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Daam Van Reeth *Editor*

The Economics of Professional Road Cycling

Second Edition

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Editor

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Foreword: One Cycling

When do we wake up the sleeping giant of procycling? When will procycling start with a blank sheet of paper to reinvent the sport and make it profitable for all stakeholders? When will procycling live up to its full potential? I believe the time is now!

The first edition of this book was published in 2016. It offered a good insight in how the sport economically works. And it was a source for me to think of solutions, what the challenges are, and especially what the potential really is. Between 2016 and 2022, not much changed. The numbers are different today, you will read that in this book, but the big problem remained the same: lack of business leadership, innovation, and collaboration prevents procycling to become an economically bigger sport. And of course, egos and the fear of losing a bit of power.

First, some facts. Since the previous version of this book, we lost many UCI ProTeams. This second tier of cycling teams is much smaller now: from 23 in 2016 to just 17 in 2022.Three UCI ProTeams come from the native country of cycling (Belgium), while ten teams are registered in the *Grand Tour* countries (France, Italy, and Spain). In other words, a *Grand Tour* in the home country seems essential for the survival of a UCI ProTeam. Or, in even better words, the second tier does not deliver enough value itself to the competing teams. They are dependent on the invitation of big races.

In the past years, we also lost some races, especially in North America. The Tour of California as WorldTour event and others. We lost races in Asia. And fingers crossed that Australia will keep their racing spirit, after the high pressure by the pandemic on professional sports Down Under. So, despite striving for a more global sport, road cycling has again become (relatively) bigger in Western Europe and less international.

To put things in the right perspective: also, most of the Western European races are having a hard time to be(come) profitable. Local authorities are less and less willing to support roadblocks for a day let alone for a week. Speedbumps, roundabouts, and a massive amount of other road furniture make it difficult to keep race routes safe for the riders. Many Belgian races rely on hospitality, instead of having a source of income out of the WorldTour. The state of the organizers, the teams, and therefore the riders is worrying. We're in a downward spiral. Conclusion: our sport is in need for real reform.

People inside and outside procycling have an opinion on how the sport should be managed. However, historical positions, quarrelling over rights, and fighting over power and of course money prevent the world of cycling to open its full potential, thereby ignoring that working together mostly delivers a better result than doing things alone. Therefore, the first step will be to sit around the table, leave all past fights and feuds behind, and look for an agreement on the basic principles for road cycling as a whole. Everyone must step into the helicopter and look to our world from that perspective.

But there is hope. Business economics always follows a good idea with a great vision and mission. There will be a sustainable model for procycling by creating a better business model for *all* stakeholders by maximizing the potential of the sport. We will create a global, attractive, and fan-centric sport, in a safe and healthy sports arena for the athletes, taking care of environment and having an eye for inclusivity. We have to look at this as one single business, let's call it *One Cycling*.

A change in road cycling should put the fans at the heart: how to create a comprehensible, attractive sport for the fans, without losing the historical attractiveness? Fans are, next to the riders, therefore eminent while safety, health, environment, and inclusivity are the pillars that support the new *One Cycling* world order. We have to realize that the competition comes from outside our sport and that the world is changing. Fans are engaged in other ways; sport has a different place in the world and is being digested differently than before. We have to reform our sport with the world of 2030 in mind.

Procycling has other potentials as well. It could lead by example the health and environmental quest many countries and cities are on today. Cycling is healthy and environmentally friendly. Procycling shows it is possible to travel more than 100 kilometers by bike, without using any fossil fuel, while keeping the body healthy. The message has big potential: "*solve traffic issues and health problems, go biking*." And by being the frontrunner of safety, procycling could also show cycling is a safe way to travel. The sport is also inclusive. Cycling is easy to access for everybody: young, old, men, women, rich, and poor. What a big signal for the world!

But how can we tap into this potential? Easy: by leadership and working together. Organizers, riders, teams, and the governing body UCI will need to step out of their trenches and finally start working together. As in every business, a clear plan and a coherent vision makes it easy to adapt to a new world. A strict format and race calendar make it clear to everyone what road cycling is up to and, importantly, what it is *not* up to. A strict format will also create value through the series.

It is very clear that riders are good at racing, organizers are good in the business of organizing, teams are good in the business of running teams, and the UCI is good in the politics of governing and making rules and regulations. And we all need each other, like the riders need each other to win races. We have to keep an eye on the problems of each stakeholder. When we agree upon that, the next move should be to create a standalone, accountable, and liable company that runs our sport from a business perspective. This new entity can be governed by the UCI, but with a board of directors representing race organizers, teams, and other stakeholders. *One Cycling* means we need to create this company and pool all rights from both teams/riders and UCI/organizers.

One Cycling will be responsible to create and commercialize the cycling series: top level and second level, and maybe third level. Create clarity for the fans for 1-day races: top-level races always on Sunday and second-level on Saturday or Wednesday, for example. Another example: top-level stage races always have the same length and format, and never overlap. Put all these races under the umbrella of a series with a clear winner (rider and team), where apples are compared with apples (only top-series points count for top-series ranking).

A shorter, more comprehensive calendar at the top level, where star riders are competing against each other in most of the races, will make it more attractive to fans. Clearer as well, as a fan will know whether it is a battle of the stars or a lower-ranked event. *One Cycling* will take the opportunity to centralize digital content, rankings, and data, which all together deliver higher media value. The central organization will organize innovation, safety, and globalization of the sport and the other pillars mentioned above. The value for all stakeholders will skyrocket.

It will take courage and strong leadership to do what is best for the sport. We might have to kill some darlings, but we will create even more instead. This book gives you a good insight in the economics of professional road cycling. A realistic view, not too positive, not too negative either. It shows road cycling's huge potential, along with the threats, especially what road cycling is lacking to harvest. I think answers to the questions in the first paragraph are easy: ride the future now.

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Contents

Chapter 1
Introduction

Daam Van Reeth

1 Context

Professional road cycling is one of the oldest professional sports. The first road cycling races date back to the late nineteenth century, and the sport has grown ever since. Throughout the twentieth century, it gathered a steady following in countries like France, Belgium, Italy, and Spain. The sport continues to grow in the twenty-first century with increasing media attention across the world. Cycling's biggest events, the *Grand Tours* (the Tour de France, the Giro d'Italia, and the Vuelta a España) and the *Monuments of Cycling* (Milano-Sanremo, Ronde van Vlaanderen, Paris-Roubaix, Liège-Bastogne-Liège, and Il Lombardia), attract tens of millions of fans who watch the spectacle from the roadside or in front of their television sets.

A comprehensive overview on what is known on the economics and management of professional road cycling therefore seems appropriate. The first edition of *The Economics of Professional Road Cycling* was published in 2016. Since then, cycling witnessed some interesting transformations. Road cycling has become younger, more spectacular, and better gender balanced recently. In 2016, Egan Bernal was a young and relatively unknown rider in the *Androni Giocattoli-Sidermec* team. Although still only aged 25, in 2022, he already bears the stamp of an "old-generation" rider due to the gulf of young talent that flooded professional road cycling with the likes of Tadej Pogačar, Remco Evenepoel, and Thomas Pidcock to name but a few. Race tactics seem to have changed as well. Highly talented riders, like, for example, Wout van Aert, Mathieu van der Poel, and Julian Alaphilippe, captured the hearts of cycling fans in recent years with their do or die approach to racing, with fearless long-range attacks and fierce man-to-man battles. This

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attractive way of racing contrasted strongly with the defensive – some say boring – style of racing cycling fans had grown used to, in which the main tactic consisted of saving every bit of energy for as late as possible in the final. Consequently, classics races, but also stage races, have been much more fun to watch. But the changes in men's professional road cycling are in no way comparable to the evolution women's professional road cycling underwent. Since 2016, in many countries, the number of women's races with live TV coverage has increased from 2 or 3 a year to at least a dozen. The women's WorldTour has quantitatively and qualitatively matured in races and in teams, and although there is still a long way to go, prize money, rider salaries, social security arrangements, and working conditions have improved significantly.

Furthermore, just like the rest of the world, professional road cycling had to deal with the COVID-19 pandemic. It led to a rescheduled calendar in 2020 with most of the racing packed in the late summer and autumn, a 2021 season where races and teams had to be extremely careful and still had to follow strict COVID-19 safety regulations, and a start of the 2022 season marked by a tsunami of illnesses and (late) withdrawals. Yet, with hindsight, we have to conclude that due to the relatively unique financial challenges professional road cycling faces, it was not impacted or economically hurt as much as many other sports. Because races are not held in a stadium, and there are no significant media rights revenues, cycling basically did not have nearly as far to fall as some other sports did. Normally, these attributes seem like a weakness in the business model, and in dealing with the COVID-19 pandemic, they constituted a relative strength.

With these developments in mind, an update of the 2016 volume was definitely in order.

2 Contents

Rather than to necessarily break new ground, this book provides a comprehensive survey of economic and management research on professional road cycling. The chapters that follow include a mix of critical surveys of what economists know about the sport, literature reviews, empirical observations, and original research. From time to time, new promising research avenues are discussed as well.

This volume specifically deals with road cycling as a professional sport and does not include cycling-related issues like cycling tourism or the bicycle manufacturing industry. Amateur competitive cycling will only be discussed as it relates to the early development and commercialization of the sport. Contributors to this book have been selected for their particular expertise, based on their own contributions to the academic literature on professional road cycling. As a result, the book became a truly international cooperation with 16 authors originating from 5 countries: France (6 authors), the Netherlands (5), Belgium (3), the United States (1), and the United Kingdom (1).

While in the previous version of this book the focus was almost exclusively on men's professional road cycling, in this volume, women's cycling receives the attention it deserves. Chapter 13 is entirely devoted to the recent developments in professional women's cycling, and in many other chapters, a section on women's cycling is now included as well. Next to Chap. 13, two more chapters are completely new and deal with topics that were not discussed in the first edition of this book. The many different aspects of assessing the economic impact of hosting major road cycling events is thoroughly discussed in Chap. 5, while Chap. 8 takes a look at the public's willingness to pay for professional road cycling events.

The book is structured in four parts. The first part (Chaps. 2, 3, 4, and 5) focuses on the organizational structure and finances of professional road cycling. The second part (Chaps. 6, 7, and 8) covers different aspects of demand for professional road cycling. Part three (Chaps. 9, 10, 11, and 12) deals with personnel and performance issues. In the final part (Chaps. 13 and 14), developing trends in professional road cycling are discussed.

2.1 Part 1: Organizational Structure and Finances of Professional Road Cycling (Chaps. 2, 3, 4, and 5)

Chapter 2 serves as an introduction into professional road cycling by describing the history of the sport and its organizational structure. Jean-François Mignot briefly discusses the origin of road cycling in the late nineteenth century and continues with a description of how throughout the twentieth century road cycling gradually evolved from an amateur sport into the sport as we know it. He explains how cycling races have developed from local races to global sport events and highlights the role of the International Cycling Union and the *Grand Tours* in the process. The complex institutional setting of modern professional road cycling is outlined next. After a brief description of its recent development, Mignot provides a detailed analysis of the current organizational setting, describing its complex interplay, the current contest modus (the UCI WorldTour), and the different players involved: the governing bodies, the race organizers, the cycling teams, and the professional cyclists.

The next three chapters zoom in on financial and economic issues of professional road cycling. In Chap. 3, the finances of professional cycling teams are analyzed in detail. Daam Van Reeth first explains why cycling team's finances differ from the finances of teams in most other sports, and he demonstrates how team budgets have grown substantially over the past 30 years. Next, supported by empirical data, he discusses in detail operating expenses as well as rider salaries as the main cost drivers of cycling teams, and he subsequently takes a look at the current revenue breakdown of cycling teams. Van Reeth also offers some thoughts on alternative financing techniques of cycling teams, such as the sharing of media rights income, the *Velon* initiative, non-fungible tokens, and a cap system. A first take on the finances of women's cycling teams closes the chapter.

As of 2022, cycling teams are still almost exclusively financed by sponsorship money. In Chap. 4, Wim Lagae sheds a clear light on this primary source of funding. He explains the business-to-business characteristics of sponsorship of cycling teams and shows how the cycling sponsorship market can be very dynamic and diverse. The duration and termination of sponsorship of cycling teams as well as a company's motives to invest in such sponsorship deals are discussed, and the importance of the integration of sponsorship into marketing communication is illustrated. He also provides insights on the economic return and effectiveness of road cycling sponsorship, and he offers an introduction into the sponsorship of cycling races. Lagae concludes the chapter with some thoughts on today's challenges for road cycling sponsorship.

The various types of impact road cycling events bring about are set out in Chap. 5. Paul Hover first defines economic impact and describes how its measurement has both strengths and weaknesses and is full of twists and turns. He then introduces a cost–benefit analysis as an alternative method for capturing the money flows instigated by a cycling event. Hover also explains that while evaluating cycling events is often financial in nature, nonmonetary types of revenues and costs should not be underestimated either. A case study of the 2015 *Grand Départ* in Utrecht closes the chapter.

2.2 Part 2: Demand for Professional Road Cycling (Chaps. 6, 7, and 8)

Professional road cycling's crucial relationship with broadcast media in general and television in particular is analyzed in Chap. 6. First, the reasons behind the successful marriage of road cycling and television are discussed. Daam Van Reeth then explains how TV audiences are measured and illustrates the complexities of understanding the actual TV audiences for live cycling broadcasts. He presents worldwide TV audience data for major cycling races and offers an insight into the composition of cycling's TV audience, based on gender and age. Van Reeth also covers the recent significant rise in media attention for women's road cycling, and he tries to shed some light on the somewhat obscure economics and value of TV broadcasting rights. The chapter concludes with a discussion of a few future challenges for televised road cycling.

In Chap. 7, Wladimir Andreff and Jean-François Mignot discuss the attractiveness and the economic success of the Tour de France, cycling's hallmark event. They explain that the Tour de France is a high-quality product, because of its accurate design, a solid event management, and a modern financing model which, like the case with other mega-sporting events, is founded on significant TV broadcasting rights. Most sports economists are also used to turn to a contest's outcome uncertainty as another explanatory variable for success. Andreff and Mignot, however, show that the Tour de France is a success story in spite of clear evidence of competitive imbalance. They conclude that in all probability the increasing economic success of the Tour since the 1980s is not caused by more competitive racing, but instead by better broadcasting of the event.

Large-scale professional road cycling events are almost always free to access for spectators but also lead to substantial organizational costs. Often, they are partly funded by local, regional, or national governments. Such events have benefits as well, some of which are intangible, e.g., the pleasure visitors derive from the event or the pride of hosting the event for local residents. In Chap. 8, Willem I.J. de Boer and Ruud H. Koning look at the value of the intangible benefits associated with large-scale cycling events. They provide a theoretical framework of willingness to pay and proceed with a presentation of the outcomes of willingness to pay studies on sports events in general and on professional road cycling competitions in particular.

2.3 Part 3: Personnel and Performance Issues in Professional Road Cycling (Chaps. 9, 10, 11, and 12)

Chapter 9 focuses on labor market issues. Jean-François Brocard and Daniel J. Larson first provide some context on professional cyclist careers and then outline the basic components of a professional cyclist's stock of human capital. Available avenues for human capital development for cyclists are also described, and the persistence of the cognitive components of human capital is discussed with regard to the cycling coaching and team management professions. The practical market exchange of human capital in road cycling has not yet received much attention in the academic literature. Brocard and Larson therefore shed some light on the levels of agent utilization in road cycling. Finally, current issues regarding the bargaining power imbalance and labor organization within the market for professional cyclists are discussed. Professional road cycling has so far struggled to develop broader pooled labor market representations for athletes. Brocard and Larson present some outlines on collective bargaining and rider unions and discuss the most recent developments in this respect.

Next, Jean-François Mignot offers an original and refreshing view on strategic behavior in road cycling competitions (Chap. 10). Based on game theoretic principles, he shows why strategy and not just brute force determines the outcome of cycling competitions. Using examples of strategic interactions between riders that occurred mainly in the Tour de France, the Giro d'Italia, and the Vuelta a España, he discusses attack timing strategy, cooperation and noncooperation in breakaways and in the peloton, three-player interactions, and sprint strategy.

Chapter 11 analyzes in great detail competitive balance in professional road cycling. Benjamin Cabaud, Nicolas Scelles, Aurélien François, and Stephen Morrow explain why performances and competitive balance are hard to define in road cycling. After a brief review of the literature on modeling performances and competitive balance in cycling, the authors introduce an innovative measure for competitive balance in cycling they developed themselves: intra-stage competitive intensity. The measure allows to calculate a global indicator of competitive intensity at different moments during a stage, and the average of the different calculations made during the stage is an indication of its overall intensity. The practical implementation of this measure is illustrated with two stages of the 2020 Tour de France.

Chapter 12 addresses the delicate issue of doping. Hans Vandeweghe presents an extremely detailed account on the long intertwined history between doping and road cycling, right from the start of the sport in the late nineteenth century and throughout the twentieth century. He also discusses the progress that has been made over the years in testing for doping as well as the difficulties that are still encountered today.

2.4 Part 4: Developing Trends in Professional Road Cycling (Chaps. 13 and 14)

Chapter 13 discusses professional women's road cycling. Similar to many women's sports, professional women's road cycling is said to have a momentum now. In a multidimensional approach, Suzanne Ryder first presents a historical background on women's cycling and on women's racing specifically. She then focuses on the current organizational structure of elite women's road cycling, and she discusses its media coverage and television broadcasting. The arguments she formulates are based on existing literature as well as on Ryder's personal original sociological research on gender and labor relations in women's road cycling.

Since the early 1990s, the International Cycling Union has repeatedly declared that the globalization of professional road cycling is a priority. In Chap. 14, Daam Van Reeth evaluates this policy objective, and he analyzes the process toward globalization at the rider level, at the team level, and at the race level. His findings show that although there is a clear trend toward globalization over the 1990–2020 period, the predominance of the core countries of cycling, i.e., Belgium, France, Italy, and Spain, is still significant, especially at the top level of cycling. Globalization is primarily limited to non-European countries with an established historical cycling tradition like the United States, Colombia, and Australia. Van Reeth also explores the globalization of the current women's WorldTour and compares the findings for the men's and women's WorldTour.

3 Conclusion

The economics and management of professional road cycling has received limited academic interest so far. The *Journal of Sports Economics* (*JSE*), created in 2000, published a first article on the sport only in 2006 (Cherchye & Vermeulen, 2006), while it took 7 years after its inception for *European Sport Management Quarterly* (*ESMQ*) to include an article on professional road cycling (Morrow & Idle, 2008). In that same year, the *International Journal of Sport Finance* (*IJSF*) also published a first article on professional road cycling (Rebeggiani & Tondani, 2008). Between 2000 and 2009, overall, only four cycling-related articles were included in those three leading sports economics and sports management journals. Things started to change from 2010 on. Figure 1.1 illustrates a steady growth in articles on professional road cycling between 2011 and 2015. In just 5 years and almost evenly spread over all 3 journals, no less than 14 papers on professional road cycling were published. However – to our surprise – after 2015, academic output stalled since only five more articles got published in those academic journals between 2016 and 2021.

This volume makes a contribution to this slowly growing body of literature on professional road cycling by presenting an insight into the overall state of sports economists' understanding of the sport. The chapter descriptions illustrate how the book brings together most of the current academic research and knowledge on the economics and management of professional road cycling. This book also sets forth an agenda for further academic research on professional road cycling by discussing the existing research and complementing it with the newest concepts, ideas, and data. We are convinced this book offers essential insights and practical information

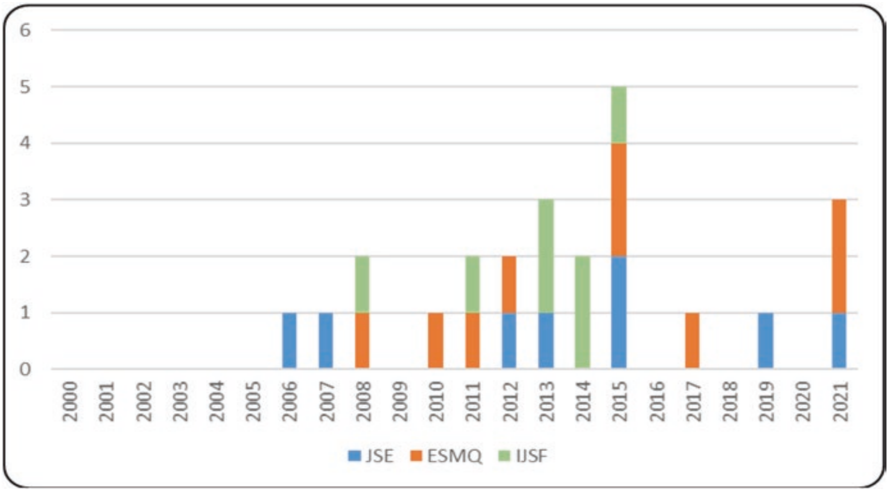

Fig. 1.1 Number of published articles on professional road cycling in leading academic sports journals (2000–2021)

that are useful not only to sports economists and sport management students and researchers but to all stakeholders in cycling. We therefore believe this volume constitutes a valuable professional reference volume that can inspire and support sports management professionals and policy-makers, such as cycling's governing bodies, team managers, race organizers, sponsors, and media, in their efforts to further develop this wonderful sport.

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Part I
Organizational Structure and Finances of Professional Road Cycling

Chapter 2
The History of Professional Road Cycling and Its Current Organizational Structure

Jean-François Mignot

1 Introduction

Why did cycling become professional as early as the nineteenth century while other sports (such as rugby) and other sport events (such as the Olympic Games) remained amateur until the 1980s? Why are the organizers of the most important bicycle races private companies? To what extent have bicycle races changed since the nineteenth century? The history of professional road cycling helps answer these and many related questions. This chapter provides a historical account on the development of professional road cycling, from local races to global sport events (Sect. 2); discusses a century of *Grand Tours*; which have long been epic races stirring up national passions (Sect. 3); and details the current organizational structure of professional road cycling, including the International Cycling Union (UCI), race organizers, cycling teams, and riders (Sect. 4).

The chapter, which mostly focuses on the history of male professional road cycling in Western Europe since the late nineteenth century, is founded on both an analysis of quantitative time series on the *Grand Tours* (and, to some extent, the classics) and a review of the existing literature on the history of professional cycling, whether economic history (Reed, 2003; McKay, 2011b; Mignot, 2014, 2016), institutional history (Dauncey & Hare, 2003), cultural history (Vigarello, 1997; Thompson, 2006), or sport history (Chany & Penot, 1997; Chany & Cazeneuve, 2003; McGann & McGann, 2006, 2008, 2011, 2012; Fallon & Bell, 2013). The historic development of women's professional road cycling is discussed in Chap. 13.

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2 From Local Races to Global Sport Events

2.1 The Emergence of Professional Road Cycling: 1890s – Mid-1950s

Bicycles as we know them – with a mobile handlebar, two equal-sized wheels, pedals, a chain, tires, and then derailleur gears – were introduced from the 1880s on. Back then, bicycles symbolized speed and modernity (Gaboriau, 1995). As Western Europeans' real income increased (in Belgium, the Netherlands, France, Spain, and Italy, the real GDP per capita multiplied by 1.8 from 1890 to 1950, Maddison, 2004) and bicycles' price plummeted, bicycle sales skyrocketed. While in 1890 there were fewer than 0.5 bicycles per 100 French people, in the early 1950s, there were close to 30 (Insee, 1952). Additionally, as employees' annual working time decreased (it was divided by 1.3 from 1890 to 1950, Maddison, 2004), newspaper sales increased. This context led sport newspapers and bicycle companies to invest in the organization of bicycle races, i.e., to finance races' operating costs and prizes, in order to increase their own profits.

Although newspapers organized the first officially recorded road races as early as the late 1860s, until the 1880s, most of the races were organized in velodromes, where they could charge entry fees (Table 2.1). From the 1890s, newspapers started

Table 2.1 The first European road races and their organizers

Race	Creation	Location	Distance (km)	First organizer
Paris (Saint-Cloud)[a]	1868	France	1.2	Michaux bicycle company
Paris–Rouen[a]	1869	France	123	Le Vélocipède illustré
Bordeaux–Paris	1891	France	572	Véloce-Sport
Paris–Brest–Paris	1891	France	1200	Le Petit Journal
Liège–Bastogne–Liège	1892	Belgium	250	L'Express
Paris–Brussels	1893	France and Belgium	407	La Bicyclette
Paris–Roubaix	1896	France	280	Roubaix velodrome builders
Paris–Tours	1896	France	250	Paris-Vélo
Tour de France	1903	France	2428	L'Auto
Il Lombardia	1905	Italy	230	La Gazzetta dello Sport
Milano–San Remo	1907	Italy	288	La Gazzetta dello Sport
Tour of Italy	1909	Italy	2448	La Gazzetta dello Sport
Ronde van Vlaanderen	1913	Belgium	324	Sportwereld
Tour of Spain	1935	Spain	3425	Informaciones
La Flèche Wallonne	1936	Belgium	263	Les Sports

[a]These races were run on machines with pedals but no chain, let alone tires

organizing races on public roads to show bicycles enabled to cover great distances and to boost their sales and their advertisement revenue. Most of these French, Belgian, and Italian annual races from one city to another, now called classics, were run on distances ranging from 250 to 400 km, which means that the best riders often had to race for more than 10 h to complete the race. Bordeaux–Paris and Paris–Brest–Paris, both created in 1891 (but discontinued in 1988 and 1951, respectively), even required the best riders to keep riding for more than 25–70 h. No wonder journalists described these races as epic fights between modern heroes. Newspapers organized cycling races, not soccer or boxing competitions, because a roadside spectator can watch a road race for a few seconds only. As a result, cycling fans demand more information and want pictures of the race, enabling newspapers to increase their circulation.

Moreover, from the 1900s, certain newspapers started organizing stage races, i.e., road races run over several days. In 1903, Henri Desgrange's French newspaper *L'Auto* created the Tour de France (hereafter often shortened to Tour), a race which included six stages over 3 weeks, totaling a staggering 2428 km. It was such a success that *L'Auto*'s main competitor, *Le Vélo*, went bankrupt in 1904. In 1909, Italian newspaper *La Gazzetta dello Sport*, which was headed by Armando Cougnet, a journalist who had followed some of the early editions of the Tour, preempted the *Corriere della Sera*'s decision to organize a stage race and created the Giro d'Italia (hereafter often shortened to Giro). Once again, it was such a success that in 1913 the *Gazzetta* went from a thrice-monthly to a daily newspaper. And in 1935, Juan Pujol's Spanish newspaper *Informaciones* created the Vuelta a España (hereafter often shortened to Vuelta). Although free for spectators, these great 3-week stage races boosted their organizers' profits by increasing their circulation and by generating additional revenue sources. While the general classification leader's jersey is yellow in the Tour (since 1919) and pink in the Giro (since 1931), after the color of *L'Auto* and *La Gazzetta dello Sport*, respectively, the Vuelta's leader's jersey had a more complex history: it has been orange (1935, 1942, 1977), white (1941), white with a red stripe (1945–1950), yellow (1955–1976, 1978–1997), gold (1998–2009), and red (since 2010).

Cities were willing to pay race organizers to host certain stages, and various companies were ready to sponsor the race to advertise their brand on the competition's route. Since 1930 and 1933, respectively, the Tour and the Giro include a publicity caravan, i.e., dozens of vehicles preceding the riders by a few minutes and distributing product samples to spectators. Today, these 3-week stage races, generally called the *Grand Tours*, are the most popular, prestigious, and lucrative bicycle races in the world, and they are still organized by media companies. The Tour has been organized by *L'Auto* (1903–1940) and by both *L'Équipe* and *Le Parisien libéré* (1947–1965), which since 1965 are owned by *Amaury Sport Organisation* (*ASO*), still the current Tour de France organizer. The Giro has been organized by *La Gazzetta dello Sport*, which is owned by *RCS MediaGroup* since 1977. The Vuelta has been organized by *Informaciones* (1935–1942), *Ya* (1945–1950), *El Correo Español-El Pueblo Vasco* (1955–1978), and *Unipublic* (since 1979), which is partly owned by *ASO*.

While newspapers organized the races, bicycle and tire companies sponsored the teams of riders, i.e., they paid for their food and accommodation so that they ride their material, prove its quality, and promote their brand through logos on their jerseys and caps. The French tire company *Michelin* sponsored Charles Terront as early as the 1891 Paris–Brest–Paris, which he won. Among the most famous bicycle companies which sponsored riders are Tour winners *Peugeot*, *Alcyon*, and *AutoMoto* and Giro winners *Bianchi* and *Legnano*. Bicycle companies sponsored riders but rarely organized races themselves because the public would have suspected them of manipulating the race to advertise their brand (Calvet, 1981).

Even though certain champions raced in sponsored teams and had a fixed annual wage, most professional riders had no sponsor. They were called *indépendants* in French or *isolati* in Italian and they had no wage: all their income came from race earnings. This is how, as early as the late nineteenth century, cycling became a professional sport. Until the 1920s, the bigger part of a rider's income came from such race earnings. French riders' wages were particularly low after the First World War, because the few remaining bicycle companies were able to cartelize the demand for riders and restrict the wages. From the 1930s (the 1930 Tour and the 1932 Giro), races started to be broadcast on the radio, and fans could follow the race live and hear the voices of their champions. As bicycle races' popularity grew, so did riders' incomes. While sponsors had to offer better wages to recruit the greatest champions, race organizers had to increase the race winnings to make it in the champions' interest to both participate in their race and fight for victory.

2.2 The Development and Crises of Professional Road Cycling: Mid-1950s – Mid-1980s

As Western Europeans' real income increased quickly (the GDP per capita was multiplied by 4.6 from 1950 to 2000, Maddison, 2004) and Europe urbanized, people bought modern motorcycles rather than bicycles. As a consequence, bicycle companies started to reduce their investments in cycling teams, and professional riders' fixed annual wages decreased. This made it in the riders' interest to look for new sponsors from outside of the bicycle industry. In 1954, Italian champion Fiorenzo Magni was the first rider who chose to be sponsored by an "extra-sportif" company (*Nivea*). While bicycle companies' control of cycling sponsorship eroded, they tried to make it illegal for extra-sportifs to sponsor teams, and in France, they also garnered the support of race organizers, who feared that extra-sportifs' investments in sponsorship might decrease their advertisement in newspapers. Extra-sportif sponsors prevailed, though, and to this day, they are the main sponsors of cycling teams.

As Western European employees' annual working time decreased (it was divided by 1.4 from 1950 to 2000, Maddison, 2004) and people spent evermore time watching TV, newspapers found bicycles races less and less profitable to organize. Races increased organizers' newspapers' circulation less than before, if only because races were also covered by competing newspapers. Moreover, races yielded few TV broadcast rights, both because most TV channels were still public, which means they did not have to compete against each other to broadcast the races, and because, compared to stadium sports of limited duration, bicycle races were hard to broadcast live (see Chap. 6). Although the *Grand Tours* had been filmed as early as the 1930s to be shown in movie theaters and from the 1950s parts of them were televised live, the live TV broadcasting of stages remained problematic for long. While in the 1970s the Spanish television still wanted to charge teams for showing publicity on their jerseys, as late as the early 1980s, it broadcasted only 15 min of the Vuelta a day. As a consequence, most race organizers were in deep financial troubles in the 1970s and early 1980s. Moreover, races' prize money decreased. For instance, while in 1955 the Tour de France offered riders a mean cash prize (total prize pool divided by the number of participants) of €5644 (in 2020 euro), in 1980, it offered only €5036 (in 2020 euro), and riders still had to share that money with team staff. Race organizers' financial crisis led them to modify certain aspects of races: "split stages" enabled them to multiply the number of cities that paid to host the race, transfers from one city to another enabled them to select only the best-paying cities, countless secondary prizes enabled them to multiply sponsors, etc.

Although riders' wages and prize winnings suffered a decline from the mid-1950s to the mid-1980s, their overall labor incomes did not decrease. Indeed, while the European public had increasing income and leisure time but still few households had TV sets, people were willing to pay to take pictures of champions, shake their hands, and have them sign autographs. This is why many small cities organized the so-called criteriums or kermesses, i.e., short 1-day road races on a local circuit that paid riders to participate, to meet their fans, and sometimes to let a predetermined rider win (McKay, 2011a). Until the mid-1980s, criteriums' appearance fees provided the majority of a rider's annual income, which is why certain *Grand Tour* champions like Jacques Anquetil did not ride the classics. They rode the *Grand Tours* to become or stay famous and the criteriums to earn money. From the early 1950s, starting with Fausto Coppi in 1949, superstars usually gave their teammates all of their *Grand Tours* or classics' prize winnings, so as to make it in their interest to sacrifice their efforts for the team leader. Superstars more than made up for these losses in the numerous, well-paid criteriums which invited the winners of the greatest races. Criteriums were such an important income source that riders hired agents to place them in these races. However, these agents (for instance, Frenchmen Daniel Dousset and Roger Piel and Belgian Jean van Buggenhout) became so influential that they gained considerable power over riders (McKay, 2011b). Agents were even able to influence races' outcomes. For instance, in the 1959 Tour de France, Jacques Anquetil and Roger Rivière conspired to have Federico Bahamontes beat Henry Anglade, partly because both Anquetil and Rivière had the same agent as Bahamontes (Daniel Dousset) but not the same as Anglade (Roger Piel). Letting Anglade win would have increased his agent's bargaining power against criterium organizers and thus increased all of his riders' appearance fees, to the detriment of Anquetil and Rivière. The role of agents in cycling is discussed more in details in Chap. 9.

Tour de France's National Teams: 1930–1961

Since the late nineteenth century, sponsored riders and teams ride the *Grand Tours*, the classics, and the other races in the name of their sponsor. The only races in which they compete in the name of their country are the Road Cycling World Championships, the Continental Championships and the Olympic Games' competitions. Another exception, though, has been the Tour de France, which was not run between sponsored teams but between national teams from 1930 to 1961, and also in 1967 and 1968.

Why did the Tour organizers decide in 1930 to exclude sponsored teams from the race? In the 1920s, the growing concentration of firms in the bicycle industry enabled certain companies to invest in team sponsorship much more than others. Their teams hired all of the best riders and were even willing to pay other teams to secure victory, so much so that the race lost much of its appeal. The *Alcyon* team won the 1927 Tour; it won first, second, and third places in 1928; and it won again in 1929. This is why, even though sponsored teams were an important source of income for the Tour organizers, they were replaced in 1930 with national teams, which were supposed to be both more equal and less willing to fix the race or otherwise collude to share the prize pool. The Tour organizers not only banned sponsored teams until 1962, but also banned commercial advertising on riders' national clothing until 1956.

Why did Tour organizers admit sponsored teams back in 1962? In the mid-1950s, as bicycle companies stopped sponsoring teams, they were replaced by companies from various other sectors of the economy. The difference between sponsors from the bicycle industry and sponsors from other sectors is that for the latter riders' jerseys, not bicycles, are the main advertising element. Therefore, the extra-sportifs could not advertise for their products on the Tour, one of the very few races where teams and jerseys (and caps) represented countries instead of private companies. These new commercial sponsors pressured the Tour organizers to replace national teams with sponsored teams. They refused that the most popular champions they were hiring all year long be included in any of the Tour's national teams. In 1962, the Tour organizers finally gave in and replaced national teams with privately sponsored teams.

2.3 The Globalization of Professional Road Cycling Since the Mid-1980s

As transportation and information costs decreased over Europe and European markets integrated, it became in the interest of both race organizers and sponsors to globalize cycling. While the *Grand Tours*' routes had long remained centered on a single country, race organizers diversified their routes, which usually increases TV audience in each of the visited countries (Van Reeth, 2013). Although the 1907 Tour and the 1920 and 1951 Giri had already visited Switzerland and the 1955 Vuelta had visited France, after World War II, several *Grand Tours* have had their first stage abroad. The 1954 Tour started in Amsterdam (partly to nip the idea of a "Tour of Europe" in the bud); the 1973 Giro departed from Verviers, Belgium, and visited five countries other than Italy; and the 1997 Vuelta started from Lisbon, which hosted the 1998 World's Fair. In honor of the Maastricht Treaty, which created the European Union, the 1992 Tour de France started in Spain and visited a record total of seven countries: France, Spain, Belgium, the Netherlands, Germany, Luxembourg, and Italy. More recently, the 2018 Giro started in Jerusalem. This was decided because Israeli billionaire Sylvan Adams wanted to promote cycling in his country. Moreover, while cycling teams had long been formed mostly of riders from one country and teams rode primarily in their own country, the nationalities of *Grand Tour* participants diversified over the years. Most of the *Grand Tours*' participants are foreigners since the 1930s in the Tour, since the 1960s in the Vuelta, and since the 1990s in the Giro. For more on the globalization of cycling, see Chap. 14.

As technological advances enabled TV channels to increase the quality and duration of the live broadcast of cycling races, audiences grew, which increased the economic value of cycling sponsorship and also sponsors' willingness to pay riders higher wages (Sandy et al., 2004). More importantly still, as European TV markets were liberalized in the 1980s, many public and private channels started to compete with each other to broadcast bicycle races, and for a small number of top cycling races, organizers' TV broadcasting rights skyrocketed (Bolotny & Bourg, 2009). For instance, from 1980 to 2000, the Tour de France's TV broadcast rights increased 65-fold, enabling the Tour organizers' budget to increase tenfold (from €5.6 million to €56 million in 2020 euro). For more on TV viewing of road cycling races, see Chap. 6.

Since the mid-1980s, riders' incomes have been increasing. Indeed, although in cycling there is no redistribution of TV revenue to teams, the increased media coverage made companies more willing to pay riders high fixed wages. This is especially true for those few cyclists with the highest marginal productivity in terms of media coverage, which implies that the wages that have been increasing the most are those of cycling's stars, in line with "the economics of superstars" (Rosen, 1981). Races' cash prizes (the riders' variable wages) have been increasing too, as shown in Fig. 2.1. For instance, from 1985 to 2010, the Tour de France rider's mean

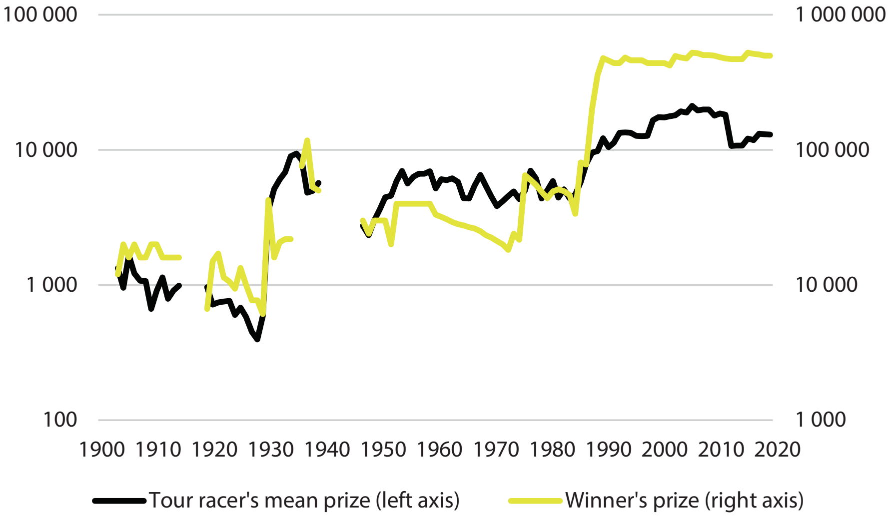

Fig. 2.1 Tour de France's prize pool, 1903–2020 (in 2020 euro). (*Source*: ASO (2021))

cash prize went from €4671 to €17,939 (in 2020 euro). Over the same period, the Tour winner's cash prize went from €33,600 to €499,500 (in 2020 euro, Mignot, 2014). Although certain races' prizes may have increased at a higher rate than the Tour's, their prizes remain (much) lower (see Chap. 3).

3 A Century of Grand Tours

3.1 National Passions: The Grand Tours' Background

Many bicycle races are century-old institutions which have become symbols of national identity. The Tour de France, the Giro d'Italia, and the Vuelta a España, but also the Ronde van Vlaanderen and the Clásica San Sebastián, all tend to cultivate their nationalist overtone. After winning the 1970 Vuelta, Spanish rider Luis Ocaña, who lived in France and was nicknamed "el francés" (the French guy) by the Spanish press, declared: "Today I feel more Spanish than ever." The 1989 Tour offered 17,890 Francs at the 1789th km to celebrate the 200th anniversary of the French Revolution, and the 1994 Tour went through the places where the Normandy landings liberated France from the Nazi occupation 50 years before. Similarly, the 1911 Giro started in Rome (instead of Milan) to celebrate the 50th anniversary of Italy's political unification, and the 1961 Giro went through the island and cities that played a role in Garibaldi's struggle to unify Italy 100 years before. In this patriotic context, it is no wonder that rivalries between riders from different countries sometimes degenerated into rivalries between supporters or between countries, especially since it was often in an organizer's interest to inflame nationalist passions in order to increase newspaper sales.

Foreign riders have had conflicts with race organizers, whom they accused to be biased against them. General classification leader Sylvère Maes, a Belgian, quit the 1937 Tour to protest against what he – understandably – saw as a biased enforcement of the rules. The Italian teams also quit the 1950 Tour to protest against organizers' incapacity to protect Gino Bartali's physical security, although Bartali's goal might also have been to deprive fellow countryman and rival Fiorenzo Magni from the general classification leadership. The Giro organizers have long established the race's route to make a specific Italian rider win. They increased the importance of the mountain stages and decreased that of individual time trials to help Gino Bartali win in 1937 and did the opposite to help Francesco Moser win in 1977, to help Giuseppe Saronni win in 1981, and to help Moser or Saronni win in 1979, 1983, and 1984. The latter Giro is notorious for various "injustices" done to French rider Laurent Fignon. By contrast, the Vuelta organizers have long favored foreigners to attract more of them to participate, increase the prestige of the race, and secure its position in the cycling calendar. They paid foreign stars to participate (e.g., Raymond Poulidor in 1967), they established the race's route to favor them (e.g., Louison Bobet and Hugo Koblet in 1956, Rik Van Looy and Roger Rivière in 1959, Freddy Maertens in 1977), and they sometimes even enforced the rules to the detriment of Spanish riders (e.g., José Pérez Francés in 1962). Foreign riders also had conflicts with the organizing country's supporters. In the 1910 Giro, French rider Jean-Baptiste Dortignacq's victory in the second stage led angry Italian supporters to attack foreign racers. In the 1975 Tour, general classification leader Eddy Merckx was punched in the stomach by a French fan of Bernard Thévenet. Foreign riders also had direct conflicts with the organizing country's riders. In the 1912 Tour, Belgian riders coalesced to make Belgian champion Odile Defraye win. In the 1935 Vuelta, Spanish riders coalesced to help Mariano Cañardo win. And in the 1985 Vuelta, Spanish riders coalesced against Scottish rider Robert Millar.

In addition, in times of international tensions, bicycle races sometimes took a political turn. Foreigners did not participate in the 1911 or 1936 Giro, because Italy was engaged in colonization wars in Libya and Ethiopia, respectively. Foreigners did not participate in the 1946 Giro either because formally Italy was still at war against most other cycling nations. Similarly, Italians did not participate in the 1936 Tour, and Germans, Italians, and Spaniards did not participate in the 1939 Tour. The Italian Fascist government directly used the Giro as a means of propaganda. For example, the 1927 Giro's prize pool was increased by 25,000 lire by Italian leader Benito Mussolini himself. In the 1930s, the general classification leader's jersey included the Fascist emblem, and in 1938, the Fascist government ordered Gino Bartali to skip the Giro to win the Tour, which he did. Bartali was recognized in 2013 by the Yad Vashem memorial as "righteous among the Nations" for helping to save hundreds of Jews from the Holocaust. After the war, in 1947, the Tour organizers did not invite German riders: the memories of Nazi occupation were too fresh. The 1963 Vuelta started in Mieres, an Asturian city where the year before miners had organized a strike which Franco's government brutally repressed. Thus, the race's start was supposed to prove the government's authority over the country.

Bicycle Races and the Twentieth-Century Wars

The twentieth-century wars affected bicycle races in several ways. First, wars canceled several races. The First World War canceled the Tour and the Giro (1915–1918), as well as the five *Monuments of Cycling* except Il Lombardia. The Spanish civil war canceled the Vuelta (1937–1940). World War II canceled the Tour (1940–1946), the Giro (1941–1945), the Vuelta (1943–1944), and the five cycling *Monuments* except the Ronde van Vlaanderen. Indeed, bicycle races could not be run in wartime because organizers lacked gasoline, food, and tires, but also because roads were destroyed. It is these war devastations which led journalists to call the 1919 Paris–Roubaix the “hell of the North.” Nevertheless, in a war-devastated country, Francisco Franco’s government organized the 1941 Vuelta to give the population an illusion of normality: the only foreign participants came from neutral Switzerland. Second, wars personally struck several riders. The First World War killed Tour winners François Faber, Octave Lapize, and Lucien Petit-Breton, as well as 1913 Giro winner Carlo Oriani. At the end of the Spanish civil war, Julián Berrendero, the future winner of the 1941 and 1942 Vueltas, was imprisoned in a concentration camp for 18 months. Finally, postwar times led *Grand Tour* organizers to go through cities and places which their country claimed as theirs. The 1919 Tour went through Strasbourg and Metz, two cities of the region of Alsace–Lorraine, which France had recuperated following the First World War. Similarly, the 1946 Giro went through the disputed city of Trieste (which became Italian only in 1954), thus angering the Slovene minority and causing riots for several days.

Although bicycle races may set national rivalries on fire, they also have long dramatized within-country rivalries. In the early *Grand Tours*, regional divisions were salient. The public identified racers by their region or city of origin: the best Italians came from Piedmont, and the best Spaniards came from the Basque country. Local supporters often threw nails on the roads to favor the local rider. The 1932 Tour made the Belgian team’s divisions among French- and Flemish-speaking Belgians clear. Later, from the 1940s to the 1960s, the Italian public was deeply divided between supporters of Gino Bartali and Fausto Coppi (“Bartaliani” and “Coppiani”), the French public was also divided between supporters of Jacques Anquetil and Raymond Poulidor (“Anquetiliens” and “Poulidoristes”), and the Spanish public was divided between supporters of Jesús Loroño and Federico Bahamontes (“Loroñistas” and “Bahamontistas”). While the attempted assassination of the Italian communist leader in 1948 led to a general strike in Italy, head of state Alcide de Gasperi phoned Gino Bartali, who was racing the Tour, to ask him to win the race and unify his countrymen. Political activists also used the *Grand Tours* to pressure the government or to popularize or otherwise promote their cause. Striking workers blocked the 16th stage of the 1969 Giro, the 5th stage of the 1982 Tour, the 14th stage of the 1980 Vuelta, and the prologue of the 1983 Giro. Most importantly, the Basque separatist movement ETA, which conceived the Vuelta a España as a Spanish invasion of its Basque homeland, sabotaged the last stage of the 1967 race. It bombed the road in the 15th stage of the 1968 race, and it sabotaged again the race's route in 1977 and 1978. That is why the Vuelta stopped going through the Basque country from 1979 to 2011, and the Basque newspaper organizing the Vuelta from 1955 on stopped doing so in 1979, even while the Basque country had been the Vuelta's most important region until then. Basque separatists also bombed several teams' material in the 18th stage of the 1974 Tour.

3.2 Epic Races: Grand Tours' Difficulty

Although *Grand Tour* organizers have kept finding ways to maintain or increase their races' epic character, many aspects of these races have changed over time, including their difficulty. While the number of *Grand Tours*' participants varied between 50 and 150 until the early 1980s, since the 1990s, it is closer to 200, the maximum number of riders in a race according to UCI regulations. In this respect, the 1926–1928 Giri, which included up to 300 riders, notably "isolati" riders related to political and military groups, were an exception.

Since the early twentieth century, each of the three *Grand Tours* lasts 3 weeks, but the number of racing days has increased substantially to the detriment of rest days. The very first Tours included less than 10 racing days and at least 1 rest day per racing day, and until the mid-1920s, the Tour and the Giro still included less than 15 racing days and almost one rest day per racing day. Nowadays, the *Grand Tours* include 21 racing days and just 2 rest days in total. In this sense, it would seem that as cycling professionalized, the *Grand Tours* became more physically demanding.

However, as shown in Fig. 2.2, at the same time, the mean distance per racing day strongly decreased, first abruptly in the 1920s (from around 350 km to around 200 km) and then continuously since the 1930s (from around 200 km to around 160 km today). This reflects organizers' anticipation of the public's changing demand. Until the 1920s, when bicycles were a symbol of speed and modernity, the public wanted to read about long stages in which riders defied the forces of nature, staggeringly long distances and durations, mountains, rain, and snow. In addition, the *Grand Tours*' sponsors wanted to prove the quality and resistance of their material in very hard conditions. The length of the stages required that riders start racing late at night or very early in the morning, so that they arrive in the afternoon and journalists could tell the story of the stage the day after. This was the time when Eugène Christophe won the 5th stage of the 1912 Tour after a 315 km breakaway, when Clemente Canepari won the 7th stage of the 1913 Giro after a 236 km solo breakaway, and when Lauro Bordin did not win the 3rd stage of the 1914 Giro despite a 350 km breakaway.

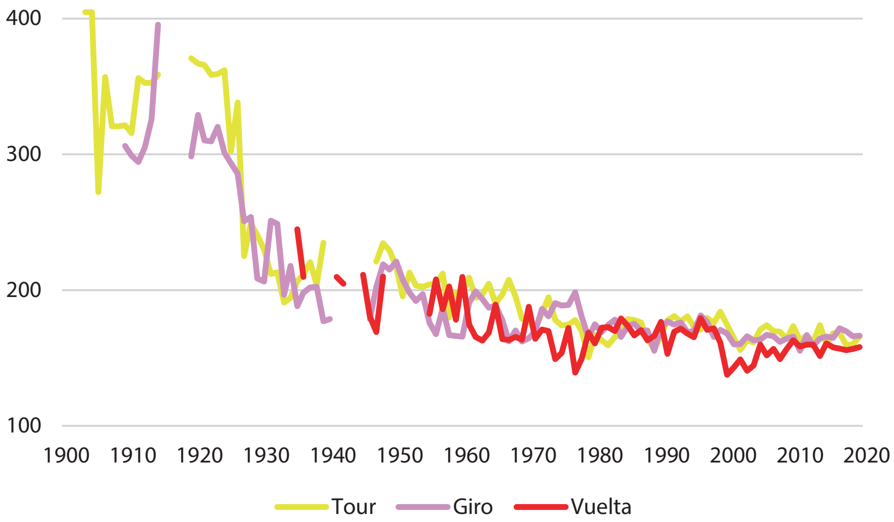

Fig. 2.2 Mean distance (in kilometer) per racing day in the *Grand Tours*, 1903–2020. (*Sources*: ASO (2021), RCS Sport (2021), and Unipublic (2021))

In the 1920s, when the *Grand Tours* started being broadcast on the radio, the public wanted to follow the race live, which given the limited radio time required more nervous, hence shorter, stages. In turn, the shortening of stages enabled organizers to increase the number of stages. In the 2000s, the mean distance per racing day has been relatively shorter in the Vuelta than in the other two *Grand Tours*, perhaps partly because the Vuelta is now raced at the end of the cycling season. If organizers want to have a nervous race despite riders' tiredness, they need to organize relatively short stages. Therefore, as the media through which the public came to follow the *Grand Tours* changed, the public's demand changed, and organizers adapted. *Grand Tours* went from epic races with a few nonconsecutive but very long stages to other types of epic races with many consecutive but shorter stages.

3.3 *Epic Fights: Riders' Performance and Grand Tours' Competitiveness*

As *Grand Tours*' difficulty changed, riders' performances increased. Not only did their quit rate decrease, their mean speed also increased. While the early *Grand Tours* were deliberately very hard to finish (until the late 1920s around 75% of participants failed to finish), riders' quit rate declined abruptly in the 1920s (from about 75% to about 50%), and it declined continuously since the 1930s (from about 50% to about 20% today). This likely reflects the 1920s drop in the mean distance per racing day, as well as the multiple ways which have made riders' lives and careers easier since the 1930s. At the same time, riders' speed increased, as the winners'

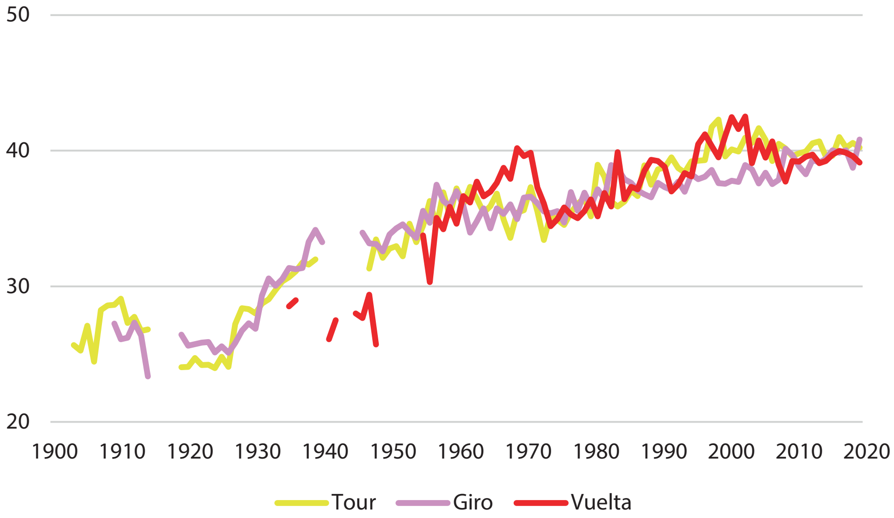

Fig. 2.3 Winner's mean speed in the *Grand Tours*, 1903–2020. (*Sources*: ASO (2021), RCS Sport (2021), and Unipublic (2021))

mean speed since the 1930s illustrates in Fig. 2.3. This reflects major long-term changes in the quality of riders' equipment, road quality, and bicycle weight. Riders' increasing speed also reflects changes in the rules of bicycle races. Until the 1930s, Giro riders had to repair their damaged bicycles, i.e., they were not allowed to replace them with new material, and Tour riders even had to perform those repairs without any help. And until the 1930s, riders were not allowed to use derailleur gears, which made them go slower in both ascents and descents. Riders' better physical preparation (diet, training, and doping) also probably had an impact on their performances. A similar increase in riders' speed is observed in the classics, in which distances have remained (broadly) constant over time. Typical race average speeds in the early twentieth century were often below 30 km per hour, while modern events easily exceed 40 km per hour. Readers interested in riders' performances could also consult Torgler (2007), Prinz and Wicker (2012), and Rogge et al. (2013).

However, the interest of professional road cycling might depend less on riders' performance than on competitive balance and outcome uncertainty. The time difference between the winner and the second-best rider, which is one indicator of competitive balance, steeply declined from the 1920s to the 1930s and then from the 1950s to the 1960s. As a result, while gaps of 30 min or more were common until the 1920s, typical gaps are less than 3 min today. In 2020, for the first time in history, all *Grand Tours* were won by a margin of less than a minute. Obviously, race organizers know better than anyone else that competitive balance is a major determinant of the success of a race, and they have long struggled to maintain or increase it. After "il campionissimo" Alfredo Binda had already won the 1925, 1927, and 1928 Giri (in 1927, he won 12 out of 15 stages and was leader from the beginning to the end), he won 8 consecutive stages and the whole 1929 race, and the crowd booed him. This is why the following year the Giro organizers paid him 22,500 lire, i.e., the equivalent of the general classification victory and several stage victories, not to participate in the 1930 Giro. And the same year, the Tour organizers had to pay him start money to convince him to participate in the Tour. When in 1934 Tour organizers included the King of the Mountains classification, they also organized the first individual time trial so that not only climbers but also riders who are strong on the flat may win the race. In the 1952 Tour, race organizers included a fighting spirit prize for the rider who attacks the most, and when Fausto Coppi dominated the race as early as the tenth stage, organizers doubled the second place cash prize so that riders fight for second if not first place. Similarly, Merckx's absolute domination over professional road cycling in the early 1970s made him relatively unpopular not only among a jealous peloton but also among non-Belgian spectators who felt he decreased races' interest, and perhaps also among broadcasters. For more details on competitive (im)balance in cycling, see Chap. 7, while on strategic behavior in road cycling competitions, see Chap. 10.

4 The Current Organizational Structure of Professional Road Cycling

4.1 General Structure

Professional road cycling is composed of various agents. On the demand side, the public is willing to pay and/or to watch advertisements in order to be able to follow the developments of a bicycle race. On the supply side, there are three main stakeholders. Race organizers are willing to pay for the race's logistics and prize money in order to sell newspapers, advertising space on the race, and TV broadcast rights, and they may also auction off the race's route to the highest bidding host cities. Cycling teams are willing to pay riders a wage (and perhaps to pay organizers a price) to advertise for their sponsors' products on the race. And riders are willing to spend energy to earn a wage, win the race's prize money and become famous. All these stakeholders, as well as the main governing body of cycling, the International Cycling Union (UCI), are mapped on Fig. 2.4 and addressed below.

4.2 Governing Bodies

As early as the nineteenth century, professional cycling emerged separately in different European countries and the USA. The foundation of national cycling federations, which took place in the late nineteenth century (e.g., the Bund Deutscher Radfahrer in 1884 in Germany or the Unione Velocipedistica Italiana in 1885 in Italy), marks the beginning of the history of the organization of professional road cycling. This decentralized organization raised several problems. First, countries

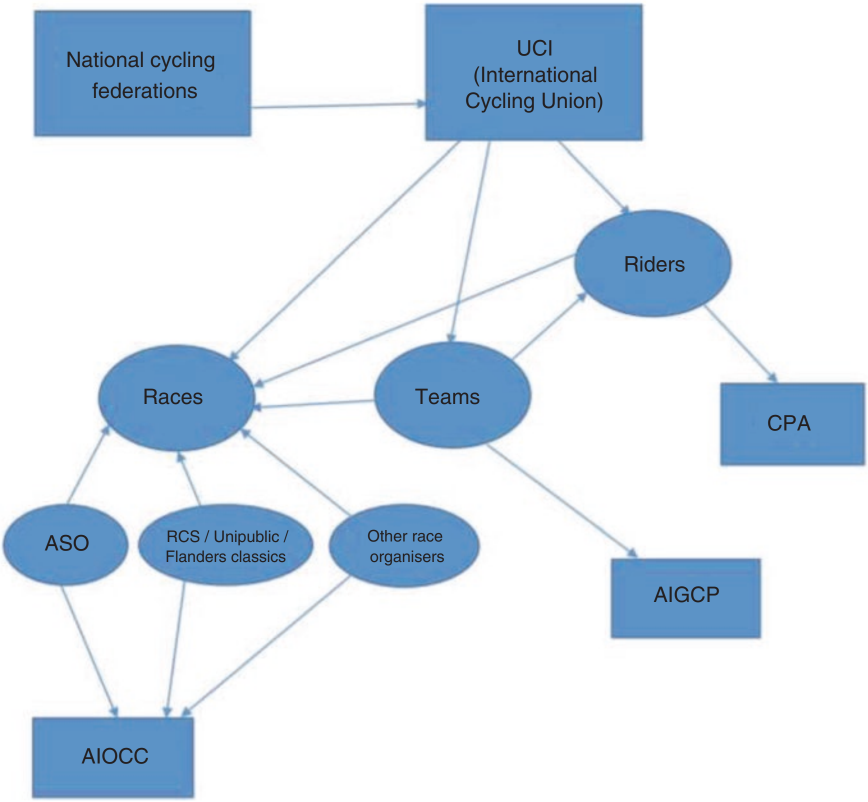

Fig. 2.4 The organizational structure of professional road cycling. (*Source*: Rebeggiani (2016))

had to agree on a common calendar to avoid that too many races are inefficiently run at the same time. Second, countries had to agree on systems of ranking for teams and riders, so that race organizers and notably the organizers of the World Championships can invite the world's best competitors. Third, countries had to agree on certain disciplinary rules. What is allowed as a "bicycle" in a bicycle race? How is the winner determined? What counts as doping? To solve these multiple coordination problems impartially, in 1900 in Paris, the cycling federations of France, Belgium, Italy, Switzerland, and the USA founded the International Cycling Union. The organization is commonly referred to as the UCI, based on the initials of its French name (Union Cycliste Internationale). The UCI was intended to be the superordinate entity for regulating, administering, and promoting the sport, and it replaced the already existing International Cycling Association (ICA), which, founded in 1892, was one of the first international sports' federations.

In 1965, under pressure from the International Olympic Committee, the UCI established two subsidiary branches: the Fédération Internationale Amateur de Cyclisme (FIAC) and the Fédération Internationale de Cyclisme Professional (FICP). The FIAC was dominated by Eastern European nations, whose cyclists were running as (often publicly paid) amateur competitors. The FIAC controlled access to the Olympic Games and allowed FIAC cyclists to compete against FICP members only on rare occasions. After the admission of professional athletes to the Olympic Games, FIAC and FICP were reunified again within the UCI in 1992. Since then, the UCI is the sole governing body of cycling.

In 2021, the UCI represented 197 national cycling federations, themselves grouped into five continental confederations: Europe, Asia, America, Africa, and Oceania (UCI, 2018, 2019). It also represents more than one million licensed cyclists (80% of them male) and more than 1500 professional riders. Most of its resources come from city contributions and broadcasting rights related to the World Championships and Olympic Games. However, the UCI is a relatively weak governing body, because it does not control the most prestigious and lucrative cycling competitions, the *Grand Tours*, which are owned by private organizers. This is why the organizers of these *Grand Tours* (*ASO*, *RCS Sport*, and *Unipublic*) have such bargaining power relative to the UCI. Below, we focus on three specific responsibilities of the UCI: the management of a cycling calendar, the creation of a world ranking system, and the setup of race rules and anti-doping regulations.

The Management of the Cycling Calendar

The UCI manages the cycling calendar, which is composed of different types of races (Table 2.2). The *Grand Tours* are 3-week stage races which are run in spring or in summer in France (Tour), Italy (Giro), and Spain (Vuelta). They are the most difficult, prestigious, and lucrative races of the cycling calendar. Only seven champions have won all three *Grand Tours*: Jacques Anquetil, Felice Gimondi, Eddy Merckx, Bernard Hinault, Alberto Contador, Vincenzo Nibali, and Christopher Froome. The classics are 1-day races. Most of them are run in spring or in autumn in Belgium, Italy, and France. The five most prestigious classics, sometimes called the five *Monuments of Cycling*, are Milano–San Remo, the Ronde van Vlaanderen, Paris–Roubaix, Liège–Bastogne–Liège, and Il Lombardia. Each of these races is in some sense unique, whether because of its cobbled sectors, its hilly sections, or any other characteristics. Only three champions, all of them Belgians, have won all five *Monuments*: Roger De Vlaeminck, Rik Van Looy, and Eddy Merckx. As the World Championships are raced close to the end of the cycling season, they do not always attract the best riders, who might feel tired after a long and hard season. The reigning World Champion wears the coveted rainbow jersey.

The period of the year when a race is organized has a profound impact on the conditions under which it is run, road cycling being an outdoor sport. While the Giro is run in spring, sometimes in cold, rainy, or snowy conditions (the epic 14th stage of the 1988 Giro with the legendary ascent and descent of a snow-covered Gavia Pass is just one extreme example), the Tour is run in summer, usually under hot weather. The cycling calendar is also a major reason why, among the *Grand Tours*, the Tour is more prestigious than the Giro, which in turn has long been more prestigious than the Vuelta. As the Tour was created first, it could act as the leader firm, like in the Stackelberg model well-known in industrial economics theory. The Tour organizers chose to run the race in July, when relatively many Europeans are

Table 2.2 Some of the most important cycling events in male professional road cycling

			Event	Date of creation	Calendar position	Country	Present organizer
Grand Tours			Tour de France (aka *La Grande Boucle*, the Great Loop)	1903	July	France	ASO
			Giro d'Italia	1909	May	Italy	RCS
			Vuelta a España	1935	September	Spain	Unipublic/ASO
Monuments of Cycling	Spring classics		Milano–San Remo (aka *La Primavera*, the spring)	1907	March	Italy	RCS
		Cobbled classics	Ronde van Vlaanderen (aka *Vlaanderens mooiste*, Flanders' finest)	1913	April	Belgium	Flanders Classics
			Paris–Roubaix (aka *La reine des classiques*, queen of classics, or *L'enfer du Nord*, the hell of the North)	1896	April	France	ASO
		Ardennes classics	Liège–Bastogne–Liège (aka *La doyenne*, the doyenne)	1892	April	Belgium	ASO
	Autumn classics		Il Lombardia (aka *La classica delle foglie morte*, the classic of the falling leaves)	1905	October	Italy	RCS

(continued)

Table 2.2 (continued)

	Event	Date of creation	Calendar position	Country	Present organizer
Non-European races	Tour Down Under	1999	January	Australia	ASO
	Grand Prix Cycliste de Québec Grand Prix Cycliste de Montréal	2010	September	Canada	GPCQM
	Tour of Guangxi	2017	October	China	Wanda Group
	UAE Tour	2019	February	United Arab Emirates	RCS
World Championships		1927	September or October	Changing	UCI

on holidays and there are relatively few alternative sport events. There is no soccer or rugby, just the Wimbledon tennis tournament, and only the 2020 COVID-19 pandemic led the Tour to be run in September. From the start, this guaranteed the Tour de France a relatively high audience, which, along with the French public's initially higher living standard than Italy or Spain's, enabled the Tour to reap relatively high revenues and thus attract the world's best riders. Since 1909, the organizers of the Giro chose to run the race before the Tour, in May or June, and from 1935 to 1994, the organizers of the Vuelta chose to run it in April or May, even though in these months fewer spectators are on holidays and there are many other sport events.

In the early 1990s, however, the UCI aimed at moving a *Grand Tour* from the congested spring period to September, in order to lengthen the racing season, increase sponsors' media coverage, and thereby increase sponsors' investments in cycling. While the Giro refused, the Vuelta accepted. Instead of skipping the spring race or considering it as a mere preparation for another race, riders could now ride the Vuelta in September to redeem or crown their season or to be selected for the World Championships. By attracting more prestigious riders and gaining more TV coverage, this reform undoubtedly increased the attractiveness, prestige, and economic value of the Vuelta, even though it is sometimes still considered to be no more than a preparation for the World Championships. For example, in 2000, fourth place Jan Ullrich quit the Vuelta to prepare for the Olympic Games, and in 2007, points jersey holder Oscar Freire did the same to prepare for the World Championships.

These European races remain the most popular. The top league of the professional road cycling calendar (the UCI WorldTour) contains almost 40 races, only a handful of them non-European, such as the Tour Down Under (Australia), the Grand Prix Cycliste de Québec and the Grand Prix Cycliste de Montréal (Canada), the Tour of Guangxi (China), or the United Arab Emirates Tour (Table 2.2). For the UCI, these races aim at further globalizing cycling.

The Creation of a World Ranking System

The UCI also manages the ranking system which, based on season-long results, determines the world's best riders, teams, and nations of the year. Until 1988, the (unofficial) ranking systems were established independently from the UCI. Several newspapers (*L'Équipe*, *La Gazzetta dello Sport*, *Het Nieuwsblad-Sportwereld*, and *Les Sports*) first managed the "Challenge Desgrange-Colombo" (1948–1958), and then the spirits company *Pernod* managed the "Super Prestige Pernod International" (1959–1988). Only since 1989, the UCI ranking system prevails, under the names of "UCI World Cup" (1989–2004), "UCI ProTour" (2005–2010), and "UCI WorldTour" (since 2011). One purpose of the UCI reform of the ranking system was to increase competition and to reduce collusion among riders and teams. Indeed, riders had to accumulate UCI points all year long to be allowed to participate in the most prestigious and best-paying races. This reduced a rider's incentive to "sell" certain races, because UCI points were highly valuable both to themselves (they directly increased their market value, i.e., their wage) and to their team (they enabled it to participate in those races where the sponsor gets the most media coverage). Another purpose of the UCI ranking system was to globalize cycling, by having non-European riders and teams participate in Western races and by including non-Western-European races in professional road cycling's calendar. This was expected to increase the quality of the show and bring additional (TV) spectators and commercial sponsors to cycling.

In 2005, the UCI decided that the World Cup would become a (semi-)closed league under the name of UCI ProTour. Since then, the UCI ProTour (2005–2010) and UCI WorldTour (since 2011) include on average 18 teams, each with 25–30 riders. Such organization effectively guarantees team sponsors a high degree of media visibility for several years, which may increase their investments in cycling. However, as these closed leagues include the *Grand Tours* and the classics, their organizers now have to select the best-ranked teams instead of having teams pay to participate or being able to freely choose them. Therefore, although closed leagues garnered the support of team sponsors (because it made their return on investment more predictable) and riders (because it increased their wages and the duration of their labor contracts), it was – and often still is – opposed by the major race organizers.

The Setup of Race Rules and Anti-doping Regulations

Many of the early race rules were decided not by the UCI, but by race organizers themselves. For instance, in the early twentieth century, the organizers of *Grand Tours* decided independently which equipment was allowed, which riders and teams could participate, which types of stages were included in the race, and how the winner was decided. While derailleur gears were invented as early as the 1890s, their use was prohibited until the 1933 Giro and the 1937 Tour, to make these epic races more difficult and more spectacular. Similarly, riders were not allowed to group into teams in many of the early Tours (1903–1909, 1919–1924), because Tour organizers believed teams and mutual help made the race less heroic. The general classification ranking was decided by a points system in certain early Tours (1905–1912) and Giri

(1909–1913). A rider's final ranking was determined by his cumulative ranks in each stage. In contrast to a time system where a rider's final ranking is determined by his cumulative time, the points system was easier and less costly to calculate and monitor. However, it was soon abandoned because it did not motivate riders. If all that counts in a stage is your rank, not your time, why fight to minimize your delay?

Today, the UCI has a major role in the setting of race rules. Equipment-related rules turned out to be particularly important in the history of the (track) world hour record, which included several records depending on the type of bicycle that was used when setting the record. In 2014, the UCI unified these classifications into a single classification in line with regulations for current track pursuit bikes. This change caused an upsurge in world hour record attempts: between September 2014 and April 2019, the record was beaten no less than six times. In road cycling too, the UCI has a major rule-setting role, although its capacity to implement these rules – through international race commissaires or otherwise – might be questionable. In the final sprint of the first stage of the 2020 Tour of Poland, Dutch rider Fabio Jakobsen crashed and was very seriously hurt after he was unlawfully pushed against the side barriers by Dylan Groenewegen, who deviated from his line. The severe consequences of the accident were also partly due to the fact that the final sprint was conducted in a downhill false flat, but only Groenewegen was sanctioned, not the race organizers. The UCI later reinforced safety measures concerning barrier installation on the race route and on the finish line, arch installations at intermediate points, vehicle circulation in the race convoy, and riders' discarding of bottles and other objects (UCI, 2021).

The UCI also establishes anti-doping rules, i.e., rules against the "use of prohibited substances and methods." For more details on doping in cycling, see Chap. 12.

4.3 Race Organizers

The main cycling race organizers are *Amaury Sport Organisation* (*ASO*), owner of the Tour de France, Paris–Roubaix, Liège–Bastogne–Liège, and the Tour Down Under; *RCS MediaGroup* (*RCS*), owner of the Giro d'Italia, Milano–San Remo, Il Lombardia, and the United Arab Emirates Tour; *Unipublic*, organizer of the Vuelta a España (along with *ASO*); and *Flanders Classics*, owner of the Ronde van Vlaanderen and other Flemish races (Table 2.2). In the organizational structure of professional road cycling (Fig. 2.4), these race organizers have considerable bargaining power because they own the broadcasting rights of the most prestigious and popular – and, therefore, lucrative – events. Before the creation of the UCI ProTour in 2005, they could even choose which teams would participate in these events. For instance, in 2003, the Tour de France chose not to invite the team of the reigning World Champion Mario Cipollini.

Race organizers jointly form the Association Internationale des Organisateurs de Courses Cyclistes (AIOCC), the International Association of Organizers of Cycling Races, which has been headed since 2009 by Christian Prudhomme, the director of the Tour de France. Along with the UCI, the AIOCC organizes the cycling calendar. Within AIOCC, some members are more powerful than others, but even the organizers of a secondary race might benefit from the UCI WorldTour. Such a closed league greatly improves the quality of the teams and riders which make the starting field, thus improving the value of the race itself.

4.4 Cycling Teams

Depending on the season, the UCI WorldTour includes on average 18 cycling teams, each of them made up of 25–30 riders as well as managerial, medical, and technical staff. These teams have both a right and an obligation to participate in each of the races of the UCI WorldTour calendar. In the organizational structure of professional road cycling (Fig. 2.4), these teams are heavily dependent on their sponsor(s), as they have no revenue from broadcasting rights or, obviously, ticket sales. The sponsors of most teams are private or public firms, such as *Cofidis*, *Movistar*, *Quick-Step*, or *La Française des Jeux*, but the recent trend in "nation branding" has led some investors to sponsor teams in the name of a country, such as Kazakh team *Astana* (since 2006), *Bahrain Victorious* (since 2017) *UAE Team Emirates* (since 2017), and *Israel – Premier Tech* (since 2020). Within each team, there usually are a small number of team leaders as well as a larger number of domestiques. For more on the finances of professional cycling teams, see Chap. 3. Sponsorship in professional road cycling is discussed in Chap. 4.

The UCI WorldTour is the highest division of male professional road cycling (Table 2.3). The second division, called the UCI ProSeries, also includes approximately 20 teams, each of them made up of 16–30 riders. The third division, called the Continental Circuits, includes between 100 and 200 teams, each made up of 8–16 riders.

Cycling teams jointly form the Association Internationale des Groupes Cyclistes Professionnels (AIGCP), the International Association of Professional Cycling Groups. In the 2010s, while race organizers (AIOCC) wanted to ban radio use between team cars and riders, the AIGCP prevented that from happening. Along with the UCI, the AIGCP also negotiates labor agreements with riders concerning their minimum wage, social insurance, and number of rest days. The role of the AIGCP in the organization of professional road cycling has been challenged, though. First, the Mouvement pour un Cyclisme Crédible (MPCC), i.e., the

Table 2.3 Number of licensed teams in male professional road cycling, 2006–2021

		2006	2011	2016	2021
1st division	UCI WorldTour	20	18	18	19
2nd division	UCI ProSeries	26	23	23	19
3rd division	Continental Circuits	125	131	174	161

Source: www.cqranking.com

Movement for Credible Cycling, was created in 2007 to encourage cycling teams to enforce the UCI ethical code more strictly and not to hire riders with a history of doping. However, only a minority of UCI WorldTour (as well as UCI ProSeries or Continental Circuits) teams have been members of the MPCC. Second, the *Velon* group was created in 2014 to develop new race formats and to promote new revenue-generating opportunities, but only about a dozen WorldTour teams joined the initiative. Both the MPCC and *Velon* continue to exist but have little or no impact in today's professional road cycling, due to the fierce opposition of the UCI and race organizers and the internal divisions among the teams. As a result, still only the AIGCP represents the team's interests with the UCI.

4.5 Riders

In the organizational structure of professional road cycling (Fig. 2.4), riders have little bargaining power, because they are highly dependent on their team. Many riders have short-term contracts of 1 or 2 years only, and since teams are invited for races – not individual riders – the opportunity to race and thus the chances a rider gets to showcase his abilities are entirely decided upon by the team management. As until the 1980s, most riders came from a peasant or working-class background (Thompson, 2006, see also Juan Antonio Bardem's 1955 movie *Death of a Cyclist*), they usually had few alternative income sources. An absence of alternative income sources makes it in a young rider's interest to take risks in order to succeed, including the use of doping.

Today, many professional have joined the Cyclistes Professionnels Associés (CPA), the Association of Professional Cyclists, which was created in 1999 to collectively protest against the exclusion from the Giro of race leader Marco Pantani following an anti-doping test. The CPA represents riders with the UCI, especially concerning riders' contracts, working conditions (rest days, safety rules including under extreme weather conditions, etc.), wages, prizes, social security, and retirement plans. The role of the CPA in the organization of professional road cycling is being challenged by the Riders' Union, which was created in 2020 to be more democratic and more combative than the CPA is. We refer to Chap. 9 for a more in-depth analysis of the specific characteristics of professional road cycling's labor market and the relationship between riders, teams, agents, and cycling federations.

5 Concluding Thought

While male professional road cycling started in the late nineteenth century in Western Europe, it increasingly includes races, teams, sponsors, and riders from all continents. This history also reflects broader, long-term economic changes, including increasing labor division. Amateur bicycle racers now become professionals at a younger age than a century ago, because they no longer need to keep some other, more predictable jobs along with their sport career. Since the 1930s, professional riders have also been specializing into certain roles in their team, whether it may be sprinters, flat riders, or climbers. The observed increase in performance inequality among Tour de France riders since the 1970s is entirely due to an increase in performance inequalities within, not between, teams (Candelon & Dupuy, 2010), which means that domestiques sacrifice their own chances more and more to help their team leader win and then share his prizes. Riders' physical preparation is also optimized. While Italian campionissimo Fausto Coppi introduced a scientific approach to diet, training, and equipment as early as the 1940s, it is only since the 1980s that science (biomechanics, aerodynamics, etc.) significantly contributes to performance. Finally, since the 1990s, starting with riders like Greg LeMond and Miguel Indurain, team leaders ceased to participate in almost all of the events of the cycling calendar. While some champions specialize in the classics, others specialize in *Grand Tours*. Nowadays, riders who specialize in the *Grand Tours* are also grouped into within-team squads that adjust their yearly fitness peak to be best prepared for one specific *Grand Tour*.

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Chapter 3
The Finances of Professional Cycling Teams

Daam Van Reeth

1 Introduction

Professional road cycling is an individual sport practiced in teams. Although cycling races are usually won on an individual basis, race organizers invite cycling teams, and not individual riders, to their events. Professional cyclists therefore need to join teams to be able to compete in cycling races. This chapter focuses on these cycling teams and offers an insight into their finances.

The finances of cycling teams are in many ways very different from the finances of teams in most other sports. First, although cycling teams operate like small businesses, according to the rules of the UCI, they are not run for profit. As a result, team budgets or team revenue should, in principle, equal team expenses. In reality, however, cycling teams do have small profits or losses. Second, cycling teams do not have a home stadium or arena. The lack of a home venue, and thus the impossibility of hosting their own cycling races, prevents cycling teams from collecting ticketing revenue, an important source of revenue in most team sports. Third, while revenue from broadcasting rights is a growing source of income in many other sports, it is currently not available to professional cycling teams. As a result, as of 2022, cycling teams are still almost exclusively financed by sponsorship money.

The data in this chapter are based on as many reliable sources as possible, such as officially published documents, team websites, and interviews by team managers. However, as is often the case with financial data of sport entities, cycling teams are rather reluctant to disclose information on their budgets or to detail the sources of revenue or the composition of the expenditures. Therefore, in some cases,

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secondary data from media sources were cautiously used whenever necessary to get a more complete picture of the situation.

This chapter is structured as follows: The next section discusses the steady growth in team budgets over the past 30 years (Sect. 2). Next, we turn to the costs of cycling teams by analyzing some rare cases of publicly available financial information. Operating expenses as well as rider salaries are analyzed in detail (Sect. 3). In Sect. 4 we take a closer look at how cycling teams are currently financed. Section 5 looks at alternative financing techniques of cycling teams, such as the sharing of media rights income, the *Velon* initiative, non-fungible tokens, and a cap system. The final section offers a first impression about the finances of women's cycling teams.

2 The Growth in Team Budgets

Much more than most other sports does the professional cycling sector lack financial transparency. This becomes clear when one wants to analyze the evolution of team budgets. In 2012, in their last known official statement on team budgets in men's road cycling, the UCI announced that the combined total budgets of the 40 professional cycling teams present at the WorldTour and at the ProContinental level amounted to €321 million or on average €8 million per team. The numbers, based on reports by Ernst and Young, showed an increase of 36% when compared to the €235 million total of 2009, which convinced at the time UCI President Pat McQuaid to claim that "men's professional cycling is prospering in these difficult times" (Velonews, 2012). Unfortunately, there has been no communication on combined total team budgets since then. It is staggering to see that while the whole world of sports evolved at lightning speed, cycling's governing body has remained silent about the team's finances for already a decade now.

The UCI never discloses individual team budgets, but also cycling teams seldom reveal detailed financial information. Only a few teams do openly communicate their budget in press releases, *Cofidis*, being one of the better examples in this respect. For some teams, budget information can be found by consulting the filed annual accounts, when they are publicly available. But to get a global view on the historical evolution of team budgets, we have to rely mainly on secondary sources. For example, the Dutch monthly *Wielerrevue* or the Flemish daily *Het Nieuwsblad-Sportwereld* do publish estimates of team budgets from time to time, for example, in their season-opening special issues. Similarly, at the start of the Tour de France, the yearly tour guide by French daily sports newspaper *l'Équipe* often includes budget estimates of all competing teams. Furthermore, in press interviews, team managers or sponsors occasionally refer to team budgets or release other financial information.

The individual team budget data that are published must be interpreted with great caution. We observed considerable differences between the reported budgets depending on the source. For instance, while in l'*Équipe*'s yearly Tour de France guide for 2014 a budget of €8 million is mentioned (l'Équipe, 2014a), the official

Cofidis press dossier released at the start of the season announced a budget of €9.5 million (Cofidis, 2014). Jonathan Vaughters, general manager of *Cannondale Drapac*, confirmed (Cyclingtips, 2017) that the *L'Équipe* estimates were not accurate, putting *Orica-Scott*'s budget closer to $25 million per year (€13 million according to *l'Équipe*) with his team at about €13 million (€10 million according to *l'Équipe*).

Sometimes, cycling teams will report inflated team budgets, especially when the prestige of the sponsor or the quality of the team needs to be emphasized. But it seems that in most cases the reported budgets are an underestimation of the actual budgets. Sponsoring companies may be unwilling to disclose the exact amount of money they are investing into a professional cycling team to avoid fiscal exposure or for strategic reasons. Furthermore, value in kind sponsorship, where a sponsor provides a value in the form of goods and services instead of cash money, obscures the picture. The expenses on value in kind-sponsored goods and services (e.g., bikes in the case of a sponsoring bike manufacturer or team cars in the case of a sponsor from the automotive industry) are sometimes left off the books or are valued at production cost instead of at market price. When this is the case, the reported budget of the team will be artificially lower than the budget of a team that does not enjoy such sponsorship benefits. Finally, the real team budget can be underestimated as well when a top rider is paid privately by a sponsor. For example, it is no secret that bike manufacturer *Specialized* pays a large part of Peter Sagan's salary, estimated at €5 million to €5.5 million in 2021. It is unclear though how this fits with the rumored €18 million budget of his team *Bora–Hansgrohe*. Should we add some part of Sagan's €5 million plus earnings to the €18 million total to get a better estimate of the actual team budget or is Sagan's salary already entirely covered by that budget?

To address these concerns, the budgets used in the analysis below are approximate best estimates based on a comparison of data collected from various well-informed sources. By monitoring such sources over many years, a comprehensive dataset that enables some historical insight was constructed. Figure 3.1 illustrates the evolution of team budgets in two ways. We computed the average team budget

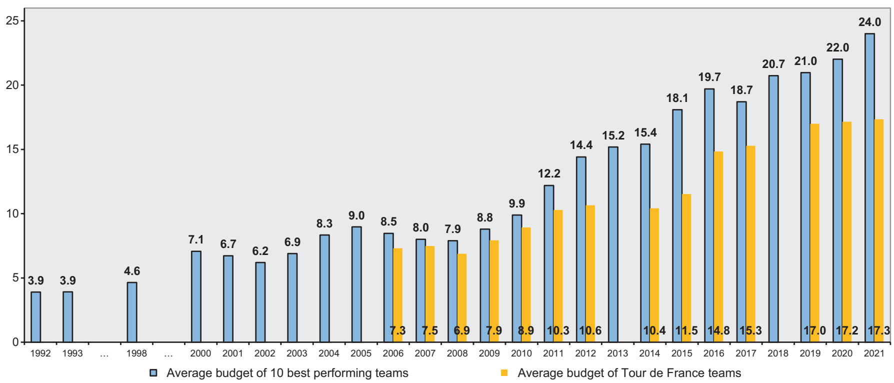

Fig. 3.1 Average team budgets (million euro, 1992–2021, nominal value)

for the ten best performing teams in each year between 1992 and 2021 (blue bars) and for all the teams participating in the Tour de France between 2006 and 2021 (yellow bars). Nominal data, not adjusted for inflation, were used. For the 1990s, the official UCI team ranking was consulted to determine the top ten performing teams. The UCI ranking underwent many changes since 2000 and is based on a subset of top cycling races only. We therefore decided to use the yearly CQ team ranking from 2000 onward (www.cqranking.com). The CQ ranking is not only methodologically consistent over the years, it is also a much better measure of a cycling team's overall performance since for this ranking results from all of the season's professional road cycling races are used.

The budgets of the ten best performing professional cycling teams appear to have increased slightly during the 1990s from about €4 million in the first part of the decade to close to €5 million by the end of the 1990s. The average budget of a top team in 1992 amounted to €3.9 million. *Banesto* was the richest team in 1992 with an annual budget of €5.3 million, followed by the Spanish lottery *Once* (€5.0 million). The average budget had increased to €4.6 million by 1998, and the same two Spanish teams topped the money list with increased budgets of €6.5 million and €5.6 million, respectively. By the turn of the century and in spite of the *Festina* doping scandal in 1998, a substantial increase in average team budgets is observed. Between 2000 and 2003, the average budget of a top cycling team was around €7 million. *Mapei* and *Telekom* had the most money to spend and were the first teams to report budgets in excess of €10 million.

In 2005, the UCI implemented the UCI ProTour competition formula, a license-based system for races and professional teams (Chap. 2). Top cycling teams invested significantly to gain access to the ProTour which led to another significant rise in team budgets. Average budgets peaked at €9 million in 2005 and fell back slightly in subsequent years, albeit at a higher level than before the start of the ProTour. *T-Mobile* and *Rabobank* were the richest teams at that time with reported budgets between €10 million and €15 million.

The growth in team budgets accelerated again from 2009 onward, as wealthy teams with reported budgets of €15 million to €20 million entered professional road cycling: *HTC-Highroad* (2009), *Katusha* (2010), *Sky* (2010), *RadioShack* (2010), and *BMC* (2011). To remain competitive, some existing top teams sought the backing of wealthy benefactors or oligarch business owners. Without even being featured on the team jersey, Czech top industrial and cycling fan Zdenek Bakala started to support financially the *Quick-Step Cycling Team* in 2011, and *Saxo Bank* was strengthened financially in 2012 when Russian banker Oleg Tinkov became a primary partner. In 2015, no fewer than a third of the 18 UCI WorldTeams were supported by such sugar daddy-type sponsors: Zdenek Bakala (*Etixx–Quick-Step*), Andy Rihs (*BMC Racing Team*), Gerry Ryan (*Orica-GreenEDGE*), Igor Makarov (*Team Katusha*), Oleg Tinkov (*Tinkoff-Saxo*), and Michel Thétaz (*IAM Cycling*). By 2022, most of them had disappeared again, but the upward trend in team budgets meanwhile continued. This is in part the result of the rise of teams funded by Middle Eastern states. The Kazakh *Astana* team has a long history in cycling (it first co-sponsored a UCI WorldTeam in 2007), but more recently also Bahrain and the

United Arab Emirates (in 2017) and Israel (in 2020) started sponsoring a WorldTour road cycling team.

The deep pockets of the *Sky/INEOS Grenadiers* team, with a budget of about €50 million in 2021, and the pressure from first wealthy benefactors and later state-funded teams resulted in a tripling of the budgets of top cycling teams between 2008 and 2021 from on average €7.9 million to €24.0 million (a compound annual growth rate of 9%). Over the same period, the average budget of the teams taking part in the Tour de France increased from €6.9 million to €17.3 million (a compound growth rate of 7.5%). The fact that team budgets kept increasing at that speed, despite the banking and economic crisis of 2008–2009 and its aftermath, the high-profile doping cases of 2012–2013, and the 2020–2021 pandemic, is testimony to the resilience of the cycling sector to external shocks, which is much stronger than most stakeholders ever anticipated.

There are mixed feelings about this evolution toward stronger dependency on deep-pocketed investors rather than on just commercial sponsorship exchanges. Although positive in the short run, the presence of wealthy benefactors and state sponsors does not warrant long-term financial stability and is not a viable growth strategy either. This was clearly illustrated when in the course of just three seasons four wealthy benefactors left cycling: Oleg Tinkov (*Tinkoff*) and Michel Thétaz (*IAM Cycling*) at the end of 2016, Andy Rihs (*BMC Racing Team*) after the 2018 season, and Igor Makarov (*Katusha*) in 2019. The dependency on benefactors provided professional road cycling an easy lifeline in difficult circumstances, which did not help either to create better awareness among stakeholders about one of road cycling's most fundamental issues: encouraging large multinational companies to a long-term commitment to the sport. Deep-pocketed investors also had the adverse effect of raising financial entry barriers to the sport, making it much harder for teams to find new commercial sponsorship, and they increase the likelihood of crowding out effects, i.e., existing smaller sponsors being pushed out of the business.

Overall, the evolution from €3.9 million in 1992 to €24.0 million in 2021 for the best performing teams and from 7.3 million in 2007 to €17.3 million in 2021 for the Tour de France teams both represent an average annual budget increase of 6–6.5%. This is significantly higher than the long-term inflation average of 2–3% in Western countries in recent decades. But cycling as a sport has not grown at the same rate over the course of 30 years: there has not been a proportional increase in days of racing, TV audiences, or other exposures that sponsors may look for. The budget increases therefore represent pure cost inflation to the teams. Although globalization (see Chap. 14) has certainly increased transportation and accommodation costs over the years, the dominant costs of cycling teams remain rider salaries (see Sect. 3.3). The cost inflation thus basically implies a steady growth in the earnings of top cyclists. While this is, of course, a good thing for the riders, from a sector point of view, questions could be raised. For a sponsor, it is worrying to find out that to remain competitive, any budget agreed upon today needs to be increased by over 6% a year to just cover wage inflation, without real evidence of an equivalent extra return or productivity.

Two Belgian UCI WorldTeams are among the few to survive through the past couple of decades and serve as excellent examples of the budget rat race at the team level. The budgets of the teams of Lefevere amounted to €2.7 million in 1992 (*GB-MG*) and have increased to €20 million in 2021 (*Deceuninck-Quick-Step*). As explained, the annual increase in budget of just over 7% this represents has since 2011 been realized with the financial support of Czech tycoon Zdenek Bakala. The other Belgian top team faced the same challenge. *Lotto*, the main brand of the Belgian national lottery, invested €400,000 as a sole sponsor in 1984. Thirty-seven years later, it is estimated that with the help of its co-sponsor *Soudal*, the team is managed with a global budget of €16 million. For the Belgian team, this represents an annual budget increase of 10.5%.

Inequality between deep pocket teams and poor teams in the same competitions also raises the issue of competitive balance (Fort & Maxcy, 2003), with the risk of making rich teams even richer and poor teams poorer. This is illustrated in Fig. 3.2 which projects the budgets of *Team Sky/INEOS Grenadiers*, *Ag2R La Mondiale*, and *Lotto–Soudal* for the 2010–2020 period. The three UCI WorldTeams are among the few for which official budget information can be found by consulting publicly available filed annual accounts. The budgets are presented and discussed almost on a yearly basis on the Inner Ring Cycling Blog from where we collected the data (http://inrng.com).

The different trend in budget growth between the three teams is obvious. The *Lotto–Soudal* budget grew between 2012 and 2017 to a maximum of €17.4 million but then started to decrease slowly. The budget seems to have hit a ceiling, and it looks like the Belgian team is facing more and more difficulties in keeping up with the budgets of other mid-tier UCI WorldTeams. As a result, it has been overtaken in budget by the French *Ag2R La Mondiale* team. *Lotto*'s budget only grew by a modest 2% a year between 2012 and 2020, while *Ag2R La Mondiale* almost doubled its budget between 2011 and 2018 (9.5% annual growth rate). In 2021, the financial

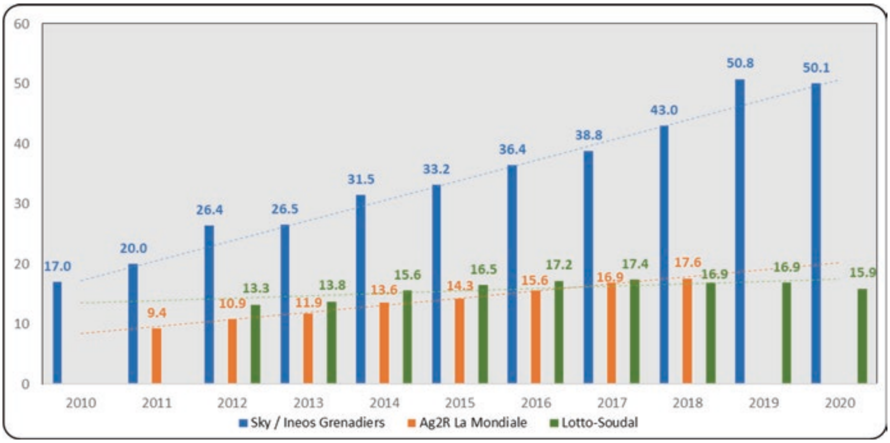

Fig. 3.2 Budget evolution of three WorldTour teams (million euro, 2010–2020, nominal value)

gap between the teams widened further when automotive sponsor *Citroën* joined the French team as a title sponsor lifting the budget to a rumored €23 million. But, as is plainly clear from Fig. 3.2 as well, both teams are unable to match the display of financial power by the richest cycling team in the world (*Team Sky/INEOS Grenadiers*). The team of manager Dave Brailsford tripled its budget between 2010, its first year in professional road cycling, and 2019 from €17 million to almost €51 million, a compound annual growth rate of 13%.

Yet, even the budgets of the richest UCI WorldTeams are relatively small compared to the money that circulates in some other sports. For example, the estimated €500 million combined budget of all 38 professional cycling teams in 2021 was still just 60% of the €828 million budget of FC Barcelona for the 2020/2021 football season (FC Barcelona, 2020), and the average budget of a UCI WorldTeam (€20 million) is only 10% of what each of the 32 NFL teams in America will receive minimally just from media rights ($220 million) (Forbes, 2021).

We conclude the section with a brief comment on the budgets of UCI ProTeams. Reliable budget data for these teams are really hard to find. From one of the few communications by the UCI, we know that between 2003 and 2009, the average UCI ProTeam budget increased from €0.8 million to €2.5 million, while the smallest team budget increased from €483,000 to €920,000 (UCI, 2009). No official information on the finances of UCI ProTeams for later years is available, but it is safe to assume that also the budgets of these teams have increased significantly over the past decade and likely will have doubled at least since 2009 to between €5 million and €6 million on average in 2021. The top UCI ProTeams taking part in the 2021 Tour de France have bigger budgets, estimated at between €7.5 million (*B&B Hotels p/b KTM*) and €13 million (*Cofidis*). *Arkéa–Samsic*, *Alpecin–Fenix*, and *TotalEnergies* are rumored to run on a €10 million budget (https://www.sportune.fr).

3 The Costs of Cycling Teams

3.1 Team Personnel

A professional cycling team is much more than a group of riders that wear the same jersey. To be able to perform at their best, professional cyclists are surrounded by people such as sports directors, doctors and physiotherapists, soigneurs, nutrition experts, mechanics, bus drivers, and press officers. Cycling teams can therefore be looked upon as small companies with specialized staff recruited to support the team's cyclists. Total team sizes do vary significantly, but a UCI WorldTeam counts on average between 60 and 90 people, including up to 30 professional riders.

It is complex and sometimes even impossible to determine the exact number of people involved in a UCI WorldTeam. Some team websites do give accurate information. For example, from the *Quick-Step-Alpha Vinyl* website (www.quickstep-alphavinylteam.com), we learn that in 2022, the team consisted of 30 riders and 55 people in support, including, for example, 14 managers and team directors and 11 mechanics. But this is a nominal head count. Because during a cycling season a team's needs for mechanics or soigneurs are highly variable, part-time contracts are regularly used. Consequently, when measured in full-time equivalents, a different picture will emerge. When a women's team and/or a development team is supported as well, the situation can get even more complicated. In January 2022, the *Jumbo–Visma* website (www.teamjumbovisma.nl) indicated there were 107, 99, and 95 staff for the men's, the women's, and the development team, respectively. But since many individuals were involved in two (or all three) of the teams, it is almost impossible to know the actual full-time equivalent staff for just the men's (or any other) *Jumbo–Visma* team. Other team websites do not give detailed information or do not publish any information at all on team staff, as was the case with the *Lotto–Soudal* website in January 2022. Consulting a team's financial accounts, if publicly available at all, does not necessarily provide a better answer. For example, the 2020 *Lotto–Soudal* accounts report just 43 employees. Since we know they had 28 riders, this would imply a total staff of only 15 managers, sports directors, mechanics, soigneurs, and so on. Obviously, a lot more people are involved in running the Belgian team. Like many other teams, on top of the core of salaried staff, *Lotto–Soudal* hires in contractors that invoice their services to the team. This becomes clear from the accounts as well: from the €15.9 million budget, about half (€7.7 million) was spent on personnel costs for the 43 employees and another €7.7 million on services and diverse goods, which presumably includes the outsourced personnel costs (Inring.com, 2022). Also, riders can operate as contractors, usually to optimize tax or social security payments. This explains why Team *Sky*'s accounts for 2011 only report just three full-time staff (Inring.com, 2018). From all this, it is obvious that an accurate comparison of team personnel across UCI WorldTeams is almost impossible to realize.

3.2 Team Expenses

Cycling teams do not publicly disclose the breakdown of their revenue and expenses. In many countries, however, the financial accounts of companies can be consulted fairly easily. Over the past 10 years, the Inner Ring website (http://inrng.com) has regularly published blog articles on the finances of cycling teams using the available annual accounts of *Team Sky* (2010–2020), *Ag2R La Mondiale* (2013–2017), *Tinkoff* (2015), *Groupama–FDJ* (2019), and *Lotto–Soudal* (2020). Much of the discussion below is inspired by the detailed and insightful analyses in those articles.

Table 3.1 presents summary data on revenue and expenses for several cycling teams. Since on many occasions the information was incomplete or not specific enough, from all the aforementioned teams discussed by the Inner Ring, only *Team Sky* from 2010 to 2015 was selected for the table. We added reliable and detailed information on the finances of *US Postal* (2002 and 2003) and *RadioShack–Nissan*

Table 3.1 Breakdown of expenses and revenue of cycling teams

	Average	US Postal 2002		US Postal 2003		Sky 2010		Sky 2011		Sky 2012		Sky 2013		Sky 2014		Sky 2015		RadioShack 2012	
		(000 $)	(%)	(000 $)	(%)	(000 £)	(%)	(000 £)	(%)	(000 £)	(%)	(000 £)	(%)	(000 £)	(%)	(000 £)	(%)	(000 €)	(%)
Revenue		**10,240**		**12,735**		**14,603**		**16,680**		**21,398**		**22,061**		**24,479**		**24,442**		**25,286**	
Sponsorship	*90%*	9990	98%	12,485	98%	13,323	91%	13,667	82%	17,488	82%	20,444	93%	21,298	87%	20,614	84%	24,869	98%
Race fees and other income	*10%*	250	2%	250	2%	1280	9%	3013	18%	3910	18%	1617	7%	3181	13%	3828	16%	417	2%
Expenses		**11,452**		**12,054**		**14,587**		**16,648**		**21,361**		**22,041**		**24,424**		**24,420**		**25,996**	
Salaries	*74%*	9814	86%	10,889	90%	8660	59%	11,001	66%	15,394	72%	15,630	71%	18,223	75%	17,982	74%	18,006	69%
Travel costs and accommodation	*8%*	986	9%	920	8%	1682	12%	1575	9%	1680	8%	1773	8%	2061	8%	2286	9%	813	3%
Bike equipment	*8%*	14	0%	12	0%	2014	14%	1407	8%	2127	10%	2112	10%	2291	9%	2091	9%	3705	14%
PR and marketing	*3%*	151	1%	−216	−2%	214	1%	1085	7%	981	5%	923	4%	778	3%	612	3%	330	1%
Office and corporate identity	*2%*	446	4%	258	2%	478	3%	362	2%	401	2%	456	2%	585	2%	572	2%	453	2%
Legal fees, registrations, etc.	*2%*	23	0%	15,5	0%	279	2%	205	1%	233	1%	319	1%	469	2%	582	2%	1974	8%
Research, medical, anti-doping	*1%*	31	0%	0	0%	299	2%	302	2%	266	1%	270	1%	305	1%	294	1%	120	0%
Miscellaneous	*2%*	−14	0%	175	1%	961	7%	711	4%	279	1%	558	3%	−288	−1%	1	0%	595	2%
Profit (loss)		**−1212**		**681**		**16**		**32**		**37**		**20**		**55**		**22**		**−710**	

Sources: Inring.com (2011, 2012, 2013, 2014, 2015, 2016), Tailwind Sports (2003), and Velorooms (2013)

(2012) as well. The revenue and expenses in the table are nominal figures in the currency of the country where the team filed its accounts.

As is the case in most companies, salaries make up the lion's share of costs to cycling teams: on average 74% across all teams in Table 3.1. This percentage is in line with numbers that are often cited in popular press by team managers. Riders account for about a third of the team size, and since some earn superstar wages, rider salaries will be the most significant salary cost to a cycling team. For *Team Sky* between 2010 and 2015, the multibillion contracts of Chris Froome and Bradley Wiggins stood out. *Sky*'s annual accounts do not allow to split rider and staff salaries, but this information is available for other teams in the table. In the *RadioShack–Nissan* team, the total rider salaries equaled €12,656,000 or 70% of the salary cost and 49% of all team expenses (Velorooms, 2013). Salaries took up 86–90% of total expenses for *US Postal* in 2002 and 2003. This high percentage probably follows from the fact that, compared to other teams, *US Postal* did not report significant bike equipment costs (see below). Total rider salaries in the 2002 *US Postal* team equaled €7,624,000 which is 78% of the global salary cost and 67% of the total team cost (Tailwind Sports, 2003).

Because cycling races are organized all over the world, travel and accommodation costs are significant. In January 2022, *Team Jumbo–Visma* posted a video on *Facebook* unveiling its new service course, the headquarters of a cycling team, with a stunning fly-through video shot by drone (https://www.facebook.com/JumboVismaRoad/videos). The video is a great illustration of the logistic nightmare of running a professional cycling team, necessitating many cars, trucks, and buses to move riders, personnel, and equipment around. For example, in 2017, the *Team Sky* fleet had £2 million worth of vehicles, but there are likely some leased vehicles on top as well (Inring.com, 2018). In Table 3.1, travel and accommodation costs represented 8–12% of *Team Sky*'s and *US Postal*'s total expenditures, while *RadioShack–Nissan* spent only 3% of its budget on logistics. Travel costs for *RadioShack* were remarkably low because presumably co-sponsor *Nissan* provided the cars. As explained, nonmonetary sponsorship complicates cost comparisons across teams since it is not always clear whether or not the in-kind benefits are included (in full) in the budget that is reported.

Bike and performance equipment is a third significant cost category. While for *Team Sky* and for *RadioShack–Nissan* bike equipment costs are between 8% and 14% of all expenses, for the *US Postal* team, such costs were close to zero. This seems to indicate that bike manufacturer *Trek* provided the bikes for free in exchange for brand promotion, a common practice in professional road cycling. Conversely, some teams have a policy of buying individual bike components for the sake of performance, e.g., *Team Sky* buying *Veloflex* tubulars or specialty carbon rims in 2012 (Inring.com, 2013). Since usually there is no detailed description in the accounts, it is unclear to what extent benefits in kind are part of the costs associated with bike equipment, further complicating any cost comparison between teams.

The three main cost categories (wages, logistic costs, and bike equipment costs) account for about 90% of all expenses of professional cycling teams. The remainder of the budget is spent on a variety of smaller costs, such as administrative costs, the costs of maintaining a website, social media presence, PR and marketing expenditures, medical costs, the occasional transfer payments, expenditures on research, and costs of inviting VIP guests. Examples of miscellaneous costs are depreciation and exchange revaluations. Next to these costs that are largely under the control of cycling teams, there are two extra costs imposed upon cycling teams by UCI regulations. In 2022, UCI WorldTeams have to pay a registration fee of €85,500 (UCI, 2021a). The registration fee for UCI ProTeams is €20,000, while UCI Continental Teams have to pay between €850 and €4250 depending on the continental federation they belong to (UCI, 2021b). In addition, there is a mandatory contribution to the cycling anti-doping foundation (CADF), which amounts to €134,774 per year for UCI WorldTeams (UCI, 2021a), €90,203 for UCI ProTeams, and between €450 and €2250 for UCI Continental Teams (UCI, 2021b).

3.3 Rider Salaries

As shown in the previous section, rider salaries account for at least half of the team's budget, and the topic therefore deserves a discussion on its own. But since contract negotiations in cycling are notoriously secretive, we have to fall back on anecdotal data from well-sourced media that speculate with reasonable certainty on the approximate salaries of riders.

The increase in team budgets (Sect. 2) has, of course, been beneficial to the riders. The wages of top cyclists in the 1970s were only a fraction of what top cyclists make today. For example, Eddy Merckx dominated international cycling at the start of the 1970s for an annual salary of "only" €50,000, while nowadays all of the world top ten cyclists earn at least €2 million. There was also no minimum salary, and up to the mid-1970s, many cyclists raced just for "trousers and a jersey" and the competition winnings. Even in the early 1980s, a significant part of many rider's annual income still came from so-called small and locally organized "kermesses" that paid riders to participate. Furthermore, there were hardly any social security regulations for cyclists, and disturbing tales of financially abused cyclists were common until the late 1980s. For instance, when Greg LeMond won the famous 1989 Tour de France, he nor his teammates from *AD Renting* had been paid for months. The team folded soon afterward, and it was team manager José De Cauwer who was left with all the debts (Vanwalleghem, 2010).

Things started to change in the 1990s when Hein Verbruggen took over UCI presidency and pushed to professionalize road cycling. Since the early 1990s, riders' fixed wages have been increasing steadily. The increase in quality and duration of cycling broadcasts concurrently increased the economic value of sponsoring. Companies are especially willing to pay more for those cyclists with the highest marginal productivity in terms of media coverage, which implies that the wages that have been increasing the most are those of cycling's superstars (Mignot, 2013). Greg LeMond was probably the first rider to witness the changes that took place. His yearly salary when he turned professional for the *Renault* team in 1981 was about $15,000. After winning the Tour de France three times, he earned $2 million (€1.5 million) with France's *Z* team in 1992 (Veloptimum, 2007). He is credited with leading the entire peloton into higher wages as he was the first rider to be paid over €1 million a year. By 2000, there were five cyclists earning over €1 million a year, and 25 riders were said to have salaries in excess of €0.5 million (De Standaard, 2000). However, the minimum salary at that time amounted to only €11,000, and many riders were not even paid this minimum.

In the past two decades, riders really started to enjoy the benefits of the increasing team budgets. In 2002, Lance Armstrong was the first cyclist to be paid over €3 million a year. By 2014, top riders like Chris Froome, Vincenzo Nibali, Alberto Contador, Alejandro Valverde, and Peter Sagan all earned between €3 million and €4.5 million, and up to 20 riders had contracts worth at least €1.5 million a year. In the text box "*How much do today's top riders earn?*", we explain that the best paid rider today pockets €6 million and at least 15 cyclists earn over €2 million a year.

But also the lesser-paid cyclists are better off. This is partly a result of the fact that also the minimum wages have been lifted considerably over the years. In 2021, the UCI stipulates a minimum salary for WorldTour riders of €40,045 (employed) or €65,673 (self-employed) and €32,300 (employed) or €52,972 (self-employed) for a ProContinental rider. To encourage the employment of promising young riders, the UCI allows teams to pay first-year professionals only 80% of the minimum salary. There is no minimum wage at the (third tier) Continental level. UCI regulations state that Continental teams have to cover expenses like bikes and kit, but not a wage. Many cyclists of the 187 teams registered at this level in 2022 are therefore likely to be riding for free. Depending on what country the team is registered in, however, there may be additional requirements. A French Continental rider must receive a minimum wage due to employment laws, while in Belgium there are three different subcategories of Continental-level teams, each with their own financial rules (Cyclingtips, 2021).

How Much Do Today's Top Riders Earn?

From time to time, rankings about the best paid riders in professional road cycling appear in popular press. The website https://procyclinguk.com/how-much-pro-cyclists-earn inventarizes that information. In 2021, Tadej Pogačar became the best paid rider in the world when he negotiated a 6-year €6 million a year contract with *UAE Team Emirates*. Peter Sagan and Chris Froome are said to earn between €5 million and €6 million. A handful rider from the *INEOS Grenadiers* team are high on the list as well: Geraint Thomas (€3.5 million), Egan Bernal (€2.8 million), Michal Kwiatkowski (€2.5 million), Richard Carapaz (€2.1 million), and Adam Yates (€2 million). Other riders with rumored salaries between €2 million and €3 million are Julian Alaphilippe, Wout van Aert, Alejandro Valverde, Vincenzo Nibali, Mathieu van der Poel, Primož Roglič, and Thibaut Pinot. At least 15 cyclists thus make over €2 million a year.

As a comparison, in the 2021/2022 season, NBA superstar Stephen Curry earned a salary of about $46 million (€40 million). Another 177 NBA players received a base salary in excess of what the best paid professional cyclist in the world got (https://hoopshype.com/salaries/players). In Formula One, top pilot Lewis Hamilton was paid $55 million (€48 million) for the 2021 season.

(Note: All salaries are without any commercial endorsements or performance bonuses.)

As becomes clear from the regulation on minimum salaries, it is important to determine if a rider is self-employed or an employee. When self-employed, a rider might make more money but could lose employee benefits like health insurance or parental leave. But a self-employed rider can instead go to the government and apply for funding himself, e.g., when losing work, because the government sees a self-employed worker as their own company. The consequences of being self-employed are different in each country. Employment lawyer Marnix van Ark explains: "In a lot of cases, self-employed cyclists are considered employees because a riders' future depends on one client. Every country has a different definition of what an employee is, but in the European Court of Justice it depends on a rider's independence. How independent are you? Can you make your own choices? If you only have one client or one team that you're working for, and all of your income depends on that one client, then you cannot make your own choices. For example, a rider must also listen to their team manager, follow a yearly schedule or live at a team base" (Cyclingnews, 2020).

There is a wide spectrum in the earnings of WorldTour riders. In most cases, a UCI WorldTeam consists of one or more marquee riders who take up the biggest part of the payroll. These riders have shown the capability of winning major 1-day races and/or *Grand Tours* and are likely to be paid between €2 and €5 million a year. Beneath them on the pay scale are a few well-paid specialists who handle the mountains or the sprints and can win multiple *Grand Tour* stages or smaller stage races. These riders earn between €1 and €2 million a year. Next are the support riders, whose only job is to help the team captains. Experience, the quality and level of support, and team loyalty will determine the salaries of these so-called domestiques. A reliable domestique will be pocketing between €100,000 and €400,000. Finally, unless highly talented, young professionals at the start of their career will usually be guaranteed a minimum salary only.

Consequently, the wage difference between the best and the worst paid rider in a cycling team can be extreme. On the website wheelmenthebook.com, a large number of internal documents on Lance Armstrong's *US Postal* team can be found. Some of the documents contain detailed information on the team's salaries and bonuses. Although the data apply to a situation that is now 20 years ago, the *US Postal* example is highly informative because – to our knowledge – it is the only publicly available document on a complete professional cycling's team wage structure.

Table 3.2 presents a summary of the *US Postal* rider salaries in 2002 and 2003. The table illustrates in detail the team's hierarchy. Lance Armstrong, the team leader, absorbs over half of total rider salaries. In October 2000, Lance Armstrong signed a contract with Mark Gorski, manager of the *US Postal Team*, that would earn him $3 million in 2001 with yearly salary increases of $500,000 up to €4.5 million in 2004 (Tailwind Sports, 2002). His earnings in Table 3.2 are slightly below the contractual $3.5 million and $4 million because part of his salary was apparently used to pay Matthew White and Victor Peña (Tailwind Sports, 2003). Roberto Heras, the second team leader and Armstrong's most important support rider in the mountain stages of the Tour de France, received about $1 million. Salaries of close to €0.5 million dollar were paid to notable team members George Hincapie and José Rubiera. Since the *US Postal* team consisted of about 20 riders at the time, the famous 20/80 rule is applicable here: the four best paid riders receive close to 80% of all rider salaries. Three more riders were that important to the team to be paid over $200,000 a year. The data show as well that when riders perform well, they are promoted: Floyd Landis' salary more than triples between 2002 and 2003 after performing exceptionally well in support of Lance Armstrong in the 2002 Dauphiné Libéré and Tour de France, while Victor Peña's pay was almost halved. All the other riders earn between $50,000 and $150,000 except for the youngsters David Zabriskie

Table 3.2 US Postal rider salaries in 2002 and 2003 (in US dollars)

	2002		2003		Contractual Tour de France bonuses
Armstrong, Lance	3,390,000	*52.8%*	3800,000	*53.2%*	GC: 1500,000/500,000/250,000
Heras, Roberto	853,581	*13.3%*	1,038,231	*14.5%*	GC: 500,000/250,000/100,000
Hincapie, George	455,000	*7.1%*	465,000	*6.5%*	GC: 5000 if team wins tour Stage: 45,000/2000/1000
Rubiera, José	391,692	*6.1%*	425,000	*5.9%*	/
Vande Velde, Christian	252,500	*3.9%*	250,000	*3.5%*	GC: 1000,000/500,000/300,000 Stage: 75,000/25,000/10,000
Landis, Floyd	60,000	*0.9%*	215,000	*3.0%*	Stage: 10,000 Leader's jersey: 2000 Selected: 5000
Peña, Victor	200,000	*3.1%*	125,000	*1.7%*	GC: 500,000/250,000/100,000 Stage: 20,000
White, Matthew	125,000	*1.9%*	75,000	*1.0%*	/
Padrnos, Pavel	105,000	*1.6%*	125,000	*1.7%*	/
Casey, Dylan	100,000	*1.6%*			/
Kjaergaard, Steffen	80,000	*1.2%*	80,000	*1.1%*	/
Ekimov, Viatcheslav	68,750	*1.1%*	150,000	*2.1%*	/
Joachim, Benoit	50,000	*0.8%*	70,000	*1.0%*	/
Van Heeswijk, Max			50,000	*0.7%*	/
Boonen, Tom	30,000	*0.5%*			Selected: $10,000
Zabriskie, Dave	15,000	*0.2%*	50,000	*0.7%*	/
Five other riders	247,500	*3.9%*	228,000	*3.2%*	/

Source: Tailwind Sports (2002, 2003)

($15,000) and the then almost unknown Tom Boonen ($30,000). First-year pro-Boonen thus earned less than 1% of the amount of money team leader Armstrong made. It is worth noting as well that only four riders received a higher salary than the €350,000 a year team director Johan Bruyneel made.

Although at the time probably unknown to most of the team's riders, this wage spread was explicitly protected in Lance Armstrong's contract (Tailwind Sports, 2002): "Under no circumstance will the salaries of Armstrong, Roberto Heras, or Johan Bruyneel be decreased should the team's annual budget fall below $12,500,000. However, should the annual budget fall below $12,500,000, other rider and staff salaries may need to be decreased." The same paragraph in the contract also states that "Armstrong will have substantial input into rider and staff composition."

3.4 Other Rider Income

So far, we basically discussed official salaries only. But a rider's total income is rarely a single salary paid each month. For instance, it is said that at the peak of his career, Armstrong's total income amounted to between €15 million and €20 million a year, four to five times his official salary. This is because professional cyclists also receive income from image rights, commercial endorsements, performance bonuses, and prize money.

Some teams split a rider salary with a proportion being paid for the rider's sporting activities and an amount of money awarded for the rider's commercial value. Such an arrangement essentially includes a monetary compensation for using the rider's image rights in the public domain. Image rights concern the various rights a rider holds in their own persona, including their name, photo or film, signature, etc. Although this contractual arrangement is based upon the idea that the images of cyclists are valuable to the team from a promotional point of view, often the main reason for such split remuneration is that in many countries salaried income is taxed differently than earnings on intellectual property. The use of image rights to complement a rider salary is therefore not undisputed. In tax-friendly countries like Luxembourg, Cyprus, or Switzerland, sometimes special companies are set up to fiscally optimize such image rights. In January 2015, it was reported that, among others, team manager Patrick Lefevere and Belgian cyclists Tom Boonen and Stijn Devolder could face trial for hiding part of their revenues from the tax authorities via complex schemes, believed to include the payment of image rights through Luxembourg subsidiaries (Cyclingnews, 2015a). The matter was later solved in a settlement agreement in which, for example, Boonen paid €3 million (De Standaard, 2017). In their annual accounts, teams are seldom specific on image rights. Only in the annual accounts of the *RadioShack–Nissan* team we found a clear reference. The team paid a total of €1,210,000 as image rights to its riders in 2012, which is about 10% of the total salary cost of the riders (Velorooms, 2013). Since most teams use this technique, in the accounts of other teams, image rights are probably "buried" in some aggregated figure. The 2020 *Lotto–Soudal* accounts, for example, show that from the €15.9 million budget, about half (€7.7 million) was spent on salaries, social charges, and pensions and another €7.7 million on services and diverse goods. Since wages usually account for 70–80% of a cycling team's budget, it is plausible that the money *Lotto–Soudal* spent on services and diverse goods includes some image rights payments as well (Inring.com, 2022).

Depending on their popularity and media value, top riders can command lucrative sponsorship deals that are entirely separated from their team earnings. Contador, for example, was said to have a commercial deal with bike manufacturer *Specialized* which earned him €2 million annually (Cyclingnews, 2013). Some examples of such personal endorsements in the 2021 peloton are Mathieu van der Poel with *Canyon* (bike manufacturer), Wout van Aert with *Red Bull* (energy drink), Julian Alaphilippe with *Richard Mille* (wristwatch), and Remco Evenepoel with *Pizza Hut* (*fast food*). With fashion store *ZEB*, Evenepoel also has a personal clothing range "R.EV 1703," the name being a combination of the initials of his name and the postal code of his hometown. According to Evenepoel, the profits are "going to a charity that I chose personally" (Cyclingnews, 2018a). Little is known, however, about the specific income cyclists get from commercial endorsements since the value of such deals is seldom disclosed.

Top riders can also earn significant amounts of money by attending events. At the peak of his career, Jan Ullrich reportedly received €50,000 for a signing session. When Evenepoel won all four stage races he started in 2020 and became Belgian's newest cycling superstar in the run-up to the summer edition of Il Lombardia, it is said there were up to 30 invitations a day for discussing a promotional deal or a commercial appearance (Het Nieuwsblad, 2020). Riders can also pocket personal appearance fees for attending races. Chris Froome reportedly earned €1.4 million for taking part in the 2018 Giro d'Italia. On a similar note, the return of Lance Armstrong – after 3 years of retirement – in the Tour Down Under of 2009 personally pocketed the American AU$1.5 million (Cyclingtips, 2021). The few remaining post-tour criteriums easily pay a €50,000 appearance fee for the overall Tour de France winner and up to €30,000 for other top contenders and multi-stage winners (Stickybottle, 2016).

Rider contracts often include performance bonuses. Top riders usually earn bonus payments with victories or podium finishes in major races, while for support riders such payments are likely to be linked to their contribution to the team's success. Some teams also introduced bonus payments based on the number of points a rider collects in an official ranking. Such arrangements may be counterproductive though since it rewards – and thus promotes – selfish behavior that can conflict with team tactics.

Bonus payments can earn riders a significant extra income. In Table 3.2, we have included some examples of bonuses found in the official rider contracts of the 2002 *US Postal* team (Tailwind Sports, 2002). The most important support riders of Lance Armstrong received solid bonuses for a podium finish in the Tour de France: $0.5 million for Victor Peña and Roberto Heras and $1 million for Christian Vande Velde. The best deal was reserved for team captain Lance Armstrong. A Tour de France win in 2002 yielded him a \$1.5 million bonus, in addition to the yearly salary increase of \$0.5 million in case of a Tour victory Armstrong already negotiated before. Although the focus in the *US Postal* team was on *Grand Tour* wins, also a bonus for top results in classics races was offered to some riders. Winning Paris–Roubaix would have earned George Hincapie \$75,000 and a Ronde van Vlaanderen victory \$35,000 (Tailwind Sports, 2002). The lesser paid riders' bonuses seem small but could be significant to them as well. Tom Boonen would have gotten \$10,000 – a third of his official yearly salary at the time – if he had been selected for the 2002 *US Postal* Tour de France team.

A final part of a rider income is prize money. Since in most races the team leader's results are determined to a great extent by the team's collective effort, it is common in cycling that prize money is shared among all members of the team. For example, in the Tour de France, the team's total prize money is divided by nine: one ninth goes to staff members like mechanics and soigneurs and eight ninths go to the eight riders in the team, each share weighted by the number of stages they completed. Since the leaders and the top riders of a team do earn substantial amounts of extra money through image rights, bonuses, and commercial endorsements, prize money is only a small concern to them. Therefore, a race winner will often renounce on his fair portion of the prize money to increase the share of the support riders who helped to secure victory. In a successful team, prize money can effectively be a significant source of income for lesser paid riders. For instance, by winning three stages and the final team classification, the *Bahrain Victorious* team collected over €211,000 of prize money in the 2021 Tour de France or almost €23,500 per rider. For a support rider with a yearly salary below €100,000, this boils down to an extra income of 25% or more. At least in theory since, as we will later show, the net prize money is significantly lower because of mandatory deductions and taxes.

From a technical point of view, prize money is received by the cycling teams and not by the individual riders. As such, it is considered a revenue to the teams, and we will therefore discuss the issue of prize money in more details in Sect. 4.2.

4 The Revenue of Cycling Teams

Table 3.1 makes clear that cycling teams are financed almost completely through sponsorship. Generally, it is assumed the title sponsors account for 70–80% of the budget, while subsponsors and suppliers bring along another 10–20%. The other revenue reported in the table stems from participation allowances and prize money, both collected from race organizers. Additionally, teams can also generate fan-based income (merchandising, hospitality, sale of used bikes) or income from selling off team assets.

As an illustration, Fig. 3.3 presents a revenue breakdown for the 2018 *Groupama–FDJ* team, with the three main sources of revenue: sponsorship (in blue, 90% of the total income), race income (in brown, 5%), and merchandising and sales (in green, 5%). Almost 80% of the €18,736,561 budget is provided by the two title sponsors,

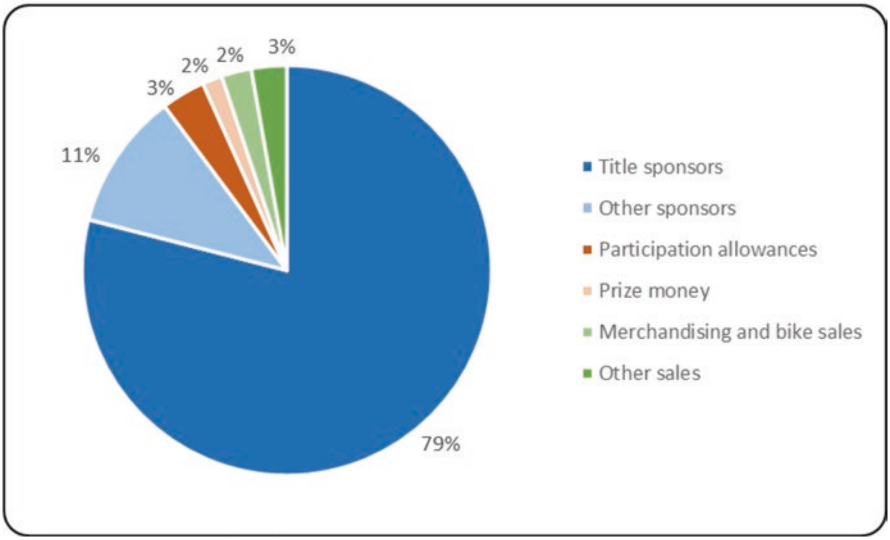

Fig. 3.3 Revenue breakdown for *Groupama–FDJ* in 2018 (Inring.com, 2020)

while other sponsorship revenue (11%) includes, for example, the annual sponsorship fee from bike brand *Lapierre* (€1.3 million). The team received €649,000 from race organizers as participation allowances and to cover logistic costs but earned only €293,000 prize money. Furthermore, there is about €500,000 linked to the sales of bikes and royalty payments on merchandise, and they sold off a team bus as well for €523,000 (Inring.com, 2020).

Given cycling teams' huge dependence on sponsorship money, its discussion deserves a chapter of its own (see Chap. 4). In the sections below, we will focus on other relevant sources of income currently available to cycling teams.

4.1 Participation Allowances and Presence Bonuses

Cycling teams usually receive an allowance for taking part in road cycling races. For the WorldTour races, the UCI sets a minimum allowance of €8500 per UCI WorldTeam, while UCI ProTeams only get €3500 (UCI, 2021a). Additionally, for stage races, organizers have to book and pay hotel rooms.

For the *Grand Tours*, the UCI specifies that the amount of the participation allowance has to be negotiated between the teams and the race organizer. Until about 10 years ago, such presence bonuses were regularly detailed alongside the prize money in the race regulations of a *Grand Tour*. For example, in 2012, a lump sum of €51,243 was paid to each of the participating teams in the Tour de France to cover participation expenses. To compensate expenses for extra personnel, a presence bonus of €1600 per rider was granted to all teams that finish in Paris with at least six riders (ASO, 2012). Also, the Giro d'Italia and the Vuelta a España provided a similar amount of money to the participating teams. After 2012, such specific information seems to have disappeared from the race regulations, but rumor has it that participation allowances in *Grand Tours* have largely remained unchanged since. Because almost no races pay out more than the UCI minimum, total participation allowances for WorldTour races nowadays amount to roughly €400,000 at best, which is just 2% of the average €20 million budget of a UCI WorldTeam.

The money the teams get is far from sufficient to cover all costs. In 2015, the *Etixx–Quick-Step* team detailed its costs from Tour de France participation (€99,150 without even including all costs), while from race organizer *ASO* it would receive only €66,543 at most, leaving a deficit of at least €30,000 (Het Nieuwsblad, 2015). Yet, the €60,000 to €70,000 that is collected from just participating in a *Grand Tour* is already more than what at least half of the teams earn in prize money during the entire 3 weeks of racing.

4.2 Prize Money

The UCI also regulates prize money. A summary on the minimum standards for the prize money in WorldTour events is presented in Table 3.3. A win in one of the *Monuments of Cycling* should guarantee the rider at least €20,000. The minimum is reduced to €16,000 for a win in another classic WorldTour race, while a stage win in a WorldTour stage race should earn a rider at least €4000. Minimum prizes for second and third are 50% and 25% of the winner's total, while the rider ranked in tenth position will receive 2.5% of this amount. In all WorldTour races, at least the top 20 riders should receive prizes (UCI, 2021a). In sports economics, a significant body of literature exists on the optimal gaps between prizes to elicit maximum effort by the athletes or teams and, hopefully, stimulate spectator interest for the sport. We refer to Chap. 7 for a more in-depth discussion of this so-called tournament theory.

Again, there is a different ruling for the *Grand Tours*. The UCI only imposes a combined total minimum amount of prize money for all stages and the general classification: €1 million for the Tour de France and €850,000 for the Giro d'Italia and the Vuelta a España (UCI, 2021a). There is no regulation by the UCI on minimum prize money for other classifications. While most other race organizers effectively restrict their payments to the official UCI minimum, all *Grand Tour* organizers award prize money well in excess of the minimum. Tour de France organizer *ASO* pays over twice the minimum amount, while Giro d'Italia organizer *RCS* pay 76% more than the minimum amount and Vuelta a España organizer *Unipublic* 31% (Table 3.3). On the downside, however, it is remarkable that throughout time, prize money only increases marginally, at a rate which does not even correct for inflation. In 2006, the total Tour de France prize money increased by 5% from €1,937,700 to €2,033,500. Fifteen years later, the total Tour de France prize money was €2,288,450, 12% more than in 2006, representing a compound annual growth rate of 0.75% only. Total Giro d'Italia prize money increased by 11% from €1,350,000 to

Table 3.3 Prize money in WorldTour road cycling races

Race	Total	Winner	Second	Third	Fourth	Fifth	Tenth	Number
Minimum prize money imposed by the UCI in 2021								
Tour de France	**1,000,000 in total for all stages and general classification**							*20*
Giro d'Italia	**850,000 in total for all stages and general classification**							*20*
Vuelta a España	**850,000 in total for all stages and general classification**							*20*
World championships	**14,000**	*8000*	*4000*	*2000*	*/*	*/*	*/*	*3*
Classic monument	**50,000**	*20,000*	*10,000*	*5000*	*2500*	*2000*	*500*	*20*
WT classic race	**40,000**	*16,000*	*8000*	*4000*	*2000*	*1600*	*400*	*20*
WT stage race (stages)	**10,000**	*4000*	*2000*	*1000*	*500*	*400*	*100*	*20*
WT stage race (GC)	**50% of the total sum of all stages**							
Real prize money in Grand Tours in 2021								
Tour de France	**2,288,450 in total for all classifications and stages, 129% over the minimum**							
Tour de France (stages)	**28,650**	*11,000*	*5500*	*2800*	*1500*	*830*	*600*	*20*
Tour de France (GC)	**1,128,800**	*500,000*	*200,000*	*100,000*	*70,000*	*50,000*	*3800*	*160*
Giro d'Italia	**1,499,510 in total for all classifications and stages, 76% over the minimum**							
Giro d'Italia (stages)	**27,540**	*11,010*	*5508*	*2753*	*1377*	*1102*	*276*	*20*
Giro d'Italia (GC)	**592,679**	*265,668*	*133,412*	*68,801*	*21,516*	*18,154*	*7863*	*20*
Vuelta a España	**1,115,825 in total for all classifications and stages, 31% over the minimum**							
Vuelta a España (stages)	**28,860**	*11,000*	*5500*	*2700*	*1500*	*1100*	*360*	*20*
Vuelta a España (GC)	**337,285**	*150,000*	*57,985*	*30,000*	*15,000*	*12,500*	*3800*	*20*

Sources: ASO (2021), RCS (2021), UCI (2021a), and Unipublic (2021)

€1,499,510 between 2003 and 2021, an annual growth rate of just 0.6%. Finally, Vuelta a España prize money increased by 6% from €1,050,880 to €1,115,825 between 2010 and 2021, an annual growth rate of 0.55%.

More interesting observations can be made from Table 3.3. First, official prize money in the UCI Road World championships, the only professional road race organized by the UCI, is embarrassingly low and reserved to the podium finishers only. A world champion merely receives about as much as the runner-up in a WorldTour classics race, and in total, only €14,000 is awarded. A positive thing that could be said, though, is that the UCI treats men and women equally since for many years already the same prize money is awarded to both. Second, according to the ruling of the UCI, from a financial point of view, a stage win in a smaller WorldTour race, e.g., the Tour of Poland, is almost worth as much as finishing third in a *Cycling Monument*, e.g., Paris–Roubaix, or as scoring a second place in the World championships. To the public, however, these performances are far from equivalent. Third, stage wins and podium finishes in *Grand Tour* stages are all valued more or less equal by the race organizers (but note how the Giro d'Italia sneakily pays €10 more for a stage victory and €8 more for the runner-up). In contrast, the difference in prize money for the general classification is huge. The Tour de France is paying almost twice the amount of money the Giro d'Italia offers and over three times as much as the Vuelta a España.

As explained, prize money is paid out to the teams. The earnings are subsequently distributed over the individual riders and staff in accordance with internal team agreements. In the annual accounts of cycling teams, prize money is therefore part of the revenue. From the information in Table 3.3 we can calculate the total prize money in the UCI WorldTour, which equals €7,013,785. When all the other races are added, total prize money in men's cycling is likely in between €9 and €10 million a year, to be divided over 35 UCI WorldTeams and ProTeams. Under the assumption that the 18 UCI WorldTeams take 90% of a €10 million prize pot in equal parts, this boils down to €500,000 per team or 2.5% of the average UCI WorldTeam budget. But the net amount in the books will be lower, because there are mandatory deductions, including a 2% anti-doping contribution. The deductions (13.82% in total in 2022) are calculated on the total prize money actually paid. Depending on the fiscal jurisdiction where the race takes place, these deductions may be made either before or after tax withheld (UCI, 2021a). Prize money will be deducted and paid to the recipients by the Centralized Prize Money Management (CPM) Platform. This platform, active since January 2019, was created by the UCI to answer complaints by team managers and riders about prize money not being paid out in due time. For example, in March 2015, a Dutch newspaper reported that the French Cycling Federation had yet to pay out prize money for the country's 2014 races, including the Tour de France and Paris–Roubaix (Cyclingnews, 2015b). More than €2 million was placed in a bank account rather than distributed to the teams and riders, arguably because the French Cycling Federation was awaiting results from drug tests to ensure that no doped riders receive prize money. The UCI mandated rider union CPA to manage the CPM. Although on its website (www.cpacycling.com) the CPA ensures transparency, efficiency, and cost savings in the management of the platform, the union has been criticized as well for keeping a generous 3.82% of the prize money for themselves: 2% for CPA administration and 1.82% for CPM administration. With all deductions and a (hypothetical) tax rate of 20%, in the end, there is less than €7 million of the €10 million prize money left to the teams and the riders.

The actual amount of prize money a team earns will of course mainly depend on the performance of the team's riders. Since only a few teams can be victorious in the races where the most money is won, there are significant differences in earnings between teams. For instance, in the 2021 Tour de France, *UAE Team Emirates* with overall winner Tadej Pogačar earned €621,580, but only two more teams collected over €200,000 of prize money. Conversely, four teams earned less than €21,000 which is not even €1000 per stage. A similar disparity in prize money earnings is found in 1-day races. According to a study on earnings in the 2015 spring classics season, discussed in Belgian newspaper *Het Laatste Nieuws* (2015) under the headline "prize money in cycling is a joke," *Etixx–Quick-Step* was the biggest earning team (€110,265), before *Katusha* (€89,155) and *Team Giant–Alpecin* (€52,800). Only 11 teams collected over €10,000 of prize money over the course of 14 races. Remarkably, the total prize money won by UCI WorldTour teams like *Team Lotto NL–Jumbo* (€6350), *Cannondale–Garmin* (€5130), and *FDJ* (€3063) during 2 months of classic racing – including four *Cycling Monuments* – was less than the money that could be earned with a single-stage victory in any *Grand Tour*.

To conclude this section, we should note that both the minimum amount of prize money and the participation allowances imposed by the UCI have remained the same since at least 2014 and, since we have no prior data, perhaps even longer. As race organizers do not share any of the media rights either (see below), the income teams and riders generate out of racing have hardly increased for a decade or longer. With a booming sports market worldwide, we cannot imagine another major professional sport where in a 10-year time span the league owner has not increased the monetary rewards for its key actors at all. Consequently, significant increases in team revenue and in rider remuneration could only come from higher sponsorship contributions, not from racing activities.

5 Alternative Financing of Cycling Teams

5.1 The Media Rights Revenue Sharing Issue

Because non-sponsorship income is very limited, team managers have a hard time balancing the budget. Cycling teams do not have a home stadium, and although millions of people watch races like the Tour de France or the Ronde van Vlaanderen from the roadside, there is almost no income from ticket sales. As a result, cycling teams have repeatedly stated their interest in a share of the money race organizers make from media rights deals. Since the teams deliver the main actors of any cycling event, a solid case could indeed be made for such a redistribution of media rights money. In spite of this legitimate demand, professional road cycling remains one of the only sports where the rights holders of the event, the race organizers, pocket all media rights without any redistribution to other stakeholders. To an outsider, this sounds very strange and outdated, as Simon Chadwick, professor of sports business strategy, already explained 10 years ago: "It's very, very unusual that the Tour de France doesn't share its revenue with the constituent parts of its brand. They're adhering to a model that was first introduced a century ago" (Duff, 2011).

Team managers and other promoters of the idea of media rights revenue sharing might have unrealistic expectations about the amount of money this could currently generate, even if race organizers would agree to a fair deal. First, due to the outdoor and migrant nature of a cycling event, there are high production costs involved with live broadcasts of races. As a result, race organizers have sometimes taken on the production costs and actually paid TV channels to broadcast the race. Higher exposure raises the status of the race which in turn facilitates finding sponsorship revenue. Today, TV channels or media companies are often official partners of race organizers, and in sponsorship deals, production costs are regularly considered to be benefits in kind offered to race organizers. To media companies, however, broadcasting a mega sport event is often a loss-making business. For instance, French TV channel *TF1* made a net loss of over €50 million with its broadcasts of the 2014 World Cup in Brazil (l'Équipe, 2014b). The total costs amounted to €135 million (€130 million broadcasting rights and €5 million production costs), while the sale of advertising slots yielded €50 million, and another €30 million was earned by reselling part of the broadcasting rights to pay channel *BeIN*. Similarly, as will be discussed in Chap. 6, *France 2* and *France 3*, the official French broadcasters of the Tour de France, record a net loss with their coverage of the race.

Second, even for the small number of top races for which TV broadcasters or media companies are willing to pay well, the amount of money available for redistribution is likely to be small. A detailed analysis in Chap. 6 explains how the global sum of media rights for professional road cycling competitions is currently somewhere in the region of €100 to €120 million a year, with the worldwide Tour de France broadcasting rights estimated at €70 to €80 million. If for any reason race organizers were to agree to rather generously share 20% of their earnings, between €20 and €24 million extra money is going to be available to all cycling teams. When revenue sharing would apply to UCI WorldTeams only, this boils down to just over €1 million per team or about 5% of the average team budget. Welcome of course, but no game changer and even in the best case scenario a long shot from what some team managers have publicly been dreaming of.

Third, there is more than revenue alone. Race organizers also incur costs and sometimes organize other (mass) sport events as well. If race organizers have any profit at all, it will definitely be much smaller than total (media rights) revenue. For example, *ASO*'s annual accounts show that from 2012 to 2016, the profit was between €30 and €50 million each year (Inring.com, 2017) or about half the value of the Tour de France media rights. Furthermore, *ASO* is involved in five major sports, organizing 240 days of competition per year, with 90 events in 25 countries (www.aso.fr). If *ASO* were to pay 20% of its media rights revenue, that would reduce profit by €15 million to €20 million. But *ASO* is not a charity organization. It is a privately owned company with profit-seeking shareholders to whom such a 30% to 50% profit cut will always be unacceptable. The shareholders will also point to the fact that *ASO* already "shares" some of its revenue with participation allowances of almost €1.5 million in total and prize money over twice the minimum amount imposed by the UCI. Moreover, profit from the lucrative Tour de France is used to cross-subsidize other cycling events (like Paris–Nice) or to invest in new cycling races (like the Arctic Race of Norway). Since revenue generated from the Tour is thus reinvested elsewhere on the calendar, *ASO* already indirectly shares part of its wealth by providing a better platform for teams to race. The same holds for other race organizers like *RCS* (cross-subsidizing races like Tirreno–Adriatico with profits generated by the Giro d'Italia) and *Flanders Classics* (cross-subsidizing races like Omloop Het Nieuwsblad with profits generated by the Ronde van Vlaanderen). Such engagements could become endangered if race organizers have to redistribute (more) money to the teams.

Although media rights revenue sharing should be part of any long-term business model of professional road cycling, at the moment for only a small number of top cycling races, such as the *Grand Tours* and the main classics races, media rights are sufficiently valuable to guarantee race organizers a profit. To most organizers of televised cycling races, however, media rights are just a welcome way to balance the budget or are a net cost. As long as professional road cycling is not well marketed and media rights are sold independently by local race organizers, media revenue will remain small. Rather than craving for a piece of the small cake that is available, it would be wiser that teams and race organizers in consultation with the UCI and the media look for a way to produce a bigger cake. But even when all stakeholders would be on the same page, a good dose of realism on cycling's global media value will be needed. As will be explained in Chap. 6, it is estimated that professional road cycling currently accounts for a marginal share of just 0.2% of the worldwide sports media rights, valued at $52.1 billion in 2021 (SportBusiness Consulting, 2021). Road cycling also only generates about 10% of the media rights revenue of the tenth most valuable in sport in the world, i.e., professional golf with global media rights amounting to $1.1 billion.

5.2 *The Velon Initiative*

One way to realize "a bigger cake" is to create new and exclusive (multimedia) content. To this end, in November 2014, 11 UCI WorldTeams formed a joint venture company that aimed to drive a financial model that ensures a sustainable future for the teams (Cyclingnews, 2014). The *Velon* group, as they called themselves, stated that it would use innovation and technology to increase the value of the sport and create upside revenue to cycling teams. The idea was to unite teams to work collectively with other stakeholders to make cycling better to watch, easier to understand, and more marketable (www.velon.cc).

The project seemed to lack realism right from the start. In Belgian media, team manager Patrick Lefevere was quoted saying that 3.5 billion people watch the Tour de France and therefore each year an extra cash inflow to the teams of €50 million could be created if 10 million of them wanted to pay €5 for a *Velon* app. As will be demonstrated in Chap. 6, the 3.5 billion viewers for the Tour de France is an utter illusion, and the average number of viewers per stage is 20–25 million at most. In order to realize the expected €50 million, one out of every two Tour de France TV viewers would have to be willing to pay €5 for the extra content the teams are offering which is highly unlikely. We can only hope that the investors behind the project used a more realistic approach in their projections.

Velon gained some momentum in 2017 with the first edition of the Hammer Series, a new racing platform organized by *Velon* in which teams of just six riders compete against each other to determine the winning formation. Each Hammer Series competition lasts for 3 days, with a different type of race each day: a flat stage for sprinters, a challenging stage for punchers or climbers, and a team time trial chase to conclude the Series. The races are imbedded in a broader program with other sports and entertainment activities to create a family-friendly festival-like atmosphere. The racing has often been spectacular, but the team time trial chase was at times chaotic. Conservative stances from the cycling world ("*cycling should be an individual sport*") and a lack of media attention (only a few TV channels covered the events live) made it difficult to get the new racing format under the attention of the public. But the major obstacle to the further development of the Series was the legal tussle with the UCI. In September 2019, *Velon* filed a complaint to the European Commission, alleging that cycling's governing body was trying to block the parallel race series that the *Velon* teams collectively own and manage (Velonews, 2020). As a result, the Hammer Series were suspended after just six editions.

In 2021, a season-long fantasy cycling game was introduced on the *Velon* platform (www.velon.cc). *Velon*'s exclusive rider power data play part in the game, with pro-riders' real-life power data being integrated as a bonus point scoring feature. The game is free to play, but its popularity is unknown since all content is password-protected. The *Velon* website further features a "live race center," and there are some videos to watch, but there seems to be little unique content. Furthermore, as of March 2022, the "latest from Velon" page lists just one news entry over the previous 10 months and only seven entries in total for 2021.

With a poorly maintained website, the Hammer Series on hold for probably many years to come, a cycling fantasy game that can be played for free, and *Velon* multimedia content that is shared publicly on social media channels, *Velon* has failed to create any new revenue to the teams yet. Seven years in existence, *Velon* has not been able either to crack the quintessential question in professional road cycling: How to motivate cycling fans to pay for content in a sport where all fan experience, be it on TV or live, has been basically free for decades and where the free nature has been a major driver of its success?

5.3 Non-fungible Tokens

Wout van Aert was the first rider to tap into a new source of income: the sale of non-fungible tokens (NFTs). An NFT is a unique digital certificate of ownership of an asset, stored as a series of blockchain data, and can come in the form of photos, videos, and audio. Certificates can be traded on a secondary NFT marketplace. Collecting and trading have always been a popular way for fans to express their passion for sport, through either assembling a collection of trading cards or filling up sticker albums. NFTs are a way of bringing that tradition into the digital realm (Sportspromedia, 2022).

In the case of van Aert, the assets featured animated images of three of his most important victories. Buyers own the digital images, though anybody is free to view or download the image for themselves. In November 2021, the three NFTs were sold in an online auction for 12.68 WEH (a form of the Ethereum cryptocurrency), which – at the time of sale – converted to about €47,000. Van Aert and his team *Jumbo–Visma* receive an undisclosed percentage of the sale as well as a further 10% if the NFTs are sold on (Cyclingnews, 2021a).

It is expected that commercial opportunities around NFTs and cryptocurrencies will be heavily explored in the near future, not only by riders and teams but also by race organizers. The possibilities seem endless, as has other sports meanwhile demonstrated. For example, the 2022 Australian Open offered "art ball" NFTs infused with real-time match data. Tennis fans could purchase NFTs that relate to a specific 19 cm by 19 cm plot of the court. Every time a winning shot landed in that plot during any match at the 2022 Australian Open, the relevant NFT was updated in real time with match and ball-tracking data (Sportspromedia, 2022). It remains to be seen though whether NFTs can evolve from a temporary hype to a stable source of income.

5.4 The (Non)sense of a Cap System

The increasing budget gap between *Team Sky/Ineos Grenadiers* and other teams (Sect. 2) fueled the demand for a cap system in professional road cycling. This demand became particularly prominent when the British team won seven out of eight Tour de France editions between 2012 and 2019. Driven by a market survey that indicated dominance by big-budget teams curbs the enjoyment of cycling fans, the UCI announced some sort of cap system was an option as part of the (planned but never materialized) 2020 WorldTour reforms (Cyclingnews, 2018b). The discussion of a cap system merits a chapter on its own. Here, we will restrict the discussion to some basic insights that explain why in all probability the introduction of such a system is not the right way to reorganize professional road cycling. For a broader discussion, we refer the interested reader to a comprehensive synthesis by The Outer Line (2021).

The rationale for a cap system is to prevent one team from gaining an unfair advantage over the rest of the competition and to enable smaller franchises to remain competitive and grow their fan base. But there are only a small number of sports leagues worldwide that use caps, like the big four American sports leagues (NFL, NBA, NHL, and MLB), the Australian Football League (AFL), and, since recently, Formula One. These "wealthy" sports have in common that they generate large income from TV rights and from hosting fans, with much lower sponsorship dependency than professional road cycling. This already raises a major question: Why even cap a "poor" sport that is so desperately in need for sponsorship money?

There is a wide variety of caps in sports. The most relevant ones are budget caps, salary caps (individually or globally), luxury caps, and cost caps. Caps can be nominal (a maximum amount of money) or proportional (a relative percentage). There is also the difference between soft caps (with various exclusions that allow flexibility in the calculation of the cap) and hard caps (with strictly defined limits). For example, with a budget cap in road cycling, total team budgets could be limited to, for example, €30 million (nominal) or to 50% of the average league budget (proportional). In a soft cap system, teams could be allowed to go to €33 million if certain conditions are met, while in a hard cap system that would be penalized, e.g., by a luxury tax. Salary caps could take the form of imposing that no rider is paid more than €4 million (individual) or that rider salary costs to the team cannot exceed €12 million (global and nominal) or should be below 50% of the team's budget (global and proportional).

Any serious discussion on the introduction of a salary cap in professional road cycling should therefore start from an analysis of the available empirical and theoretical research findings, if only to determine the relevant or preferred type of cap system. It is worthwhile to have a look at the Formula One cap system to illustrate the complexity. To stop cost inflation between Formula One teams, a cost cap, not a budget cap, was introduced. It is not a salary cap either since it only covers expenditure that relates to car performance. The cost cap excludes all marketing costs, race driver salaries, and the costs of the team's three highest paid staff. Property costs, fees to enter the championship and purchase licenses, flight and hotel costs for race and testing travel, and all corporate income tax are also exempt (www.formula1.com). In the context of professional road cycling, a similar cost cap would basically apply to the costs of the bikes and the salaries of the nonexecutives staff only, which does not make much sense. In fact, any realistic cap in professional road cycling is likely to hurt rider salaries in the first place.

Furthermore, there are some features of cap systems that make a successful implementation in professional road cycling very questionable. First, cap systems require complete financial transparency. Like in American sports, it would imply the publication of the individual salaries and bonus payments of the whole peloton, and like in Formula One, it would require the teams to detail and account for every single cost they make, which would automatically end all value in kind sponsorship. Second, cap systems often go hand in hand with redistribution mechanisms to create a better level-playing field. Both money and playing talent can be redistributed, but neither is plausible in the current business model of professional road cycling. Monetary distribution typically originates from media rights and other income that are generated at the league level, which remains inexistent in road cycling as long as the UCI (or anyone else) is incapable of monetizing the WorldTour (or any rival league). Redistribution of playing talent, e.g., through a draft system, can only in strictly regulated closed leagues. Since the free movement of workers is a fundamental principle of the European Treaty, it seems impossible from a legal point of view to ever introduce such a binding redistribution mechanism in European sports.

6 The Finances of Women's Cycling Teams

Women's road cycling has made a giant step toward professionalization in the last decade, and this is also reflected in a significant growth in team budgets. In 2017, the typical cost to run a UCI professional women's team was as little as €100,000, while a top team had a budget of €200,000 to €250,000. A 2016 survey of over 400 UCI registered women professionals demonstrated that half of the women's peloton had to work a second job in order to make financial ends meet with 52% of the women professional riders actually return parts of their salaries to the team, in order to pay for basic necessities such as equipment, travel costs, and the services of a trainer (The Cyclists' Alliance, 2017).

Just 5 years later, the budgets have increased at least fivefold. The 14 women's WorldTeams in 2022 are rumored to run on budgets between €1 and €3 million annually, while a second-tier team is more likely to have a budget between €100,000 and €500,000 (Cyclingnews, 2021b). The strongest second-tier teams like *Lotto–Soudal Ladies* and *Cofidis Women's Team* have budgets of €500,000 and €1000,000, respectively. The rapid budget growth is partly due to two important dynamics: the spectacular increase in media attention in recent years with evermore women's races receiving live TV coverage (Chap. 6) and the reforms the UCI initiated in 2020, with new financial requirements for women's WorldTeams that include paying riders a minimum salary of €15,000 (employed) or €24,600 (self-employed), along with social insurances and benefits such as maternity leave as part of the standard self-employed contract (Cyclingnews, 2020). However, there are only 14 registered top-tier teams. The 50 or so second-tier continental teams are not required to pay their riders the minimum wage, although some do. The foundation of The Cyclists' Alliance (TCA) in 2017 by former professional cyclists Iris Slappendel, Carmen Small, and Gracie Elvin has been important as well. Much better than the official rider union (CPA women) has the unofficial TCA been able to address the financial (and other) abuses in women's cycling. For a broader perspective on the role of the UCI and TCA in the development of women's road cycling, we refer to Chap. 13.

Higher budgets definitely benefited top riders but at the same time widened the wage gap. A yearly survey by TCA with over 100 respondents shows the number of female professional riders receiving zero salary increased from 17% in 2019 to 25% in 2020 and even 34% in 2021. In addition, 43% of the riders who were surveyed had to reimburse their team for either equipment, mechanical service, medical costs, or travel costs in 2020 (Cyclingnews, 2021b).

A growing number of sponsors from professional men's road cycling start to understand the potential of investing in a women's team as well. This became very clear in December 2021 when *Deceuninck*, title sponsor of a highly successful team managed by Patrick Lefevere, decided to jump ship to co-sponsor a much smaller rival team, *Alpecin–Fenix*. When asked about the move, CEO Francis Van Eeckhout specifically cited the lack of a women's team under Lefevere's regime as a reason for the switch (Cyclingnews, 2021c). Another sponsor pointed to the significant return of sponsoring women's cycling as well by quoting that "spending 5% of the cycling budget on women's cycling generates 10% of the overall return" (personal communication).

As a result, the number of men's UCI WorldTeams with an integrated women's WorldTeam has grown to eight in 2022 (Table 3.4): *Team BikeExchange–Jayco* (since 2013), *FDJ Nouvelle–Aquitaine Futuroscope* and *Team DSM* (since 2017),

Table 3.4 Link between women's WorldTeams and men's teams in 2022

Women's WorldTeam	Corresponding men's team	Category of men's team
Canyon–SRAM Racing	/	/
EF Education–TIBCO–SVB	EF Education–EasyPost	UCI WorldTeam
FDJ – Nouvelle–Aquitaine Futuroscope	Groupama–FDJ	UCI WorldTeam
Human Powered Health	Human Powered Health	UCI ProTeam
Liv Racing–Xstra	/	/
Movistar Women's Team	Movistar Team	UCI WorldTeam
Roland–Cogeas– - Edelweiss Squad	/	/
Team BikeExchange–Jayco	Team BikeExchange–Jayco	UCI WorldTeam
Team DSM	Team DSM	UCI WorldTeam
Team Jumbo–Visma	Jumbo–Visma	UCI WorldTeam
Team SD Worx	/	/
Trek–Segafredo	Trek–Segafredo	UCI WorldTeam
UAE Team ADQ	UAE Team Emirates	UCI WorldTeam
Uno-X Pro Cycling Team	Uno-X Pro Cycling Team	UCI ProTeam

Source: www.cqranking.com

Movistar Women's Team (since 2018), *Trek–Segafredo* (since 2019), *Team Jumbo–Visma* (since 2021), and *UAE Team ADQ* and *EF Education–TIBCO–SVB* (new in 2022). Two more men's UCI WorldTeams, *Lotto–Soudal* (already since 2009) and *Cofidis* (new in 2022), have a women's team as well but at the second-tier level, which leaves only 8 out 18 men's UCI WorldTeams without such a partner team. From the point of view of the women's WorldTeams, we see from Table 3.4 that next to the eight teams that are linked to a men's UCI WorldTeam, there are two more teams with a corresponding men's team at a lower level. *Human Powered Health* and *Uno-X Pro Cycling Team* are both UCI ProTeams in men's cycling. Therefore, only 4 out of 14 women's WorldTeams have no clear (sponsor) link with a men's team.

A common sponsor does not automatically imply a tight connection between the men's and women's team, but significant economies of scale can be realized when teams share a service course, training camps, or bike equipment. It might also improve awareness on gender balance, equality, and fairness, as was demonstrated by the decisions of *Trek–Segafredo* and *Team BikeExchange–Jayco* to raise the minimum salary of its women's riders to match the rate mandated for the WorldTour riders on its men's squad. Yet, integrating a women's and a men's team is not necessarily the best way to go forward in the long run. While potentially helping women's road cycling to enhance its visibility and to boost its economic and commercial potential, the policy of integration risks the women's teams continuing to be seen as subaltern to the men's counterparts. A critical question for women's cycling stakeholders therefore continues to be whether professional women's road cycling should follow the same sponsor-driven path taken by the men's or, instead, develop and implement a different business model altogether.

7 Concluding Thoughts

In cycling's outdated business model, between 70% and 80% of a team's budget is provided by the title sponsor(s), and over 90% of the budget is financed by the combined money from title sponsors, subsponsors, and suppliers. Teams and sponsors are in a mutual embrace. Teams are at the mercy of the cash infusion from the sponsors, while sponsors stay with the teams as long as they think it is the best alternative (Rebel, 2016). But teams find themselves in a particularly weak negotiating position. The yearly sponsorship cycle (Fig. 3.4) illustrates how year after year team management has to hope the title sponsors are satisfied with the results and the economic return, just to be able to continue for yet another season. If a title sponsor withdraws, a new sponsor has to be found. Either the cycle will then start again under a new name or the team will fold. As a result, teams have no lasting identity. Although some teams have started fan programs, like *Lotto–Soudal* with the "Captains of Cycling" project, it remains difficult to build long-term fan loyalty this way, let alone generate sustainable income from a fan community. The illusive sharing of TV rights and the *Velon* initiative demonstrate as well how cycling teams are looking to diversify their earnings but struggle to realize anything.

The result is a continuous Darwinist survival struggle for sponsors from which even the best teams in the world cannot escape. For example, in 2018, Patrick Lefevere, general manager of the season's most victorious team (73 victories), was only able to secure the new title sponsor *Deceuninck* at the very last moment. As explained in Sect. 6, in spite of the continued competitive success (66 victories in 2021), just 3 years later, *Deceuninck* decided to sponsor the smaller Belgian

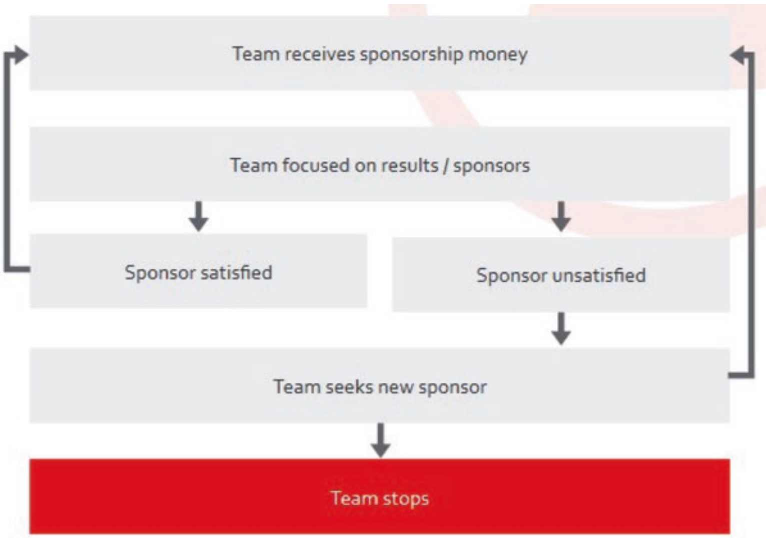

Fig. 3.4 The yearly sponsorship cycle (Rebel, 2016)

Alpecin–Fenix team instead. Also in 2021, *Soudal*, co-sponsor of the Belgian *Lotto* team since 2015, announced it would become the title sponsor of the Lefevere team in 2023. Such a sponsor switch between the two Belgian UCI WorldTeams had happened before. Led by the flamboyant Belgian entrepreneur Marc Coucke, *OmegaPharma* (or its subsidiary brands *Davitamon*, *Predictor*, and *Silence*) sponsored *Lotto* from 2005 to 2011 before moving to Lefevere's team in 2012 (Cyclingnews, 2021d). It should be a concern for the sport when cycling sponsorship becomes a bit of a game of musical chairs, when sponsors simply switch teams, rather than teams being able to attract new sponsors into the sport. The next chapter discusses professional road cycling sponsorship in much more details.

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Chapter 4
Sponsorship in Professional Road Cycling

Wim Lagae

1 Introduction: On the Origins of Team Cycling Sponsorship

Sport sponsorship is any commercial agreement by which a sponsor contractually provides financing or other support in order to establish an association between the sponsor's image, brands, or products and a sport sponsorship property in return for rights to promote this association and/or for granting certain agreed direct or indirect benefits (Lagae, 2005). Professional road cycling was one of the first sports to be practiced commercially through sponsorship. Cycling teams, sponsored by *Dunlop*, *Peugeot*, or *Simpson*, competed in the first editions of endurance races like Bordeaux–Paris already at the end of the nineteenth century (Boesman, 2013). Frame and bike component constructors dominated the sponsorship of cycling teams up to World War II. From the 1950s onward, nonsport brands like *Nivea*, *St. Raphaël*, and *Maes pils* entered professional road cycling.

Until well into the 1970s, professional road cycling was limited primarily to Belgium, France, Italy, the Netherlands, and Spain. Mainly midsized businesses were the major sponsors of the important teams. Cyclist sponsorship was characterized primarily by folklore and hobbyism. In a period of modest budgets, a number of bicycle manufacturers (including the Belgian *Flandria* and the Italian *Bianchi*) could remain the main sponsor of a team. Iconic was the successful *TI Raleigh* team of Dutch manager Peter Post. Cycling team sponsors came from very diverse sectors: food (chocolate bar *Mars*), beverages (the Spanish soft drink *Kas* and the Belgian beer *Maes*) and dairy products (*IJsboerke* ice cream), home furnishings (*FAGOR*), car brands (*Fiat* and *Renault*), truck brands (*DAF Trucks*), post-order companies (*La Redoute*), and cigarette brands (*Boule d'Or*).

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From the start of the 1980s, the professional cycling peloton attracted cyclists from non-European countries like the United States, Australia, and Colombia (Chap. 14). Not only the professional peloton but also the cycling calendar gained a more international flavor. A number of multinationals zeroed in on this growth and gradually elbowed the small company sponsors from the cyclists' jerseys. Trendsetter and pioneer of the group of the sponsoring multinationals was the Japanese electronics giant *Panasonic*, which sponsored the top team of the same name under the direction of sport director Peter Post between 1984 and 1992. *Hitachi* and *Toshiba* followed *Panasonic*'s example and became the main sponsor of a cycling team during the second half of the 1980s.

The entrance of multinationals into the international professional peloton led to an increasing demand for top cyclists, which in turn led to increasing pressure on the team budgets (Chap. 3). Bicycle brands could no longer maintain a position of main or solo sponsor of a team. They were reduced to the role of material or co-sponsor. In the second half of the 1980s, brand names of supermarkets (*Super U*), home furnishings (*Château d'Ax*), audio and TV equipment (*PDM*), electrical appliances (*Gewiss*), clothing (*Carrera* and *Z*), and lotteries (*Lotto* and *ONCE*) discovered cycling sponsoring. The great leap forward for international professional cycling came in the 1990s. The catalyst for continued internationalization and professionalization was the appointment of Hein Verbruggen in 1991 as chairperson of the International Cycling Union (UCI). He implemented various reforms, inspired by tennis and Formula 1, from which the current structure and organization of professional road cycling developed. In what follows, we will focus on these current characteristics.

This chapter is structured as follows: The second section explains the business-to-business characteristics of team cycling sponsorship and shows how the cycling sponsorship market can be very dynamic. Next, we discuss the duration and termination of sponsorship of cycling teams (Sect. 3) as well as a company's motives to invest in cycling sponsorship (Sect. 4). In Sect. 5, we illustrate the importance of the integration of sponsorship into marketing communication. The return and effectiveness of cycling team sponsorship are analyzed in Sect. 6. This is followed by an introduction into the sponsorship of cycling races (Sect. 7). We conclude with some thoughts on today's challenges for cycling sponsorship (Sect. 8).

2 Business-to-Business Characteristics of Team Cycling Sponsorship

A title sponsor in professional road cycling is defined as a sponsor whose brand name is in the officially registered UCI team name. The UCI allows two title sponsors only per team. As far as the economic activity of the title sponsor of the WorldTeams is concerned (catalogued by the European NACE code), Benijts et al. (2011) demonstrated that corporate sponsors mostly come from the industrial sector

(34.6% and 37.8% in 2004 and 2008, respectively) and, to a lesser extent, from the financial and insurance sector (22.9% and 24.2% in 2004 and 2008, respectively). Second, regarding the title sponsor's country of residence, both in 2004 and 2008, the title sponsors mainly originated from Western Europe and to a lesser extent from Central-Eastern Europe and the United States. The fact that professional road cycling failed to attract corporate sponsors outside Europe was mainly caused by the characteristics of the UCI ProTour at the time which, despite its intentions, failed to include a substantial amount of cycling events outside Europe.

Benijts et al. (2011) also analyzed the business-to-business (B2B) versus the business-to-consumer (B2C) nature of the title sponsors. Business-to-business marketing implies executing business deals. For instance, the Italian construction company and iconic team cycling sponsor *Mapei* is specialized, among others, in the building of sport venues. Business-to-consumer marketing deals with brand servicing consumer markets, such as *Cofidis* or *Education First*. The sponsorship of cycling teams by frame constructors goes back to the origins of professional road cycling at the end of the nineteenth century. The cash and barter of frame constructors as *Cervélo*, *Specialized*, *Cannondale*, or *Ridley* is a main source of income for WorldTeams. For bike brands, the performance of top cyclists in road races is a unique product placement strategy. Due to the ecological and healthy image of cycling, the renaissance of biking in cities and regions worldwide is remarkable. Through their product placement investment with top teams and cyclists, the high-end frame brands want to increase sales and profits. The business-to-business versus the business-to-consumer nature of the title sponsors did not change significantly since the introduction of the UCI ProTour (now UCI WorldTour) in 2005. As we can see from Table 4.1, in 2004, 2008, 2014, and 2021, title sponsors were mainly focused on business-to-consumer markets: 46.2%, 50.0%, 40.7%, and 44.5% of the sponsors, respectively. Title sponsors that were mainly focused on business-to-business markets only accounted for 33.3%, 36.4%, 22.2%, and 21.0%, respectively. Country team sponsors as United Arab Emirates, Astana, Bahrain, and Israel were categorized in the mixed category: business-to-consumer (attracting tourists) and business-to-business (shifting image of the country).

A WorldTour cycling team has on average a group of 30–40 sponsoring firms. Next to the title sponsors, teams also make use of technical suppliers (frame constructors, wheel suppliers, etc.), clothing sponsors, food and exercise sponsors,

Table 4.1 The business-to-business vs. business-to-consumer nature of the title sponsors in the UCI WorldTour

	2004		*2008*		*2014*		2021	
	Number	*%*	*Number*	*%*	*Number*	*%*	Number	%
B2B	13	33.3	8	36.4	6	22.2	6	21.0
B2C	18	46.2	11	50.0	11	40.7	13	44.5
B2B and B2C	8	20.5	3	13.6	10	37.1	10	34.5

Source: Benijts et al. (2011), UCI (2021)

Table 4.2 Partners and sponsors of the two Belgian WorldTeams in 2022

Type of sponsor	Quick-Step–Alpha Vinyl	Lotto–Soudal
Title sponsors	Quick-Step, Alpha Vinyl	Lotto, Soudal
Frame sponsors and technical suppliers	Specialized, Shimano, PRO, CeramicSpeed, Compress Sports, Geo Dynamics, Morgan Blue, Tacx	Ridley, Shimano, CAPS, Lezyne, Vittoria, Logicycle, 4iii, Cerma, Selle Italia, DT Swiss, Look, Deda Elementi, EME, Feedback Sports, Lizard Skins, Fietssticker.be, K-Edge, KMC, Tacx, Jagwire
Clothing sponsors	Castelli, Oakley, CORE, Supacaz	Vermarc, DeFeet, Harveste
Food and exercise sponsors	Coca-Cola, QM Sportscare, Meatless Farm, 6d Sports, Sportz88, Retül, Garmin	Caffè Vergrano, Nutribel, NAQI, Thrive, Hyperice, OTE parts, REVOR, Uriage
Logistic sponsors	BMW, Lemmens, Le Couter	Škoda
Miscellaneous partners	EKOPAK, Napoleon Games, Safety Jogger, Renson, Latexco, Janom, Bruno Denijs, Klein Constantia, Fietsen vanuit Ieper, Bang & Olufsen	Viking Lotto, Deloitte, Logiscycl.com

Source: Team websites

logistics sponsors, and so on. Cycling teams thus serve as a marketing and corporate communications vehicle for various groups of corporate sponsors (Brewer, 2002; Lagae, 2005, 2021). This network of brands constitutes the business-to-business environment of a top-tier cycling team. Table 4.2 illustrates the composition of the sponsor pack of the Belgian teams *Deceuninck–Quick-Step* and *Lotto–Soudal* in 2022. Suppliers might also sponsor competing teams. For example, joint sponsors for both Belgian teams are bike gear brand *Shimano* and indoor bike trainers brand *Tacx*.

The cycling sponsorship market is very dynamic, as illustrated by the change in composition of title sponsors in the official UCI name of the *Lotto* (the main brand of the Belgian Lottery) team since 1984. Over the course of 30 years, about a dozen companies joined *Lotto* as a co-sponsor (Table 4.3). *Omega Pharma* was a partner for seven seasons, from 2005 until 2011, albeit under different brand names for the first 5 years (*Davitamon*, *Predictor*, and *Silence*, respectively). The future of the *Lotto* team was guaranteed until 2022 with the Belgian multinational and glue manufacturer *Soudal* as second title sponsor. Table 4.3 also illustrates that laminate brand *Quick-Step* was introduced in 1999 in professional cycling as co-sponsor of the *Mapei* team. Between 2003 and 2011, *Quick-Step* was the first title sponsor. In 2012, it became a co-sponsor again when *Omega Pharma* switched partners and joined the *Quick-Step* team as the title sponsor. In 2015, *Omega Pharma* decided to use one of the subbrand names, the sport brand *Etixx*, in 2015 as main title sponsor of the *Etixx–Quick-Step* team. From 2016 until 2018, *Quick-Step Floors* remained the only title sponsor. In the next 3 years, *Deceuninck*, a Belgian stock-listed windows company, and *Quick-Step Floors* financed the WorldTeam as title sponsors. In 2022, the UCI name of the WorldTeam of Patrick Lefevere changed into

Table 4.3 The composition of the title sponsors of the *Lotto* and *Quick-Step* teams between 1984 and 2022

Years	UCI name Lotto team	UCI name Quick-Step team
1984	Tönissteiner–Lotto	/
1985	Lotto	/
1986–1988	Joker–Eddy Merckx	/
1989–1991	Lotto–Superclub	/
1992–1993	Lotto–Belgacom	/
1994–1995	Lotto	/
1996	Lotto–Isoglass	/
1997–1998	Lotto–Mobistar	/
1999	Lotto–Mobistar	Mapei–Quick-Step
2000–2002	Lotto–Adecco	Mapei–Quick-Step
2003–2004	Lotto–Domo	Quick-Step–Davitamon
2005	Davitamon–Lotto	Quick-Step
2006	Davitamon–Lotto	Quick-Step–Innergetic
2007	Predictor–Lotto	Quick-Step–Innergetic
2008–2009	Silence–Lotto	Quick-Step
2010–2011	Omega Pharma–Lotto	Quick-Step
2012–2014	Lotto–Belisol	Omega Pharma–Quick-Step
2015	Lotto–Soudal	Etixx–Quick-Step
2016–2018	Lotto–Soudal	Quick–Step Floors
2019–2021	Lotto–Soudal	Deceuninck–Quick-Step
2022	Lotto–Soudal	Quick-Step–Alpha Vinyl

Source: Update of Lagae et al. (2012)

Quick-Step–Alpha Vinyl, two floor subbrand names of the *Mohawk Group* (Lagae, 2020, 2021).

Title subsponsors not prolonging their sponsorship agreements were replaced by title sponsors with similar business demographics in terms of (1) economic activity (*Mapei* and *Quick-Step* are do-it-yourself brands), (2) the country of residence (all subtitle sponsors of *Lotto* are Belgian brands), and (3) the business-to-business vs. business-to-consumer nature of the firm (the name sponsors of the *Lotto* team are mainly B2C, while the name sponsors of the *Quick-Step* team are a B2C-B2B mixture).

3 Duration and Termination of Team Cycling Sponsorship

In the literature on sport sponsoring, it is asserted that not sport leagues but the sponsor networks (Wagner et al., 2017), media exposure of the sport (Berrett & Slack, 2001), the ability of the sport in increasing brand awareness and brand image (Chadwick & Thwaites, 2005), and the international popularity of a sport (Benijts & Lagae, 2012; Morrow & Idle, 2008; Berrett & Slack, 2001; Meenaghan, 1983) are important in understanding why firms select a specific sport for sponsorship purposes (Chadwick & Thwaites, 2005; Olkkonen, 2001). Slätten et al. (2017) identify internal versus external motives and opportunistic versus altruistic motives in selecting sport sponsorship. The importance of image transfer and the sponsorship selection process is discussed in Boronczyk and Breuer (2021) and Stieler et al. (2019).

A key asset of sponsorship of professional cycling teams is that the brand name of the sponsor is used as the name of the cycling team, which gives opportunities for brands in brand name recognition, realizing image transfers or supporting sales. In cycling, a team sponsor gets auditive and written amplification of the brand name in classic mass media and on social media.

With respect to the duration of team cycling sponsorship contracts of title sponsors, we notice opposite tendencies. On the one hand, five title sponsors of WorldTour teams in 2022 were already active (either as a primary title sponsor or as a secondary title sponsor) in professional road cycling many years prior to the implementation of the UCI ProTour in 2005 (Table 4.4). Long-term cycling sponsors are *Lotto* (38 years), *Cofidis* (25 years), *La Française des Jeux* (25 years), *Quick-Step* (25 years), and *Ag2r* (22 years). Two of them, *Cofidis* and *Quick-Step*, announced a 5-year prolongation of their title sponsorship contract in 2021, as did *United Arab Emirates*. Six of the nineteen teams, however, have only title sponsors that are 5 years or less in the cycling sponsorship business.

Table 4.4 Title sponsor's loyalty to professional road cycling (WorldTour teams 2022)

WorldTour team	Number of years as a title sponsor
Lotto–Soudal	38/8
Cofidis, Solutions Crédit	25
Quick-Step	25
FDJ–Groupama	25/5
Ag2r–Citroën	22/2
Movistar Team	18
Astana	18
Trek–Segafredo	11/6
Wanty–Gobert Matériaux–Intermarché	10/10/2
BORA–Hansgrohe	7/5
Team Jumbo–Visma	7/4
Bahrain–Victorious	6/2
EF Education–EasyPost	5/1
UAE Team Emirates	5
INEOS Grenadiers	4
Israel Start-Up Nation	3
Team DSM	3
Team BikeExchange–Jayco	2/1

Source: Own calculations

Table 4.5 Motives for ending title sponsorship

Motive	Year: sponsors
Change in marketing strategy	2021: Deceuninck 2018: Lotto-NL, Dimension Data 2014: Belisol, Belkin, Sharp 2013: Vacansoleil, DCM 2012: RadioShack 2009: Bbox Bouygues Telecom 2008: CSC, Scott 2007: Discovery Channel 2006: Illes Balears
Doping abuse in team	2012: Rabobank 2010: Team Milram, Footon–Servetto 2008: Saunier Duval 2007: T-Mobile 2006: Phonak, Liberty Seguros
Economic crisis	2020: CCC, NTT, Sunweb 2013: Euskaltel-Euskadi
Change in strategy of the Maecenas	2018: BMC 2016: IAM Cycling 2012: Leopard
Regulatory dispute on online gambling	2007: Unibet.com

Source: Benijts et al. (2011), Lagae (2020, 2021)

Title sponsors who did not prolong their agreements motivated their decision to quit cycling by a variety of reasons. A majority of them referred to changes in corporate marketing strategy (Table 4.5), while other title sponsors referred to regulatory problems (in the case of *Unibet.com*), doping abuse (in the case of, for example, *Liberty Seguros*, *Phonak*, *Saunier Duval*, *T-Mobile*, *Team Milram*, *Footon–Servetto*, and *Rabobank*), or the economic crisis (in the case of, for example, *Euskaltel–Euskadi*). *Belkin* raised the issue of the absence of a global cycling audience and the prevailing dominance of a Euro-centric cycling audience and visibility.

Contrary to the COVID-19 impact on football business (Grix et al., 2020; Hammerschmidt et al., 2021), professional road cycling countered relatively well the negative economic shock of the pandemic (Lagae, 2020, 2021). Some title sponsors nevertheless had to exit the cycling sponsorship arena. The COVID-19 caused deep economic recession in the travel business resulted in the exit of the *Sunweb Group* as a title sponsor after the cycling season 2020. The Dutch chemical concern *DSM* became the new title sponsor of the team of manager Spekenbrink. The Central and Eastern European shoe retail concern *CCC* and media group *NTT* also stopped title cycling sponsorship as a result of the pandemic.

4 Motives for Team Cycling Sponsorship

The motives for cycling sponsorship vary widely (Lagae, 2005, 2020, 2021). Within a professional approach to sport sponsoring, the selection of the sport depends on the marketing and corporation communication goals and the intended target group reach. An important restriction in sport sponsoring is that a brand communicates a limited message. Usually, nothing more than the brand name and the logo is communicated. Therefore, sport sponsoring acts first and foremost on cognitive goals as brand name recognition. Brand value is created, first through passive and later through active brand awareness. A business-to-consumer product will only sell well when the brand is sufficiently well known to the public. In title sponsorship of a professional cycling team, the repetition of a brand name is the factor that increases the brand awareness. For instance, through a yearlong and repeated name dropping and lettering of the brand name, *Quick-Step* evolved from being only one of the brands in laminate parquet to a generic brand in a leading position. With its yearly sponsorship, *Quick-Step Floors* wanted to achieve more and better distribution space in do-it-yourself businesses in key European countries along with improved brand awareness. However, not only in consumer markets but also in business-to-business markets sport sponsoring ensures added brand value. Chemical concern *DSM* offered a communication platform to its employees and to the distributors of its products in the key European countries. Values like innovation, dynamism, flexibility, effort, character, and endurance were transferred from cycling to the brand. Frame brands, bike component brands, and sports- and cycling-related brands on the other hand strive for behavioral goals and attempt to support and increase sales of high-end frames. Brands like *Trek* see professional road cycling as a product placement opportunity and also as a platform for generating new business.

However, one of the peculiarities of sponsorship of top cycling teams is the persistence of hobbyism, i.e., the fact that teams are sponsored by wealthy benefactors not for commercial reasons but merely because of their passion for the sport. This type of managers or team owners risk to act in an economically irrational manner because unless they are well surrounded, they lack expert knowledge to challenge their enthusiasm for the sport. Wealthy benefactors or oligarch business men in today's peloton are Ron Baron and Sylvan Adams (*Israel Start-up Nation*), Gerry Ryan (*Team BikeExchange*), Kazak politicians, the sheiks of Bahrain and the United Arab Emirates, or Zdenek Bakala, who supports the *Quick-Step–Alpha Vinyl* team.

Since at the top of a company there is some room to maneuver, allowing personal objectives to be fostered alongside the company goals, decision makers can be amateurish in the selection and development of sport sponsorship offerings. This *danseuse du président* (*dancer to the president*), spouse-driven sponsorship, or management by hobby (Crimmins & Horn, 1996) was typical of old sponsorship cultures, when the sport manager's job was finished once the promotional sport rights were bought. Because of hobbyism, the sport sponsorship projects could be an end in itself instead of a means of promotion. Indeed, the success or failure of integrated communication depends on the managers' ability or lack of it to maintain a rational distance from the sport sponsorship events (Lagae, 2005).

5 The Integration of Sponsorship Into Marketing Communication

Before getting into sponsorship, business people must carefully evaluate possible marketing goals with respect to name recognition, corporate image building geared to target group expectations. Only after these objectives have been identified and formulated clearly will the marketing staff be able to evaluate whether sponsorship of a professional cycling team is going to pay off in added value. If marketing objectives remain unclear, then this enhances the chance that the sponsorship falls through.

Sponsorship of a cycling team is usually the cornerstone of a broader sport marketing communications strategy. In a sport environment, a sponsoring brand may usually communicate only its brand name and logo. This limited message should therefore be supported by other communications tools. It is commonly acknowledged that organizations need to surround sport sponsorship with other marketing communication tools in order to reach the targets (Arthur et al., 1998; Meenaghan, 1991). Sponsoring a professional cycling team is not a target on its own, but an important element in the organization's external and internal communication strategy.

A sponsor of a cycling team needs to integrate the sponsorship investment in its public relations strategy in order to maximize the name-dropping and auditive reinforcement of the brand name in the sports press and in the overall audiovisual and printed press. Creating goodwill to the name of the sponsor with the media is an important goal of the following types of media activation of cycling sponsorship:

- Organization of a hybrid (digital and live) press conference: e.g., *Team Quick-Step–Alpha Vinyl* gathering the press in Calpe in January 2022
- Organization of the team presentation: e.g., *Team Sunweb* presentation in January 2019 in Berlin
- Availability of team information on all social media (website, *Twitter*, *Facebook*, *Instagram*, *LinkedIn*): e.g., www.lottosoudal.be
- Organization of contact moments with the local and foreign sports and lifestyle press: e.g., laminate floor brand *Quick-Step* inviting the housing press
- Press approach actions on a case-by-case basis: e.g., media training of staff and professional cyclists
- Curative and preventive crisis communications: e.g., press release following a crash of a rider
- Follow-up and approach of individual journalists: e.g., the follow-up of *Team Jumbo–Visma* conversation managers of journalists who asked for interviews for the top riders

5.1 *Leveraging Team Cycling Sponsorship? The* Sunweb *Case*

European tour operator *Sunweb* invested in title sponsorship of a WorldTeam between 2017 and 2020. The sponsorship budget for *Team Sunweb* amounted to 15 à 20% of the global international marketing budget. The commercial goals of online tour operator *Sunweb* focused on increased interest and new purchases from the moment consumers start their online search for their next vacation. By adding sponsorship as a unique asset to the marketing mix, *Sunweb* could further differentiate itself in its communication and further expand its reach new audiences. Communication goals of *Sunweb's* international sponsorship strategy targeted on increased brand awareness and consumer confidence. Through the sponsorship of an integrated men's and women's WorldTour team and an international development team, *Sunweb* was present in online and traditional media and obtained, as an online brand, "street visibility." As a business-to-consumer e-commerce company, *Sunweb* has to convert offline into online. The e-commerce group has no travel offices and is therefore not physically present in the streets. *Sunweb* achieves street marketing and media through team cycling sponsorship and differentiated in this way from its competitors.

Through a mix of online and offline activations, the *Sunweb Group* targeted at an increase in the database and online audience. The social media value of the brand name *Sunweb* continued to grow both internationally and in the Netherlands, where the number of followers on *Facebook* was growing faster than in previous years. As a result of the street visibility through cycling sponsorship, the travel group could further disinvest in offline media.

The baseline of the *Sunweb Group* was "Sponsor memories, not just victories." This creative cornerstone summarizes the sponsorship story. Memories are everyone's most precious possession. Take them away, you lose the only wealth in life. Of course, big wins like the double-team time trial world title or Tom Dumoulin's Giro d'Italia victory in 2017 contributed to memories, but they are not the most important stories. "Keep challenging," the baseline of the cycling team, was the common ground where both the cycling team and the title sponsor looked for marginal gains based on data that make the difference at the finish. The growing active cycling fan base and recreational community was targeted to experience meaningful cycling moments together via *Sunweb* hangouts and *Sunweb* rides. The storytelling around cycling experiences was a cornerstone of the activation strategy (Lagae, 2020, 2021).

5.2 *Leveraging Team Cycling Sponsorship: The Soudal Case*

After 2 years as a side sponsor of *Lotto–Belisol*, in 2015, the Belgian multinational company *Soudal* stepped in as co-title sponsor of the *Lotto–Soudal* team. The sponsorship aimed at brand awareness and an image shift of *Soudal* as a cost-effective brand. In order to create additional commercial payback, the world leader in joint sealants, adhesives, and PU foam developed a range of bicycle maintenance products in line with both the existing products and the cycling sponsor's identity. The company's chemists, in close collaboration with *Lotto–Soudal*'s mechanics, developed the *Soudabike Pro Box*, consisting of various highly specialized cleaning products, degreasers, and lubricants for the various bicycle parts. The professional men's team, the *Lotto–Soudal* women team, and the development team were the ultimate test lab for this product range.

In addition, the marketing platform of the *Lotto–Soudal* team provided a superior marketing platform for the communication and commercialization of the mix of products for recreational cyclists and competitive riders. The point-of-sale communications centered around endorsements by well-known professionals of the team. Also, the packaging of the various products closely matches the look and feel of the *Lotto–Soudal* cycling team equipment. The claim "WorldTour Quality" and the unique selling proposition "Official *Lotto–Soudal* Supplier" offer value to the growing pack of cycling tourists who identify themselves with their favorite professional cyclists.

The *Soudabike Pro Box* was officially launched during the presentation of the *Lotto–Soudal* Tour team in 2015 in the presence of the international (cycling) press. The team's social media provided instructional videos focusing on the product range. The launch of the *Soudabike Pro Box* included several products and selected *Lotto–Soudal* merchandising in one package. The combination of this product range in line with the sponsorship and vigorous sponsor activation in the form of integrated marketing communication resulted in a smooth facilitation of access to distribution and thus access to consumers (Lagae, 2018).

Team cycling sponsorship was also leveraged through the subbrand *Fix ALL*. The UCI allows a cycling team to a change in name for one race every season. This created opportunities for *Soudal*. The *Lotto–Soudal* team participated in Paris–Nice 2016 and 2017 under the name *Lotto–Fix ALL*. The identity change during that 1 week was integrated into the marketing communications mix. What does the *Fix ALL* brand mean? The viral marketing campaign consisted of a sponsorship activation movie that went viral. The creative storytelling generated attention via the *Twitter* accounts, *YouTube* channels, and *Instagram* and *Facebook* accounts of *Soudal*. Through brand name mentions, likes, and shares, classic media attention followed. The viral movie via an attractive storytelling concept ("*Fix ALL* tube rolls from Paris to Nice") was further deployed via paid *Facebook* banners and pre-roll advertising on *YouTube*. The activation campaign added an experiential dimension of this low-involvement product. Due to the brand support, the *Lotto–Fix ALL* shirts and special edition *Ridley* became collector's items (Lagae, 2018).

6 The Economic Return of Team Cycling Sponsorship

Communication managers are evaluated against the combined returns of all instruments employed in the communication mix. Although cycling sponsorship does not escape this estimate of effectiveness, it is still often being evaluated through the sport sponsorship or marketing manager's intuition and personal interpretation. Ideally, clear objectives must be formulated first, and time and budget for the evaluation phase must be reserved before the start of the cycling sponsorship project. In practice, however, this is rarely what happens. It may even be worse because, as mentioned before, sometimes the many emotions that cycling brings along explain why companies continue team sponsorship too long. In such cases, the extra money to support the cycling team leads to investments with a poor yield, while it could have been invested in other means of promotion with a higher return (Lagae, 2005).

It is widely accepted that consumers move through three major stages in their response to a promotional campaign. In the cognitive phase, the improvement of the brand recognition and knowledge is key, while the affective phase is oriented to the promotion of the brand attitude and preference. Finally, the behavior phase involves stimulating buying or the intention to buy. Three types of cycling sponsorship effectiveness can be measured: exposure (is it visible?), communication (is it liked?), and commercial results (is it sold?). A crude evaluation tool for the effectiveness of sponsorship awareness is media exposure measurement. A visibility analysis of the brand exposure on shirts, trousers, cap, fashion equipment, car fleet, and other printed materials needs a special approach and a particular action.

The presence of a sponsorship object in the printed media is another important component of visibility. This includes the visibility of the sponsorship brand name in the daily newspapers and weekly periodicals and in specialized press. Table 4.6 compares the media value and number of articles of *Rabobank* as a sponsor of a cycling team versus the media value and number of articles of *Rabobank* resulting from all news related to its banking activities.

The advertising equivalent of publicity (AEP) can only provide useful information on year-on-year comparisons, on comparisons with competing sponsors or properties, and on maximizing future exposure (Lagae, 2005). However, media exposure evaluation is the subject of considerable debate within sport sponsorship professionals. Although often used, exposure-based methods have been heavily criticized (Crimmins & Horn, 1996; Cornwell & Maignan, 1998). A substantial

Table 4.6 Exposure cycling sponsorship *Rabobank*

Year	Team sponsorship		Other publicity		Total	
	Articles	Media value	Articles	Media value	Articles	Media value
2007	6388	€10,029,930	4550	€7,297,927	10,938	€17,327,857
2008	5363	€9,351,109	4839	€8,314,659	10,202	€17,665,768
2009	6214	€10,045,407	4913	€8,660,795	11,127	€17,706,202
2012	5021	€11,238,826	5687	€10,950,393	10,708	€22,189,219

Source: Crielaard (2012)

limitation of measures of exposure is that they frequently inflate the real value of AEP. Typically, article length is equated with advertising space, even though the sponsor's name may be occasionally mentioned in the article. Another source of inflation is that when quantifying the AEP, the maximum rate card value is assumed, while few organizations have to pay these full rates. Furthermore, the question also arises how verbal mentions of brand names, the tone of the broadcast, and specific positive or negative references to the sponsorship or property should be weighed. Furthermore, the frequency and reach of exposure may give an indication of the probability of having been in contact with the target group but could say nothing about the quality or impact of the contact (Lagae, 2005).

An extension of exposure measurement is measurement of sponsorship awareness. As a cycling team sponsor, *Rabobank* evaluated on a regular basis sponsorship awareness in the Netherlands. Are people aware of the sponsorship by *Rabobank*, and what is their opinion on the brand fit? The target group comprised cycling fans and non-cycling fans. In 2004, the sponsorship was already well known to almost 100% of the cycling fans and to more than 70% of the non-cycling fans. Between 2004 and 2012, an average of almost 74% of the cycling fans and almost 56% of the non-cycling fans estimated the brand fit "sufficient" to "very good." However, during the last quarter of 2012, when the bank decided to end sponsorship in the aftermath of the USADA doping report on Lance Armstrong, the number of Dutch people considering the brand fit successful obviously decreased. *Rabobank* also organized a survey among the local branches of the bank. In 2005, according to 95% of the branches, *Rabobank* had to continue the sponsorship. In 2012, this number had decreased to 80%. On October 19, 2012, the day the bank ended the sponsorship agreement, almost 60% of the employees said the decision was "regrettable but right." A quarter of the employees called it just "right" and 15% found it was "regrettable."

A stronger test for sponsorship accountability is the measurement of the communication results. In the case of brand tracking, the brand itself is the subject of which the effect is being measured. This provides information that enables an analysis of the effect of the integrated sport sponsorship communication. Brand tracking is difficult, however, since the main problem with the evaluation of sport sponsorship is the isolation of its effect from the impact of advertising and other promotional techniques (Cornwell & Maignan, 1998).

Most evaluations do not attempt to measure the direct impact of sport sponsorship on sales. This is because the sport sponsorship objective is usually to generate awareness and change the brand image, and not to generate sales directly. Impact on sales is only measurable if localized or short-term sponsorship is used as this makes comparison easier with control areas or periods. Only in such cases it is possible to determine the incremental sales volume generated by sport sponsorship. It is clear that these measurement limitations substantially complicate the analysis of sponsorship effectiveness on "real-life" commercial data (Lagae, 2005). In selected cases and under very strict conditions, the effectiveness of sponsorship can be assessed by estimating the commercial results. The French cycling sponsor *Cofidis*, established in 1982, specializes in providing instant consumer credit. Due to the advertising clutter, *Cofidis* did not succeed in developing sufficient brand awareness and gaining brand confidence, let alone becoming top of mind. Therefore, in 1997, cycling sponsorship was selected to realize their marketing objectives in an alternative and creative manner and to compete with the large banks. The commercial results from cycling sponsorship in Belgium were significant. The turnover in outstanding loans soared between 1997 and 2002 with a growth of 111%, outperforming the sector growth with at least 35% (Lagae, 2005). In 2021, *Cofidis* announced the sponsorship of a women's team from 2022 onward and a 5-year prolongation of their title sponsorship of the men's team.

La Française des Jeux, another French title sponsor, sells lottery tickets and sports betting products, excluding, of course, any betting related to professional cycling. Based on yearly questionnaires, they found that since the start of their sponsorship of a professional road cycling team in the late 1990s, the increase in the yearly amount of money spent on *La Française des Jeux* gambling products by French cycling fans and by French cycling-active people was €75 higher than the increase in money spent by non-cycling-interested French citizens. Since the former are much more likely to have seen any *La Française des Jeux* cycling-related publicity, the company considers this to be a real return of its investment in cycling sponsorship (Huguenin, 2014). Unfortunately, such evidence on effectiveness is still scarce, and more research is needed to investigate the commercial impact of cycling team sponsorship.

In general, there are huge differences between title sponsors in leveraging cycling sponsorship investment into their marketing communications mix. Some organizations developed sponsorship into an intrinsic part of the overall marketing communications mix (e.g., *Cofidis*), while others entered into cycling sponsorship with little thought of building a coherent sponsorship communications strategy (e.g., *Bahrain*). The organization of the sponsorship development and the choice of marketing communications instruments seem to vary widely between the title sponsors of teams, depending on the nature and motives of their sponsorship. Crisis communication is also likely to be one of the main concerns of cycling team sponsors. For Maecenas financed cycling teams, sponsorship is often looked upon as the hobby of the CEO, sheik, or politician. Their personal (dis)likes influence the corporate sponsorship activities. However, an important success factor for cycling team sponsors is the building of a coherent sponsorship communications strategy. It is suggested that more sports marketing efforts and an intense cooperation are needed between the cycling teams and their main sponsors in order to develop better cycling sponsorship investments.

7 Sponsorship of Cycling Races

Road cycling is strongly related to the media already since its origins in the late 1800s. As explained in Chap. 2, the first cycling races were created to promote newspapers. The Tour de France was first organized in 1903 by the French newspaper *L'Auto* in order to increase sales and to beat its rival *Le Vélo*. Similarly, in Italy, the Giro d'Italia was meant to promote *La Gazzetta dello Sport*, and the Ronde van Vlaanderen in Belgium served as a communications vehicle for *Sportwereld*.

Until 1930, the teams at the start of the Tour de France were sponsored by frame constructors. In 1930, Tour director Henri Desgrange decided to introduce a new formula and ordered that the frame-sponsored trade teams should be replaced by national teams. This was also the year the Tour de France publicity caravan was created. The money generated by the caravan served to provide the bikes and to finance the hotel costs. In 1930, the publicity caravan included ten vehicles only. Nowadays, there are about 200 vehicles in the caravan, representing more than 40 brands. Companies pay between €200,000 and €500,000 to be part of the caravan, and during the 21 days of racing, they distribute about 14 million product samples.

Beyond the brands in the publicity caravan, the Tour de France is supported by a large pack of sponsors (Table 4.7). There are no official data on the sponsorship money these sponsors pay, but based on press releases and newspaper interviews, a rough picture emerges. For instance, it is rumored that main sponsors such as *Le Crédit Lyonnais*, *Škoda*, or *Krys* each contribute €6 million a year, while the official partners all pay between €1 and €1.5 million. The other sponsors, such as the technical partners and the official suppliers, but excluding the broadcasters, the media partners, and the institutional partners, are charged between €100,000 and €800,000. As a result, the global sponsorship income of the Tour de France amounts to about €50 million every year.

Thanks to its prime position in the media, the Tour is by far the most lucrative cycling race in the world. Due to the lack of sufficient sponsorship income, most of

Table 4.7 Tour de France sponsors in 2021

Tour's club (main sponsors)	Le Crédit Lyonnais Škoda E. Leclerc Continental Krys
Official partners	Vittel, Santini, Orange, Century 21, NTT, Tissot, AG2R La Mondiale, Antargaz, Named Sport, Shimano
Official suppliers	Cochonou, Puget, Le Gaulois, Jules, Tourtel, Yamaha, Senseo, Barane, Logis, FDJ, Sodexo, Adecco, Domitys, Bostic, AkzoNobel, Lesieur
Official supporters	Haribo, Extra Total
Technical partners	Doublet, Petit Gruau, DNP, XPO Logistics, Norauto
Official broadcasters	France.tv sport, Eurovision
Official media partners	Le Parisien, France Info, France en bleu
Institutional partners	AMF, Assemblée des départements de France, Ministère de l'intérieur, Ecosystem
Regional partner	Dansk Metal

Source: www.letour.fr

the other race organizers are breaking even or might even be losing money. Nevertheless, we can distinguish two interesting evolutions. First of all, brands investing in name or title sponsorship of cycling races are a growing phenomenon. The Dutch beer brand *Amstel*, name sponsor of the Amstel Gold Race since its origin in 1964, is a famous example. Today, more and more races on the international calendar include the name of a brand in the officially registered UCI race name, including WorldTour races such as the Flemish GP E3 Saxo Bank Harelbeke (finance) and the German EuroEyes Cyclassics Hamburg (laser eye surgery). Also, in the continental circuits, the naming rights are granted to brands, such as the Baloise Belgium Tour (insurance holding), the Primus Classic–Impanis–Van Petegem (beer), the Danilith Nokere Koerse (prefabricated houses), or the Sparkassen Münsterland Giro (finance).

A second remarkable evolution is the growing need for organizers to join forces as a result of their unstable business model. In Belgium, *Flanders Classics*, founded in 2010, is a cooperation among the organizers of seven cycling races: Omloop Het Nieuwsblad, Dwars door Vlaanderen, Gent–Wevelgem in Flanders Fields, Ronde van Vlaanderen, Scheldeprijs, Brabantse Pijl, and Brussels Cycling Classic. *Flanders Classics* joint ventured also with the local organizers of the Druivenkoers in Overijse. Thanks to this cooperation, the organizers realize economies of scale in the organization and commercialization of competitive and tourist races and can offer their sponsors a yearlong exposure. The main partners of *Flanders Classics* are *KBC* (bank and insurance company) and *Proximus* (telecommunication company). *BMW*, *Het Nieuwsblad*, *Lidl*, *Lotto*, *Sport Vlaanderen*, *Kwaremont*, and *Cycling in Flanders* co-sponsor the cycling sport marketing group *Flanders Classics*.

The motives for sponsorship of cycling races are comparable to those of team cycling sponsorship: increasing brand name awareness, transferring image components through storytelling and supporting sales. Unlike team sponsors, race sponsors profit from the popularity of cycling without depending on the rider's performances or the risk of doping scandals. But sponsorship of races also includes a disadvantage: the sponsoring brand risks to crowd out in the brand name clutter of the pack of cycling team sponsors.

8 Challenges for Cycling Sponsorship

A basic condition for successful sponsorship has long been the integration of the cycling investment into the advertising, sales promotions and direct marketing, and social media mix of the sponsoring brand (Cornwell & Kwon, 2019). Advertising is any paid, nonpersonal communication through various mass media by organizations who hope to inform and/or persuade a particular target group. The content of advertising is determined and paid for by a clearly identified sender. Direct marketing communications are a personal and direct way to communicate with customers and prospects. Possible classic ways of using direct marketing communications are personalized brochures, direct mailings, telemarketing actions, etc. New ways to communicate interactively with different stakeholders are being offered by the own digital footprint of a cycling team. Conversation managers post relevant content through the digital, social, and mobile media and interact with fans and customers (Koronios et al., 2020). Sales promotions are the set of activities conducted by marketers to stimulate sales in the short run. Sales-stimulating campaigns are price cuts, coupons, or sampling. Point-of-purchase communications, personal selling, exhibitions, and trade fairs could also create an extra value to the sales force, distributors, or the consumer, aimed at increasing sales in the short run.

However, the world of branding and sponsorship has changed and become more sophisticated. The main challenge of sponsorship consists in formulating clear conversational, experiential, and payback targets (CEP). This CEP sponsorship or sponsorship 3.0 (Lagae, 2018, 2020) starts with a thorough preparation of the sponsorship match by the sponsor and the rights holder.

Firstly, there are the conversation goals, which aim not only at repetition and interpretation of the brand name but also at storytelling with fans and stakeholders (Papadatos, 2006; Van Belleghem, 2014). Due to the explosion of social media, digital became the new normal. This facilitated brands to exploit better their own digital channels. Sponsorship quickly turned out to be a powerful biotope to converse about distinctive experiences. Through their own social media channels, rights holders began to create unique stories. The Wolfpack story of the *Quick-Step–Alpha Vinyl* team of manager Patrick Lefevere illustrates this point. The Wolfpack nickname symbolizes the hunger for victories of the winning cyclists: “the strength of the pack is the wolf, the strength of the wolf is the pack.” Another team cycling sponsorship example concerns *Team Sky*. During the Tour de France in 2018, *Team Sky* drew attention to the Pass on Plastic campaign of the media conglomerate *Sky* through a specially developed shirt depicting an orca.

Alpecin–Fenix, the team of Mathieu Van der Poel, appeared on the team presentation of the Tour 2021 in Brest in a custom shirt. This was a tribute to Raymond Poulidor, the grandfather of team leader Mathieu van der Poel and nicknamed “Poupou.” The riders were dressed in a purple outfit with gold sleeves, remembering the iconic *Mercier* jersey Raymond Poulidor wore when he was sponsored by *Mercier* during the 1970s. The UCI granted *Alpecin–Fenix* special permission to wear this “Poupou” jersey. *Alpecin–Fenix* managed to raise €50,000 with the #MerciPoupou campaign. The team management distributed the merchandising revenues over five nonprofit organizations supporting kids in practicing sports.

Secondly, experiential sponsorship aims at supporting and changing the brand image and sharpening the brand experience. Experience is crucial in brand communications (Boswijk et al., 2005). Typical of a meaningful experience in leisure time is that all senses are involved, that there is an increased concentration and a clear goal. For the cycling fan and customer, races are not always about victories, but rather developing storylines around relevant experiences. The pharmaceutical company *Novo Nordisk* sponsors a continental cycling team that only contracts professional riders who live with type 1 diabetes. Via the cycling platform, *Novo Nordisk* communicates to their diabetes clients that they can participate in sports in a fairly normal way. Chemical concern *INEOS* provides another example of storytelling of a cycling team focusing on unique content and experiences concerns. Within days of the start of the national COVID-19 lockdowns, the chemical concern built new plants to make sanitizer products. In response to national shortages, the title sponsor of the most expensive cycling team delivered these to hospitals in the United Kingdom and Europe and worldwide. The professional cyclists assisted, as brands ambassadors, with the delivery of the sanitizer products.

A third goal of sport sponsorship is to realize payback effects. For example, laminate brand *Quick-Step* aims to increase brand loyalty and support sales through sponsorship. Sales will be also stimulated by the cycling sponsorship through creating distribution space and strengthening the business network. Bicycle brand *Specialized* may generate direct payback effects through testing product innovations and showcasing their brand in the competitive cycling environment. Unlike conversation and experience sponsorship, payback sponsorship focuses more on increasing revenue, either in the short or in the long term. Commercial payback effects are important not only in consumer markets but also in business markets. *Callant Verzekeringen*, a Flemish business-to-business brand in insurance, has been side sponsoring the ProContinental cycling team *Sport Vlaanderen–Baloise* since 2007. Sport sponsorship is a cornerstone in the marketing strategy of the insurer. In addition, *Callant* promotes comprehensive bicycle insurance for the consumer market.

Payback does not only concern commercial but also societal objectives in sponsorship of women sports (Morgan, 2019). Cycling sponsors can put *corporate social responsibility* into practice by investing in the development of women's cycling. The *Team DSM* case illustrates that conversational, experiential, and payback goals are intertwined in supporting the growth of women's cycling. Chemical and bioenergy concern *Royal DSM* is the only title sponsor of their men's, women's, and development teams. The origins of the management behind *Team DSM* go back to 2008. Already in 2011, the management took the decision to invest in a women's cycling team. At that time, title sponsors were equipment brand *Skil* and *Koga* bikes. Title sponsors rotated and the team name changed into *Skil–Argos* (2012), *Argos–Shimano* (2013), *Giant–Shimano* (2014), *Liv–Plantur* (2015–2016), and *Team Sunweb* (2017–2020). Unique in the team history is their double in the 2017 World Championships team time trial in the Norwegian city Bergen. Leading ladies Lucinda Brand and Ellen van Dijk wrote history, while Tom Dumoulin led the men trial time in their gold race.

The sponsorship match between the business-to-business multinational and the team management starts from a win-win relationship: the sponsor invests in exposure and in a storytelling, experiential, and pay-back platform. In an ideal world, both parties should participate and contribute on an equal base to the joint venture. The mission of *Team DSM* and of title sponsor *DSM* is to develop within professional cycling a sustainable performance model. Male and female riders and staff members are challenged. Next to title sponsor *DSM*, the sponsorship network comprises of a pack of 75 partners. For instance, sponsors like bike constructor *SCOTT* or car brand *Volvo* develop projects with commercial and social impact.

The support for a women's cycling team can not only be considered as corporate social responsibility but also as an investment in an undervalued share. The marketing departments of the American bike manufacturer *Trek* and the Italian coffee brand *Segafredo* invest in a professional women's team since 2019. The realization that sponsor visibility and value for women's cycling will only increase in importance follows from the 2021 Paris–Roubaix experience. While the men's *Trek* team did not generate much visibility, the women's team succeeded in generating tons of exposure during the impressive solo of more than 80 kilometers of Lisa Deignan. Moreover, Elisa Longo Borghini, a *Trek* rider as well, finished third. The women's podium ceremony in Roubaix seemed to be a demonstration of the product placement power of the *Trek* bikes, queen of the cobblestones.

In 2021, the title sponsors of five of the eight registered women's WorldTeams also sponsored a men's WorldTeam: *DSM*, *Trek–Segafredo*, *Movistar*, *FDJ*, and *BikeExchange*. The title sponsors of the other registered women's WorldTeams were *Canyon–Sram*, *SD Worx*, and *Liv Racing Xstra*. From 2022 onward, the number of teams holding a UCI Women's WorldTour license increased from 8 to 14. Of the six new teams, *EF Education*, *Jumbo–Visma*, *United Arab Emirates*, and *UNO-X* are sponsors of men's cycling teams as well. The two remaining newcomers are the American *Human Powered Health* team and the Swiss *Roland–Cogeas–Edelweiss Squad* team. To some firms, the opportunity to support a women's team as well has become a decisive element in the sponsorship decision. At the end of 2021, *Deceuninck* decided to finish their title sponsoring of the team of Patrick Lefevere. Surprisingly, they stayed into cycling sponsorship as a main partner of the *Alpecin–Fenix* team. One of their motives was the attention of the team management for women's cycling.

Next to the growth in women's WorldTour teams, the rapid development of the WorldTour racing circuit for women is also impressive. New event sponsors stand up as well. For instance, the virtual cycling training app *Zwift* is presenting partner from 2022 onward of the renewed Tour de France Féminin. With the project "closing the gap" consulting group *KPMG*, partner of *Flanders Classics*, rolls out a plan to develop professional and recreative women's cycling in Belgium.

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Chapter 5
The Economic Impact of Major Road Cycling Events

Paul Hover

1 Introduction

1.1 Rise of Professional Road Cycling Events

All kinds of events have been growing in size and diversity worldwide, and sport events account for a large proportion of them (Clark, 2008). For sport enthusiasts, sport can be seen as a magic dust which can be sprinkled around in the form of sport events (Houlihan & Lindsey, 2013), and they can create a mass community ecstasy (Crompton, 2004). Sport events also lead to a variety of money flows between groups of stakeholders. While there is enough proof for the emergence of economic benefits, it is vital to realise that desirable or profitable effects are not guaranteed and that they are not equally distributed among people and organisations.

The rise of professional road cycling events made a significant contribution to the development of the sport event industry. Professional road cycling has a long history; the first road cycling races date back to the late nineteenth century (Maso, 2003; Van Reeth & Larson, 2016). The history of the well-known *Grand Tours* dates back to the first part of the twentieth century. The Tour de France was first staged in 1903 and the first Giro d'Italia was organized in 1909. Inspired by the success stories of the Giro d'Italia and the Tour de France, the first Vuelta a España was held in 1935 (Morrow & Idle, 2008; Mignot, 2016). Especially the Tour de France but also the Vuelta a España, the Giro d'Italia and the legendary 1-day races can be considered as key pillars of today's professional road cycling.

The organisation rights of the Tour de France, the Giro d'Italia and the Vuelta a España are owned by commercial organisations, namely, *Amaury Sport Organisation*

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(*ASO*), *RCS Sport* and *Unipublic*, respectively. The European Cycling Union (UEC) owns the organisation rights of the European Championships and the Union Cycliste Internationale (UCI) those of the World Championships. These organisations have a monopoly position, meaning that they have the exclusive right to decide which event is staged where and under which conditions. Although limited by a wide geographical area, the *Grand Tours* and the international championships have a footloose character. Every year, the event takes place in a different city, even though some cities staged these events more than once.

1.2 Rivalry Among Cities

As a result of the combination of the footloose character of the *Grand Tours* and the international championships and the substantial demand from the market, cities (and regions) who want to organise a professional road cycling event have to bid for the organisation rights (Ashworth & Voogd, 2000; Preuss, 2005; Bull & Lovell, 2007; Balduck et al., 2011). Regularly, in a bid process – and if successful the organisation of the event – the public sector, civil society organisations and the private sector join forces. Cities which spend money on a bid process – and, if successful, on the organisation of the event – expect that the event leads to certain benefits for the city, both for its residents and for the local private sector. As the idea is that the money will be well spent, proponents prefer to speak about investments in the bid process and the event, instead of costs. It is not uncommon that a bid process of a city for a sport event is part of the local economic and societal agenda and strategy (Chalip & Leyns, 2002; Chalip & McGuirty, 2004; O'Brien & Chalip, 2008). But sport events are not the sole way to contribute to the realisation of policy objectives; this can also be achieved by attracting professional sport teams and building sport stadiums (Getz, 1997).

The organisation of professional road cycling events is characterised by a commercial motive from its early start. Newspaper companies initiated the organisation and wrote about the heroic races in their newspapers, aiming for an increase in newspaper sales. And not without success. For example, the newspaper sales of Tour de France initiator *L'Auto* tripled thanks to the articles about the first edition of the Tour de France in 1903 (Maso, 2003). Given this commercial basis, what is the reason that the public sector spends time, energy and (taxpayers) money on professional road cycling events and other sport events? In general, intervention in sport by the public sector is substantial in many countries. Until the middle of the twentieth century, the rationale for public intervention was mainly driven by the demand for military preparedness, but that explanation is not applicable any longer. Organisers of professional cycling events normally cannot cover their costs from the income they generate, like income from private sponsorships (Burgan & Mules, 1992). As for cycling events, it is crucial to note that watching a cycling race from the side of the road is free of charge, except for some places for VIPs (Van Reeth & Lagae, 2016). This implies that the revenues from ticket sales are very low. Of course, if the private sector is not able to develop a profitable business model for a product or a service, including a professional cycling event, this does not necessarily mean that the public sector should intervene and support financially. According to welfare economic theory, the public sector should only become involved in sport events to avoid market failure (Solberg & Preuss, 2007). Market failure has many causes, but public goods are perhaps the most relevant to mention from the perspective of cycling events. A professional cycling event can be seen a public good. These goods are non-excludable and non-rival. A cycling event can promote an entire city as a place to visit or to invest in, and this benefits the whole city; nobody is excluded. In addition, the use of public goods is non-rival as the use of these goods by some consumers does not influence the supply and the availability for others.

As will be described later, frequently, there are more than a few reasons why cities want to host a professional cycling event. However, the promise of an economic boost as a result of the organisation of the sport event often is an important motive (Baade & Matheson, 2004). The expected economic uplift includes the stimulation of tourist spending, both during and after the event (Gratton et al., 2000; Zimbalist, 2010). The arguments that underlie the investment of public funds in sport events and facilities for economic purposes are described by Crompton (1995, 2006). First, residents of a community give funds to their city council in the form of taxes. Second, the city council uses a proportion of these funds to subsidise the event. Third, the event attracts out-of-town visitors. Fourth, the visitors spend money in the city. Fifth, the money from outside the community creates income and jobs for residents. Sixth, this income and jobs benefit the residents. This last step completes the cycle as community residents are responsible for generating the funds, and they receive a return in the form of new jobs and more income (Fig. 5.1).

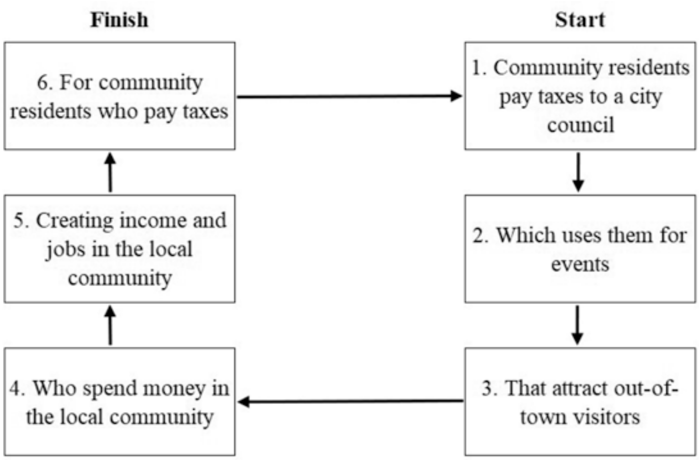

Fig. 5.1 Conceptual economic rationale for public investment in sport events. (*Source* Adapted from Crompton (1995) and Crompton (2006))

2 Events, Impact and Legacy

2.1 Sport Events

Professional cycling events come in all shapes and sizes. To generate a better understanding of these various appearances, Gratton et al. (2000) categorised major sport events in four groups. This grouping offers insight to which extent the event is capable of creating positive economic impact. The word 'major' signifies the importance of the sporting outcomes of the events (e.g. national, European, or World Championships) rather than the economic potency. The typology is relevant to indicate that not all 'major' events in sporting terms are important in economic terms:

- Type A: Irregular, one-off, major international spectator events generating significant economic activity and media interest
- Type B: Major spectator events, generating significant economic activity, media interest and part of an annual domestic cycle of sport events
- Type C: Irregular, one-off, major international spectator/competitor events generating limited economic activity
- Type D: Major competitor events generating limited economic activity and part of an annual cycle of sport events

Examples of type A sport events are the Olympic and Paralympic Games and the FIFA World Cup Football. These events are one-off in terms of place, not from a temporal perspective. *Le Grand Départ* of the Tour de France is a cycling event that can be grouped under this category. Wimbledon and the FA Cup Final are examples of type B sport events. In cycling, Liège–Bastogne–Liège is an example of a type B event. Examples of type C events include European Junior Boxing Championships and the IAAF Grand Prix. The European Track Cycling Championships are a cycling type C event. National championships in various sports, including cycling, belong to category D.

For a good understanding of the 'life cycle' of a sport event, it is also crucial to acknowledge that there are five phases. These phases (adapted from Solberg & Preuss, 2007) are:

- Pre-bidding
- Bidding
- Pre-event
- Event
- Post-event

2.2 Main Stakeholders

A wide range of organisations and people are involved in the production and consumption of a professional road cycling event. These main stakeholders can be clustered into nine groups:

- Event organiser (professional employees)
- Host city
- Rights holder (e.g. *ASO* or the UCI)
- Participants (cyclists and accompaniment)
- Spectators:
  - From the road side (along crowd barriers), this is a visitor.
  - Via a spectator hub (in a fan zone, if provided), this is a visitor too.
  - Via media (television, social media, print media).
- Residents (local community, spectators and non-spectators)
- Sponsors (partners of rights holder and local sponsors)
- Volunteers (persons offering time and labour freely or for a minor financial compensation)
- Media (journalists, photographers)

At first glance, the visitors of a sport event can be seen as consumers. However, the event visitors from the road side and those who watch via a spectator hub are more than just sport event consumers. They are coproducers (Crawford, 2004; Dwyer et al., 2018) because an important part of the event experience is created by them. The COVID-19 pandemic, leading to cycling events without voluminous live event visitors, has underlined this dramatically (Miles & Shipway, 2020).

2.3 Legacy and Impact

These days, virtually all cities which host major cycling events do not solely aim for a well-organised event in terms of security, atmosphere, planning and finance. The event organisation and partners also have the ambition to create a desirable impact or legacy as a result of the organisation of the event. Preuss (2007) defines legacy as follows: irrespective of the time of production and space, legacy is all planned and unplanned, positive and negative, tangible and intangible structures created for and by a sport event that remain longer than the event itself. Preuss' definition of legacy has five dimensions:

- The degree of planned/unplanned structure. An example of planned tourism structure is the realisation of a permanent art work in the city centre which reminds of the cycling event which took place there. A terror attack, or even the fear for it, is unplanned and can damage the image of a city.
- The degree of positive/negative structure. This dimension is ambivalent as it has two sides. For example, a positive legacy for the hotel industry can at the same time be a negative legacy for the environment.
- The degree of tangible/intangible structure. Tangible structures can be counted and sometimes can be put in monetary terms, for example, the number of inbound cycling tourists visiting the event. Feelings of happiness among cycling event visitors are an example of an intangible structure.

- The duration and time of a changed structure. Some structures of an event can appear before, during and after the event. This can be deducted from the five phases of the event life cycle presented before.
- The space affected by changed structure. The legacy of an event in a city differs per city area. Frequently, the specific site in the city where the event takes place benefits more from the event than other city locations.

As opposed to the event legacy, the event impact is triggered by a short-term impulse, frequently as a direct and automatic consequence of the organisation of the event (Preuss, 2007). Examples of impact of a cycling event are hotel bookings of cycling teams and expenditures on food and drinks by event visitors.

2.4 Types of Impact

There are various types of impact that can result from a cycling event. These types of impact can arise in all the phases of the event. Moreover, they can affect one or more stakeholders. Thus, when speaking of impact, one can distinguish between the type of impact, the period it occurs and the stakeholders involved. A renowned typology of impact of events, which is applicable for cycling events, is the typology of Ritchie (1984). He distinguished six types of event impact, specifically economic, tourism/commercial, physical, sociocultural, psychological and political (Table 5.1). Additionally, Ritchie (1984) distinguished positive and negative manifestations of every impact type. Positive and negative impacts are not mutually exclusive as the same type of impact can be evaluated positively by one group of stakeholders and at the same time negatively by others.

Fredline et al. (2004) developed another categorisation of impact of events which has become well-recognised too. This concerns triple bottom line reporting, originally thought up by John Elkington, an expert on corporate social responsibility and sustainable development. They differentiate between economic (profit), social

Table 5.1 Impact types of events

Type of impact	Examples of manifestations Positive	 Negative
Economic	Increased expenditures	Price increases during event
Tourism/ commercial	Increased awareness of the region as a tourism destination	Risk of damaging reputation in case of improper practices
Physical	Improvement of local infrastructure	Overcrowding
Sociocultural	Increase in participation in activity associated with event	Commercialisation of activities of a private nature
Psychological	Increased local pride	Visitor or host hostility
Political	Propagation of political values held by government	Ego trips of individuals

Source Adapted from Ritchie (1984)

(people) and environmental (planet) impacts or components. The added value of the triple bottom line in the perspective of Ritchie's typology is the explicit mentioning of the environmental component. Hereafter, the types of impact Ritchie (1984) distinguished are briefly illustrated. After that, the remaining part of this chapter will largely concentrate on economic impacts.

According to Agha and Taks (2018), economic impact is a new spending in a local economy less any expenditure that have left the local economy due to the event in question. A key point is that the economic impact is created by money flowing into the city and money flowing out of the city because of the event. Hotel bookings of a foreign cycling team in the host city are an example of a positive economic impact. According to Ritchie (1984), price increases during the event are an example of a negative manifestation of economic impact.

The tourism/commercial impact is strongly linked to economic impact and refers to the development of the number of tourists who spend money in the city. Furthermore, road cycling events can attract a lot of media attention and offer the opportunity to showcase the city to an international audience (e.g. Preuss, 2005). For example, stage 6 of the Giro d'Italia in 2021 started in Genga, and the Italian city seized the opportunity to showcase their main tourist attraction, the Grotte di Frasassi, one of the largest cave systems in Europe. Interestingly, the name of the tourist destination, the caves, was chosen over the name of the city as the official start of the stage. Media attention can incite persons who followed the event via the media to visit the host city after the event, leading to local spending. This is called the showcase effect (Hiller, 1989; Fredline et al., 2004; Lamont, 2009). *Le Grand Départ* in 2015 in Utrecht in the Netherlands led to worldwide media attention. For example, The Washington Post (2015) described the host city as 'A vibrant, architecturally distinctive and happening place hidden in the shadow of Amsterdam, its famous neighbour to the north'. French newspaper Le Figaro (2015) used an appealing metaphor: 'On dirait un tableau de Vermeer' ('It looks like a painting by Vermeer'). Besides the number of tourists, an event may also sort effect on the type of tourists. An example of a negative manifestation of tourism/commercial impact of a sport event is the risk of damaging the reputation of the city in case of improper practices. Another possible negative impact is the potential occurrence of the couch potato effect (Allmers & Maennig, 2009) affecting retail sales by domestic consumers. If this effect occurs, because of the event, domestic consumers are redirected from their usual consumption behaviour. To avoid noise and congestion, they entertain themselves at home and follow the event live via the media, perhaps restricting themselves to the consumption of potato fries (Allmers & Maennig, 2009; Baade & Matheson, 2001).

The physical impact refers to infrastructure and accommodations, both sport-related (like a sport stadium) and not sport-related (hotel). A positive expression of physical impact is the improvement of local infrastructure, for example, public transport and the realisation of a new or improved sport facility which is well used and financially sound operated after the event. This is an example of what Allmers and Maennig (2009) refer to as a novelty effect. Catchy examples of a physical legacy of a professional road cycling event in the Netherlands is the routing of the opening time trials of the Tour de France in 2010 in Rotterdam and in 2015 in Utrecht, which are still permanently signed in both cities (Van Bottenburg et al., 2015; Mölenberg et al., 2020). Overcrowding is an example of a negative form of physical impact. Another example of a repeatedly cited negative manifestation is the occurrence of a white elephant (Alm et al., 2016). A white elephant is a metaphor for a physical structure which was built for the event, typically a large sport facility, which remains structurally underused during the post-event period, leading to high costs without sufficient income in return. In comparison with other major sport events, professional road cycling events do not provide significant physical impact because the events do not depend on stadiums, large press centres and athletes villages (Bull & Lovell, 2007; Frandsen, 2017). Races take place on public roads, momentarily closed for traffic, and the teams stay in hotels. Still, it is not uncommon that infrastructural developments are planned in the run-up to the event, to ensure that the roads are safe and attractive.

Sociocultural impact relates to a broad range of impacts, including the strengthening of the local social fabric and the sense of community (Zimbalist, 2010), and the increased level of participation in sports which could result from the organisation of the event (Weed, 2009). Advocates of elite sport events regularly refer to the emergence of this demonstration effect: a process by which people feel inspired by elite sport and the achievements of elite athletes at sport events to increase their sport participation or to take up new sports (Weed, 2009). Although expectations frequently rise high that this effect occurs, the evidence for the manifestation of this kind of effect is, at best, mixed (Frawley, 2013). Rotterdam in the Netherlands had the ambition to use *Le Grand Départ* in 2010 and the supplemental activities as a catalyst to promote bicycle use (as a means of transport) among residents. Special attention was paid to women, youth and minorities (Van Bedaf, 2012). Evidence suggests that bicycle use in Rotterdam increased from 47% in 2010 to 56% in 2015 (De Graaf, 2015). It is not possible to speak of a causal relationship between the 2010 Grand Départ and the increase in bicycle usage. Nevertheless, it is to be expected that the activities surrounding it aimed at the stimulation of bicycle usage as well as investments in infrastructure influenced the intention to use the bike positively. As Bursa and Markus (2020) rightly point out, a large sport event, even if positively perceived by residents, is not capable of leveraging a behavioural change towards active mobility on its own; it must be accompanied by complementary measures. Events can also contribute to cultural development, typically through supplemental activities which are organised alongside the event. An example of a negative type of sociocultural impact is the development that an event could damage the sociocultural values which the host city is trying to develop.

From a positive point of view, psychological impact refers to what economists call psychic income (Burgan & Mules, 1992; Crompton, 2004). Psychic income can stem from various aspects of the event, among which the obtainment of the golden medal of the personal favourite participant or team, a festive atmosphere or as a result of the sense of community. The psychological impact can intensify when stakeholders, like visitors, realise that the event is historical and unlikely to be repeated in the lifetime (Berridge et al., 2019). There are a variety of types of psychic income, also referred to as a feel-good factor, if seen from a positive point of view (Fredline et al., 2004). Pride, joy, happiness, entertainment and excitement can be counted among the most important appearances of psychic income or the feel-good effect. These feelings can lead to certain behaviour. For example, Oswald et al. (2015) show that feelings of happiness make people more productive. Derom and VanWynsberghe (2015) cited the director of the Ronde van Vlaanderen visitor centre who talked about the spectators of the Ronde van Vlaanderen, exemplifying the feel-good effect among numerous cycling enthusiasts: 'I mean, suddenly there is a population that says: guys, look, forget everything, today is the Ronde van Vlaanderen. The normal social criteria are abandoned. A bit like carnival, things are accepted that would normally not be allowed. The Ronde van Vlaanderen is another dimension, another planet, very bizarre'. It should be noted that especially in the northern part of Belgium (Flanders), following professional cycling is a popular leisure activity. The sketch of the mood among Flemish cycling fans during the Ronde van Vlaanderen is comparable with the elated and carnivalesque atmosphere among Dutch cycling fans on L'Alpe d'Huez during the Tour de France, when the Dutch organise the so-called Dutch corner parties at the seventh bend (e.g. Mignot, 2016). The Dutch corner party starts about 3 days prior to the pelotons' arrival. Bull and Lovell (2007) also refer to a carnival atmosphere as a result of the organisation street markets, free music programmes and parades which were organised alongside the first stage of the Tour de France in 2007 in Canterbury (United Kingdom). Psychic income can create liminality and communitas. Liminality refers to a state in which the structure and order of normal life dissolve, everyday obligations cease to exist and new forms of relationship are founded, based upon a levelling of structures (Bull & Lovell, 2007; Chalip, 2006). Communitas can be seen as an extension of liminality and refers to a unique social bond between strangers who happen to have in common the fact that they are in some way travelling or 'on holiday' together (Bull & Lovell, 2007; Chalip, 2006). As far as known, there is no counterpart for the term psychic income in the sport event literature, even though an opposite effect occurs too. One could argue to call this opposing effect psychic loss, which can be expressed in hostility or aversion among residents towards sport event participants and spectators, momentarily overrunning 'their' city.

Lastly, there is the political impact. Ritchie (1984) distinguishes between macropolitical factors and micropolitical factors. As to the macro level, public or private organisations from a city may seek to improve the reputation of their city for commercial reasons, with a sport event used as a vehicle. It is also possible that public or private entities want to stage an event to promote an ideology. At the micropolitical level, there is the aspiration of individuals of public or private organisations to make use of the visibility offered by the involvement with a sport event to enhance personal careers. Although there are negative examples of ego trips, it must be recognised that many events rely on the efforts of one or a couple of individuals who receive few rewards while experiencing high costs. In these cases, recognition for efforts in terms of visibility seems legitimate. The occurrence of both macropolitical and micropolitical impact is no exception as regards professional cycling events. For example, Morrow and Idle (2008) show the political value and impact of the

Tour de France when they quote the event director: ‘The Tour de France belongs to every French person, to every region … The Interior Minister – and I understand him – considers that the Tour de France is part of French national heritage, something important for the image of France’.

2.5 Leveraging and Legacy Planning

The UCI (2021) claims hosting a UCI-event helps a city to achieve economic, touristic and social objectives. It is true that there are opportunities to achieve these goals. Still, it is a major challenge to make sure that a professional cycling event leads to the aspired impact and legacy. Frequently, in the run-up to the event, one sees that a fever of expectations (Mean et al., 2004) arises among proponents of the event, fuelled by enthusiasm. Regularly, there are high expectations as regards the organisation of the event itself and as regards the positive impact and legacy it will create. This is also the case for economic impact, which is often below expectations (Allmers & Maennig, 2009). But if a city does not solely has the ambition to organise a professional cycling event well but also strives for desirable impacts and legacies for stakeholders, how can this be realised, and under which conditions?

The activities which could be undertaken are leveraging and planning for legacy. Leveraging is a strategic planning for long-term desirable legacies and refers to activities which need to be undertaken to achieve this, besides the organisation of the event itself (Chalip 2004, as cited in Balduck et al., 2011). This activity focuses attention on the means to obtain desired objectives in terms of impact and legacy through integration of an event into the host community’s marketing and management strategies. Leveraging differs from legacy planning as legacy planning merely concentrates on the event and the outcomes it might render for the community (Taks et al., 2015). If creating impact and legacy is taken seriously, it is crucial to plan for it by developing and implementing strategies. These strategies demand for sufficient financial and human resources. Especially in the case of leveraging, it is understandable that partner organisations are selected as the event organisation is concentrated on the event itself.

As opposed to sport event management, leveraging and legacy planning are still in its infancy. Too often, the sport event manifests itself as a ‘greedy institution’, absorbing a lot of time and money and leaving too little resources for strategies aimed at creating the intended impact and legacy (Breedveld & Hover, 2015). For example, as key stakeholders, residents are frequently not involved in leveraging and legacy planning strategies (Misener & Schulenkorf, 2016). In addition, repeatedly, a sport event is too often seen as an intervention in itself, instead of a platform or catalyst for other, existing interventions. However, there are indications that planning for impact and legacy is gaining some more attention in the sport event industry (O’Brien & Chalip, 2008; Misener & Schulenkorf, 2016). This is also noticeable in the business of professional cycling events. For example, the Ronde van Vlaanderen has been leveraged to promote bicycle tourism by organising a participatory equivalent (since 1992) and building a Ronde van Vlaanderen visitor centre (since 2003) which is open all year round (Derom & VanWynsberghe, 2015).

Organising a professional cycling event is not interesting for every city. This is also true the other way around. A rights holder of a sport event is not willing to offer the organisation rights to every city. For a city or region, it is vital to think before bidding (Zimbalist, 2010). The organisation of a professional cycling event is promising for both the city and the rights holder when certain conditions are met.

First, it is important that there is sufficient support among residents. Residents act as hosts and therefore influence the way an event is experienced by spectators and other stakeholders. Moreover, local governments act on behalf of residents and invest their tax payers' money, and frequently an overwhelming number of the spectators are residents (Fredline et al., 2003).

Second, one should be realistic about what can be achieved with the organisation of a sport event and parallel activities. In 1973, the mayor of Montreal stated that 'The Montreal Olympics can no more have a deficit, than a man can have a baby' (Flyvbjerg & Stewart, 2012). Unfortunately, the event became a financial burden for the Canadian city for many decades. This event proved to be a lesson for some subsequent organisers of the Summer Games, although a significant underestimation of costs was still seen after this event (Hover et al., 2013; Zimbalist, 2015). A sport event is a flash in history, leading to limited effects (Solberg & Preuss, 2007). The glitter and glamour of sports can make proponents of the event blind to the realistic opportunities and goals which can be achieved. It is essential to think clearly, analytically and less emotionally about sport events and their potential in terms of impact and legacy (e.g. Coalter, 2007).

Third, there should be a certain 'match' between the city and the sport event. Regularly, it is seen that cities develop sport policy plans in which they concentrate on specific types of sports. A city which sees cycling (events) as one of the ways to achieve local policy goals can get more out of a professional cycling event compared to a city with a focus on another type of sports. Preuss and Andreff use the metaphor of a surfer riding the waves. Although they refer to the Olympic and Paralympic Games, the metaphor is also applicable to professional cycling events: 'In order for a surfer to best ride the wave, he has to be in the water, ready and already moving in the right direction when the wave arrives and carries him. The same is valid for cities hosting the Games. The wave of positive energy that the Games bring to a city can be fully leveraged only if the city is already moving into the same direction the wave is going. If a city is not already in a development process or has contradicting plans, the energy of the Olympic Games cannot be leveraged in the same way. Then typically cities are left with structures that are not really needed. So, a city must plan from the very beginning how to use the energy to develop positive legacies' (The Olympics Studies Centre, 2018).

In the context of the sport event bid selection process of a city, the concepts of event resource demand and city resource supply (Agha & Taks, 2015) are helpful.

The event resource demand refers to the human resources (people, knowledge), financial resources (money) and physical resources (sport accommodations, hotels) needed to organise the event. The city resource supply concerns the resources a city supplies to stage the event and to host the event attendees (and other stakeholders). In the process of selecting sport events to bid for, the first step is to inventory the city resource supply. Secondly, the resource demand of a selection of sport events should be inventoried. This selection can be based on the focus of the local sport (event) policy, possibly focussing on a range of specific types of sports. This analysis leads to more insight in which events could suit the city well and which could suit the city less well.

Hover and Stam (2017) offered practical strategies to increase the economic impact of a sport event. First, attract stakeholders who reside outside the region where the impact should be generated. More specifically, it is the part of this group which would not be in the region if the event was not organised, which is of economic significance. Second, stimulate the extension of stay in the region, for example, by informing spectators about other things to do and visit in the region. To succeed, it is important to market activities that match the interest of the target group, which highlights the necessity to gain insights in the profile and interests of the target group. Third, stimulate stakeholders to spend more money, even without an extension of stay. This also requires insights in the target market. Fourth, limit crowding out effects. This effect refers to the occurrence that event stakeholders, typically a large group of spectators, lead to residents leaving the city or (other) tourists avoiding the city.

3 Measuring Economic Impact and Legacy

3.1 Rise of Economic Impact Studies

Since the 1980s, the economic impact of sport events has gained interest. The study into the economic (and social and environmental) impact of the 1985 Adelaide Formula 1 Grand Prix by Burns, Hatch and Mules is an early and well-known example (Fredline et al., 2004; Preuss, 2005). Nowadays, the economic impact of professional cycling events is measured habitually, both by academics (Van Bottenburg et al., 2015; Hover & Bakker, 2015) and commercial organisations (Ernst & Young LLP, 2019, 2021).

An attempt is made to describe what economic impact is, how it is measured, to which results the studies led, what a cost-benefit analysis is and how non-economic types of impact can be captured. The quality of the economic impact studies has an effect on policies of public and private organisations as it is assumed that policies are fuelled by proof, obtained through research. Stiglitz et al. (2010) interpret this clearly and briefly: ‘What we measure affects what we do; and if our measurements are flawed, decisions may be distorted’.

3.2 Determining Number of Visits and Visitors

The number of visitors is one of the most important factors which influences the level of the economic impact. Commonly, determining or estimating the number of spectators is one of the initial building blocks of an economic impact study. For this reason, this matter is addressed first.

When determining the number of spectators at a road cycling event, the first question is what the definition of a (live) spectator is. From a theoretical point of view, this is an easy question to answer. But this is slightly misleading. A spectator of a road cycling event can be defined as someone observing the cycling race along the roadside (see, for example, Aguiar, 2016). Local authorities can use a broader definition, usually including persons near the roads where the event takes place but who do not observe the race. Nonetheless, a 'visitor' who does not watch the race should not be included in an economic impact analysis. Furthermore, for a multi-day cycling race, it is important to distinguish between spectators (visitors) and visits (Davies et al., 2013; Hover & Bakker, 2015). A visitor who watches a multi-day cycling event during 3 days means that there is one visitor who pays three visits.

After the definitions are clear, the challenge awaits to estimate the number of visitors and visits. This is a demanding task because a professional road cycling event is largely supplied for free (Morrow & Idle, 2008; Andreff, 2016; Van Reeth & Larson, 2016; Davies et al., 2010; Davies et al., 2013). Consequently, the number of spectators cannot be derived from ticket sales.

Perhaps the best way to estimate the number of visitors is through triangulation. In this approach, a combination of sources is used to estimate the number of visitors. Potential sources are estimates of the event organiser, estimates of local authorities, spectator surveys, entry counts of cycling fan zones, observations of crowd densities, analyses of television footage and stills photography (Davies et al., 2013; Hover & Bakker, 2015). Sources have different levels of reliability and validity, what should be taken into account when estimating the number of visits and visitors. The event organiser and their partners (like the rights holder and sponsors) consider the attendance as a key performance indicator. This means that they benefit from a high number of visits, which potentially (but not necessarily) undermines the reliability of the statements from these stakeholders as a source for the estimation of visitors and visits. Another methodological point of attention when estimating the number of visitors results from the fact that visitors frequently visit more than one place along the roadside. When two photos are taken from a crowd alongside the road 30 minutes apart, it is nearly impossible to determine how many persons are on both pictures.

3.3 Direct Economic Impact

An economic impact study registers additional money flows that are generated as a result of the organisation of a sport event (Késenne, 2012). As delineated before, this additional money flow is the result of new spending in a region less expenditures that have left the local economy. A key word is 'additional': an additional money flow relates to expenditures that would not have occurred without the event (Burgan & Mules, 1992).

The definition of economic impact might give the impression that the related measures are conceptually uncomplicated (Ritchie, 1984). Still, the answer on the question whether the organisation of professional road cycling events makes the economic wheel go round is full of twists and turns. Even in relatively simple economic impact studies, the calculation of economic impact is burdened with methodological challenges. Perhaps the most prominent challenges are an assessment of the extent to which money flows in conjunction with the event would have occurred in the absence of it (Baade & Matheson, 2001). This means that it might be clearer to speak of the estimation of the impact instead of the registration of it.

The scope of an economic impact study can be stretched to employment. Simply put, the additional full-time equivalent job years can be derived from the additional income received by dividing additional income by an average annual full-time wage for the sector where the income is received (Gratton et al., 2005). Sometimes, the (monetised) media impact is seen as economic impact too, but this is questionable as the money flow is artificial.

Important aspects to address before conducting an economic impact study are the definition of the event, the region for which the economic impact is calculated and the time frame. As regards the definition of the event, it is possible to include or exclude supplemental activities, such as a congress and a recreational bicycle tour. There is no 'right' or 'wrong' choice; these considerations largely depend on the need for information by the client of the study (usually a public organisation like a local government or an event organiser) or the focus of the researcher. The economic impact of a cycling event can be calculated for a city, but also for a region or a country. Suppose that the economic impact is measured for a region and that the event attracted 100,000 visitors from other regions in the country and 50,000 visitors from abroad. The expenditures of the visitors who visited the region especially for the cycling event represent an additional flow of money and are included in the economic impact. But from a national point of view, the 100,000 visitors from other regions are just switching expenditure from other activities, and only the expenditures by the 50,000 foreigners represent an additional flow of money. Although the economic impact of a sport event on a local level can be substantial, on a national level, it can be almost negligible. For this reason, Preuss (2007) states that the gross domestic product and other key economic variables for a region are too general to demonstrate the impact of a sport event, even for a type A sport event. Regularly, the time frame, referring to the timing of spending, concerns a range of days before the event (a week or so) and a period of a few days immediately after the event. Studies focussed on measuring the economic impact of an event on the long term – habitually tourism spending after the event – are less common.

To calculate the economic impact, data from all stakeholders are required. Besides the size of the groups of stakeholders involved, the most important piece of information that must be obtained from each stakeholder is the amount of money that flows into the host region as a direct result of the organisation of the event. This is the additional money flow. Thus, money that was also spent in the region if the event was not organised must be excluded from the calculation. Based on the origin of expenditures and the location of the expenditures, four options can be distinguished (Table 5.2). These options represent four elementary steps when calculating the economic impact.

Money from outside the region which is spent outside the region is neutral and is not applicable for an economic impact study. The benefit or positive impact is generated by a part of the money that originates from outside the region and is consumed in the region. The part of this money that was spent as a result the organisation of the event is beneficial and is called additional. Money that stems from the region under research and is spent outside the region is a cost and has a negative effect on the economic impact. Lastly, there are expenditures inside the region which also originate from inside the region. This is a reallocation and does not influence the economic impact.

One can distinguish direct, indirect and induced income (Kasimati, 2003; Gratton et al., 2005; Clark, 2008). Direct income is initial or first-round additional spending. For example, a cycling event visitor buys a glass of beer from a pub, which is income for the pub owner. This direct income creates a chain reaction in the economy. Indirect income is income of other organisations as a result of the direct income; these are subsequence effects. In the case of the purchase of the glass of beer of the visitor, indirect income is the income of the brewer where the pub owner buys the beer. Induced income refers to household spending from the income derived from the direct and indirect employment. Thus, this is when the employees of the pub and the brewer spend their income, resulting in another effect in the economy. The indirect and induced income is at times referred to as secondary impact, multiplier impact or economic ripple effects (Crompton et al., 2016).

One group of stakeholders requires more attention from a methodological point of view, namely, the residents, both those who visit the event and those who do not visit the event. It is not certain that expenditures of residents should contribute to the economic impact negatively, positively or not at all (Agha & Taks, 2018). Traditional methods exclude residents' spending as one assumes that these expenditures would occur locally irrespective of the organisation of the sport event and that these expenditures substitute for other expenditures (Crompton, 1995). Nowadays, researches regularly apply other approaches, understandably leading to different economic impacts.

Table 5.2 Matrix with first steps to calculate economic impact

	Location of expenditures	
Origin of expenditures	Outside the region	Inside the region
Outside the region	Neutral (not applicable)	Benefit (positive impact)
Inside the region	Cost (negative impact)	Reallocation (no impact)

Source Adapted from Preuss (2005) and Agha and Taks (2018)

3.4 Direct, Indirect and Induced Economic Impact

Economic impact studies aimed at measuring the direct additional impact are quite common. Yet, economic impact analyses can also go some steps further. This concerns the inclusion of indirect and induced impacts. An extensive economic impact study can also take into account more groups of persons whose behaviour is affected by the event. Additionally, an extensive economic impact study can also take crowding out, opportunity costs, leakages, the consumer surplus and a substitution effect into account.

The total economic impact – the direct, indirect and induced impact – can be calculated after the direct impact is obtained (Crompton et al., 2016). This total economic impact is estimated by applying a multiplier (Baade & Matheson, 2001). A multiplier is a way of measuring how important a specific industry is to other industries. Multiplier analysis requires insight in the industry in which the money is spent as every industry is characterised by a different multiplier. National statistical agencies can provide this information. For example, a multiplier of 2 logically implies a doubling of direct benefits.

Next to the stakeholders mentioned before, more groups of persons whose behaviour is influenced by the organisation of the event can be identified, including persons who are not interested in the event and who do not have any connection with it. Preuss (2005) speaks of event-affected groups. He distinguishes the following ten event-affected groups during event time:

1. Extentioners: tourists who would have come anyway but stay longer because of the event
2. Event visitors: persons who travel to the region because of the event
3. Home stayers: residents who opt to stay in the region and spend their money at home rather than on a vacation out of the region at some other time in the year
4. Runaways: residents who leave the region and take a holiday out of the region
5. Changers: residents who leave the region and take their holidays at the time of the event rather than at some other time in the year
6. Casuals: tourists who would have visited the region even without the event
7. Time switchers: tourists who wanted to travel to the region but at another time
8. Cancellers: tourists that totally cancelled their trip
9. Pre-/post-switchers: tourists that will come later or came earlier
10. Residents: residents who stay in the region during the event and would also have been in the region without the event

Ideally, an economic impact study takes into account the behaviour of these ten groups, but this is very challenging in terms of both method and funding. While gathering data from event visitors is not very troublesome, the opposite is true for other groups. For example, it is more problematic to determine the (negative) impact that is created through ‘runaways’, ‘cancellers’ and ‘pre-/post-switchers’ because there is no central registration of these persons. As a result, it is a major challenge to determine the size and the (expected) spending pattern of these groups.

A professional cycling event may lead to the occurrence of crowding out. A crowding-out effect occurs when residents leave the region ('runaways') and/or tourists avoid the region because the event takes place ('cancellers' and 'pre-/post-switchers, together referred to as 'avoiders') (Preuss, 2005; Preuss, 2007; Késenne, 2005). While a group of residents can be excited that the event is organised in their city, another group may be dismayed or even disgusted and escape the city, for example, because of the expected large crowds invading the city, traffic congestion, noise pollution and detours. These reasons to evade the city can also apply to the 'avoiders'.

Naturally, the money of event stakeholders could also have been spent on other things. For example, when a local government decides to spend €2 million on the organisation of a professional cycling event, those euros cannot be issued in another way. That alternative way of spending, for example, the investment in a sport stadium or an educational project, would lead to a certain impact as well. This is where opportunity costs come up. Opportunity costs refer to the benefit of the best alternative expenditure (Késenne, 2005; Crompton, 2006; Preuss, 2007; Sterken, 2006). Calculating opportunity costs is challenging because alternative expenditures are very difficult to determine as this often refers to hypothetical and uncertain situations. If opportunity costs are neglected in an economic impact study of a sport event, it is wise to remember that an alternative expenditure would also represent an economic impact.

An expenditure in the region for which the economic impact is calculated does not always contribute to the specific geographical economy. A professional cycling event is often accompanied by temporal providers of food, beverage and sport retail, sometimes clustered in villages or squares. It is common that a proportion of these temporal sellers are not settled in the specific region. As a consequence, expenditures on products from these sellers drain to other regions. The leakage effect is the proportion of the expenditure that does not stay in the region for which the economic impact is calculated (Baade & Matheson, 2001; Baade & Matheson, 2004; Davies et al., 2013). These money flows are lost for the region.

A substitution effect occurs when the expenditures in a specific region come at the expense of expenses in another region (Baade & Matheson, 2004). Suppose that a national government financially supports the organisation of a professional cycling event in a city in a country with €1 million. This amount cannot be spent in other cities in the country.

Clearly, many ways of measuring economic impact of sport events exist. There are different assumptions (direct, indirect, induced), the size of the impact region can differ (city, region, country), the event definition can be narrow or broad (including or not including supplemental activities), it could be a pre-event or post-event study (reference figures, new data), and specific effects may or may not have been corrected for (crowding out, opportunity costs, leakages). For this reason, it is nearly impossible to compare the economic impact of sport events, especially when events are held in different cities (Agha & Taks, 2015).

3.5 Controversy over Economic Impact Studies

Economic impact studies are not free from disputes. This critical debate can be traced back to two groups of arguments. First, often economic impact studies for cycling events are paid by (a combination of) the following organisations: the public organisation involved (the host city), the national cycling federation, the organiser of the event and the rights holder. Observably, these organisations are involved in the cycling event and can frequently be seen as event proponents. When organisations pay for an economic impact study, there can be a risk that they put pressure on researchers to produce the desired results, which includes a high number of visitors and a high economic impact. This can lead to an abuse of economic impact studies (Dejonghe, 2004). Economic impact studies are regularly considered necessary for political justification (Preuss, 2007), paid for by organisations with a motive to exaggerate and with the aim to convince a sceptical public (Crompton, 1995; Crompton, 2006). Second, economic impact studies may lead to inaccurate results because of conscious or unconscious methodological mistakes. Crompton (1995, 2006) listed major contributors to the incorrectness of economic impact studies. These include failing to accurately define the region for which the impact is calculated and including all local spectators. In addition, inappropriate multipliers are used, information on the spending behaviour of those who are not included in an expenditure survey is lacking (Baade & Matheson, 2004), costs are underestimated (Zimbalist, 2010), crowding out is neglected (Késenne, 2012), and negative impact is ignored (Balduck et al., 2011).

3.6 Cost-Benefit Analysis

A starting point of economic impact studies is that costs and benefits are not absolute categories (Késenne, 2012; Oldenboom, 2006). The distinction between costs and benefits depends on the perspective. For example, the bid fee and the fee for the organisation of the UCI Road World Championships in 2025 (an 8-day event) are 30,000 CHF (roughly €27,000) and eight million CHF (approximately €7.3 million), respectively (UCI, 2021). These millions are a benefit for the UCI, but a cost for the World Championships organisation. In an economic impact study for a host city, the fees would be seen as a cost and would therefore have a negative impact because the origin of the expenditures is from inside the region and the location of expenditures is outside the region. Similarly, the fee of *Le Grand Départ* in 2007 and 2015 amounted to €4 million (Morrow & Idle, 2008; Hover & Bakker, 2015). As these examples show, a substantial proportion of the benefits of major sport events often flows to international sport federations (Solberg & Preuss, 2007).

In contrast to economic impact studies, in cost-benefit analyses, the distinction between a cost and a benefit is made (Késenne, 2012). Per money flow, the researcher has to decide who are the takers at the expense of which makers (Mazzucato, 2018).

To be able to make the difference between a benefit and a cost, the researcher has to choose for which organisation or industry the cost-benefit analysis is conducted. As to a professional cycling event, a cost-benefit analysis can be conducted for the national government, for the local government and for the rights holder. Unsurprisingly, the perspective influences the result. For example, the London Olympics and Paralympics in 2012 led to substantial benefits for the shops in and around the Olympic Park in East London. Other parts of the city, however, were described as a 'ghost town' while the Games were taking place, and popular touristic venues such as the Royal Botanic Gardens and the London Zoo saw a meaningful decrease in visitor numbers compared to the same period the year before (ALVA, 2012; Hover et al., 2013). As this example shows, the costs and benefits are unevenly distributed among industries and locations (see also Chalip and Leyns (2002)). This can also be the case for groups of residents. In 2013, a year before the FIFA World Cup Football in Brazil, millions of Brazilians took to the streets in more than 350 cities to protest against skyrocketing costs for major sport events only the elite would benefit from (Horne & Whannel, 2016; Hover & Breedveld, 2017).

For the reason that an economic impact study does not make a distinction between benefits and costs, these studies do not yield an argument for a government to financially support a sport event. Only a cost-benefit analysis with the government as a starting point can provide the information to support the decision-making (Késenne, 2005). Therefore, numerous researchers propose cost-benefit analyses instead of economic impact studies. In practice, however, economic impact studies for sport events are more common than cost-benefit analyses. This is because economic impact studies commonly lead to nicer results (i.e. a high and almost always positive impact) and are usually cheaper and quicker to conduct.

3.7 Beyond Economic Impact

American politician Robert Kennedy once pointed out that 'the gross domestic product measures everything in short, except that which makes life worthwhile' (Boelhouwer, 2016). He discussed the limitations of measuring gross domestic product, which is the monetary value of goods and services produced by a country during a period in time. The essence of his talk perhaps was that if the status of the economy is known, it is not necessarily clear what the situation in society is. The parallel with the theme of this chapter is that the popular economic impact studies of sport events aim to capture economic impact, but normally neglect other types of (societal) impact, including sociocultural and psychological impact. Many impact studies often disregard intangible impacts in favour of economic ones (Bull & Lovell, 2007; Fredline et al., 2004; Berridge, 2012), whereby potentially important societal indicators remain unmeasured.

The focus on monetary impact is remarkable since the economic impact, if measured correctly, is relatively small for many sport events (De Boer et al., 2019), and other types of impact, for example, the feel-good effect and the image effects for hosts, might be of larger importance than the economic impact (Allmers & Maennig, 2009). There are two reasons for the emphasis on economic impact. First, in many modern societies, professionals in the private and public sector are used to measure every progress in monetary terms. Hence, research into the impact of sport events, ordered by public and private organisations, is economically oriented. Second, non-economic impact is harder to capture by researchers.

Nevertheless, in recent times, impact studies of sport events seem to pay more attention to non-economic impact (Agha & Taks, 2015; Chalip, 2006; Fredline et al., 2003; Hover et al., 2016). Non-market effects are priceless and can be valuable to society. Some of these effects do not last very long. Dolan et al. (2016) showed that hosting the Olympics and Paralympics in 2012 had a positive impact on the life satisfaction and happiness of Londoners during the Games, but also that the effects were gone within a year.

Economic impact studies relate to products and services which are traded on a market. As a result, there is a price for these products and services, and one can speak of market effects of sport events. However, there are non-market effects as well, referring to things or impact that cannot be bought on a market. For example, you cannot buy feelings of pride and pleasure in a shop. Non-market effects are also called soft effects or intangible effects. Monetary valuation methods offer a way to put non-market effects in monetary terms. There are two groups of monetary valuation methods. Stated preference methods are based on data that are not observable in the market and that have to be deduced from responses to hypothetical questions in surveys. Revealed preference methods are based on data that are observable in the market and that can be revealed from observations of real-world choices (Baarsma, 2000). The contingent valuation method (CVM) is a frequently applied monetary valuation method based on a stated preference (Carson, 2000), and the travel cost method is an example of a revealed preference method. An uncomplicated example of the CVM is a question in a survey for residents: What is the maximum amount of money that you are willing to contribute to the sport event in your city? The principle of the travel cost method is that the time and travel cost expenses represent a price one wants to pay for a specific destination, like a sport event. An important difference between stated and revealed preference methods is that revealed preference methods are not capable of measuring the non-use value, also referred to as the existence value (Baarsma, 2000; Allmers & Maennig, 2009). For example, it is thinkable that a resident of a city where a cycling event takes place does not visit the event, does not read about it, but as a non-user nevertheless endorses the financial support from the local government because he or she expects that the event contributes to achieving the city's economic and societal objectives and for the reason of a festive atmosphere in the city. For example, Vekeman et al. (2012) showed that sport events can have a value for users (visitors) as well as for non-users (those who are not interested).

Monetary valuation methods were put into practice in the field of professional cycling events. For example, De Boer et al. (2019) used the CVM for estimating residents' ex ante and ex post willingness to pay for hosting the opening stages of the Giro d'Italia in 2016, which was held in the Gelderland region of the Netherlands. They found that the percentage of residents with a positive willingness to pay changed from 29.7% before the event to 39.3% directly after the event. Average willingness to pay rose significantly from €3.58 to €4.45 per person, leading to an increase of residents' valuation from €5.8 million before the start of the event to €7.1 million immediately after. Following the event in the media and attending the event contributed to the residents' willingness to pay. We refer to Chap. 8 for a more elaborate discussion of this study. This example shows that the value of non-market effects of professional cycling events should not be underestimated and that the value can be millions of euros.

4 Le Grand Départ 2015

In this paragraph, in-depth attention is paid to the topics discussed before, using the 2015 Grand Départ in Utrecht as a case. *Le Grand Départ* is a type A sport event (Gratton et al., 2000), signifying that the event is a major international spectator event generating substantial economic activity and media interest. *Le Grand Départ* Utrecht lasted 4 days:

- Team presentation in Park Lepelenburg in the city centre (Thursday, 2 July)
- La Caravane d'Utrecht (publicity caravan) in the city centre (Friday, 3 July)
- First stage, a time trial through the city centre (Saturday, 4 July)
- Second stage, with a start in the city centre (Sunday, 5 July)

The project organisation chose to operate as a foundation, named 'Le Tour Utrecht'. This separate foundation has been set up to put matters at an organisational and legal distance from the municipality, which acted as a commissioner for the event. For example, using the foundation made it possible to separate the project budget and payment transactions of Le Tour Utrecht from the supervisory and commissioning role of the municipality. A drawback of this set-up was that the project organisation worked with a tight project budget that did not provide for unforeseen costs and that supplemental funding from the municipality was not easy to receive. This put the budget under some pressure.

The organisation consisted of three clusters:

- Technology, mobility and safety
- Marketing, communication and hospitality
- Side events

Many stakeholders were involved, both from the public sector (national, regional and local government) and the private sector (including the automotive industry, insurancers, information technology companies, university and hospitality firms). With the organisation of the event, Utrecht wanted to showcase the best of the local assets to the world. As commissioner for the organisation of *Le Grand Départ*, the municipality formulated the following mission: 'Organise *Le Grand Départ* de France in Utrecht with legacy (pre and post)'. The following objectives were described in the project plan:

- Set up a perfectly safe and well-organised event.
- Make the most out of Utrecht, and display creativity, organisational power and promotion of the city with an enhanced image (purpose: present Utrecht as the most hospitable city in the Netherlands, as a city of knowledge and culture in an economically strong region, as a healthy city involved in sports).
- Boost Utrecht as a cycling city.
- Promote (doping-free) sport.
- Strengthen the relationship with the business community, and link businesses to a long-term agenda for the city.
- Accomplish a concrete legacy through the relation between elite and grassroots sport among others and as a catalyst for existing municipal programmes.

These objectives were elaborated in three groups of projects:

- Engineering, security and mobility. The aim for this project cluster was to organise a high-quality event with a focus on safety, accessibility and mobility.
- Marketing, communication and hospitality. The objective was to integrate the event as Le Tour Utrecht, thereby marketing the city of Utrecht, to promote the elite sport profile and image of the Netherlands and to stimulate a healthy lifestyle.
- Start-up programme and legacy. The aim was the organisation of a festive, safe and perfectly organised side event programme. This programme ensured meeting marketing objectives to best showcase the city of Utrecht and show what the city has to offer in the fields of sport, culture, knowledge and economy.

The side event programme, also referred to as the 'Utrecht 2015 Programme', was launched 100 days prior to *Le Grand Départ*. This programme was developed to leverage the potential opportunity the event offered. The purpose of the start-up programme was to increase Utrecht residents' involvement and connecting sports (cycling) with culture, knowledge and economy. More than 250 activities were organised, culminating in the week before the team presentation. The activities were characterised by little 'top-down' guidance from the project organisation and opened doors for 'bottom-up' initiatives, instigated by residents. Participants and visitors of the side events rated the programme with an average score of 8.2 on a scale from 1 to 10.

Event sponsors were not allowed to use the words 'Tour de France', 'Tour' and 'Grand Départ' in their marketing and communication campaigns. These rights were exclusively reserved for the commercial partners of the rights holder *ASO*. Nonetheless, there was an alternative as the project organisation initiated the legally permitted label 'Utrecht 2015', which was used by many local and national sponsors. Never before had the organisation of an event in Utrecht led to such a large scale of collaborative relationships between municipal institutions, the business community, sport organisations, cultural institutions and knowledge institutions (Van Bottenburg et al., 2015).

The economic impact was calculated on the basis of the application of the national guideline for economic impact studies for sport events, prescribed by the Dutch Ministry of Health, Welfare and Sport. The guideline is developed by a consortium of Dutch sport researchers. This guideline prescribes to measure the additional direct money flows that are generated as a result of the organisation of a sport event less expenditures that have left the region. The direct economic impact was estimated for the municipality of Utrecht. The stakeholders studied were visitors (live spectators), the cyclists and accompaniment, the *ASO* and partners, the volunteers (aptly named 'Tour Makers'), the press representatives and the project organisation. Following the research guideline, only additional persons were included in the estimation of the economic impact. These are persons that would not have visited Utrecht if the Tour de France had not taken place in that city.

The number of visitors was estimated through triangulation. Sources were observations of independent researchers, visual sources (of amateurs, professional news media, press photography and independent researchers) and websites (including Google Maps). This leads to an estimation of 748,000 visits during 4 days. The average number of visits per visitor was estimated at 2.02, based on a visitor questionnaire with a sample of 791 respondents. The number of (individual) visitors can therefore be estimated at 370,000. Sixty per cent of the visitors were men, 44% were under 35 years, and 54% cycled in a sporty way 12 months before the event. Fifty-one per cent of the visitors were additional visitors. All residents were not seen as additional. The economic impact generated by visitors was estimated at €18,844,000.

Twenty-two cycling teams, with a total of 198 riders and 300 accompanying staff, participated in the 2015 Tour de France. They are all considered additional persons. However, not all expenditures were seen as impact for the reason that 15 teams did not stay in hotels in the municipality of Utrecht and therefore did not result in an outside money flow into the city. The *ASO* delegation in Utrecht added up to 475 persons, all considered additional. There were 2,000 accredited media professionals as well, all regarded as additional persons. The event was made possible by 1,301 volunteers, of which 61% were seen as additional (39% were residents of Utrecht). This led to a direct economic impact for Utrecht municipality of €210,000 (teams), €570,000 (*ASO*), €28,000 (volunteers) and €382,000 (media).

The project organisation worked with a budget of €18.1 million and communicated a break-even result. The financial contributions of the local government (€6 million), the private sector (€5.5 million) and the Ministry of Health, Welfare and Sport (€2.3 million) were the most important sources of income. The financial support from the municipality is not considered as additional as it is assumed that municipal resources would sooner or later benefit the municipality anyway and are thus considered as a shift in spending in time. Prime expenditures were the fee to the *ASO* (€4 million), costs of infrastructural nature to develop a safe and attractive course (€3.9 million) and organisational costs, including salaries (€2 million). The calculation of the direct economic impact of the project organisation for the municipality of Utrecht is estimated at €2,993,000. The estimated total direct economic impact consists of the sum of the impact that has been realised by the six groups of stakeholders, which is €23 million (Table 5.3) (Hover & Bakker, 2015).

Table 5.3 Estimated economic impact of Le Grand Départ 2015 for the municipality of Utrecht

	Euros
Visitors	18,844,000
Cyclists and accompaniment	210,000
ASO and partners	570,000
Volunteers	28,000
Press representatives	382,000
Project organisation (including public sector)	2,993,000
Total	23,027,000

Source Hover and Bakker (2015)

Some industries and organisations took financial advantage of the event. This includes the *ASO* and a selection of bars, restaurants, hotels and ice cream shops in the city. Others were disadvantaged, like clothes shops and bookshops. However, it must be noticed that it is problematic to determine the isolated effect of *Le Grand Départ* on retail sales. It is plausible that the extremely warm weather during the event – over 30 degrees Celsius – influenced sales too.

On the whole, *Le Grand Départ* was a big celebration. The excitement was palpable throughout parts of the city, building up from the kick-off moment on 26 March 2015. According to some persons involved, *Le Grand Départ* was the largest festive event Utrecht has ever hosted. Noteworthy, there have been hardly any incidents necessitating police intervention. The sunny weather contributed positively to the atmosphere too, though the high temperatures could also have been experienced as a nuisance by some.

Visitors evaluated the event with an average rating of 8.4 on a scale of 1 to 10. This appreciation rate is particularly high in comparison with earlier major events in the Netherlands. Visitors of the 2010 Grand Départ in Rotterdam had evaluated the event with a score of 8.0, while the arrival of the second stage of the 2010 Giro d'Italia in Utrecht was assessed with a 7.8, and the start of the Vuelta a España in 2009 in Assen had received a score of 7.7 (University of Applied Sciences Rotterdam and MeerWaarde, 2010; Van Gool et al., 2009; Briene et al., 2010).

Almost nine out of ten visitors expected *Le Grand Départ* in 2015 to contribute to promoting Utrecht as a tourist destination. Eight out of ten visitors indicated taking pride in the fact that the Tour de France started in Utrecht (89% of the visitors were residents). More than a quarter of visitors felt encouraged to practice sport activities. The question is whether this intention led to actual participation in sports. As far as known, no research has been done on this type of impact of *Le Grand Départ* 2015 yet. Previous research into this topic has shown that this relationship is not self-evident: the organisation of a major sport event does not automatically lead to an increase in sport participation and physical activity among visitors or other stakeholders (Weed, 2009; Frawley, 2013).

To better understand the 'value' of attending the event, the CVM was applied, a monetary valuation method based on a stated preference. A hypothetical question was asked to visitors: 'Attending *Le Grand Départ* is free of charge. Suppose this was not the case, how much would you be willing to pay for an entrance fee, per person per day?' Forty-nine per cent of the visitors responded they would pay an entrance fee. This proportion increases with the respondents' age: 33% in the respondents aged under 20 group, rising to 62% among respondents aged over 55. For those willing to pay such a fee, the average amount was €13.51. An indication for the hypothetical or artificial 'monetary value' for all visitors of the event can then be determined as follows: number of visits (790,000) * share willing to pay (49%) * average entrance fee (€13.51) = approximately €5.2 million. This amount is the consumers' surplus: the difference between the (hypothetical) price a spectator is willing to pay and the price he has to pay to attend the event (zero).

Before the event (in June 2015) and afterwards (in October 2015), the city of Utrecht conducted a survey among residents about the expectations and experiences regarding the event (IB Onderzoek, 2015). The post-event study learnt that 88% of the residents expected that *Le Grand Départ* would contribute to the promotion of the city (pre-event: 86%). Seventy-nine per cent felt proud after the event (pre-event: 68%). Ninety per cent of the residents looked back positively (pre-event expectation: 62%).

As to the tourism/commercial legacy, the number of overnight tourists in Utrecht increased from 355,000 in 2015 to 449,000 persons in 2019 (+26%). The number of overnight stays increased as well, from 542,000 to 752,000 (+39%) (Statistics Netherlands, 2021). Though these touristic developments in Utrecht are significant, there were also increases in overnight tourists and their stays in the same period in the other three major Dutch municipalities (Amsterdam, Rotterdam and The Hague), which obviously did not host *Le Grand Départ* in 2015. In Amsterdam and Rotterdam, growth numbers were even higher than in Utrecht. Moreover, the increase in overnight tourists and overnight stays already started several years before *Le Grand Départ*, both in Utrecht and in the other three major municipalities. With the available data, it was not possible to determine the isolated effect of *Le Grand Départ* on the tourist developments in Utrecht. Lastly, the number of overnight stays is limited by the capacity of hotels and other lodging accommodations. As far as Utrecht is concerned, there is a shortage of hotels during peak moments (Municipality of Utrecht, 2021). This means that the presented number of tourists and their stays are no impeccable indicator for touristic demand.

5 Conclusion

This chapter attempted to describe the impacts of a major cycling event. Most attention has been paid to economic impact. Above all, major cycling events and supplemental projects offer opportunities for positive economic impact and legacy for stakeholders involved. There is evidence that hosting major cycling events result in money flows of millions of euros. Assuming sunny weather conditions, a major cycling event attracts tens of thousands of cycling enthusiasts, cycling teams and other stakeholders to the host city, fuelling the economy of the host city with 'new money'. Worldwide media attention is guaranteed, offering a good potential for a showcase effect (Hiller, 1989).

On the other hand, however, this chapter makes clear as well that watchfulness is advised when studying the economic impact and legacy of a major cycling event. Economic impact studies can be conducted for window dressing. As Coalter (2007) points out 'the choice of particular methodologies reflects political rather than research needs'. Just like in cycling, there are 'winners' and 'losers' in economics. Hence, many economists advocate cost-benefit analyses instead of economic impact studies. If an economic impact study is still carried out, it is recommended that this is conducted by independent researchers and that negative economic impacts are measured as accurate as possible. In addition, the impact and legacy of activities surrounding cycling events are too often neglected. Although cycling events make the economic wheel go round, the events also make the hearts of cycling enthusiasts beat, leading to large-scale explosions of positive feelings. This non-monetary impact is regularly unmeasured too, while these effects deserve more attention in studies into the impact and legacy of sport events because the social raison d'être of a sport event is perhaps its public celebration (Kidd, 1992).

The chapter concludes with an example of an economic impact study of the 2015 Grand Départ. The municipality of Utrecht and its private stakeholders continue to embrace cycling. In this respect, cycling relates to a sport for professionals as a recreational sport but also as a healthy and sustainable way of transport in the city. The belief in the power and potential in cycling has certainly not diminished since 2015. The municipality of Utrecht submitted a bid for the start of the Vuelta a España in 2022. In May 2021, *Unipublic*, the organizer of the Vuelta a España, announced that the event will start in the municipality of Utrecht in 2022. This was an exceptional moment in the history of hosting professional cycling events as the Dutch city will become the first in the world to be visited by all three *Grand Tours*.

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Part II
Demand for Professional Road Cycling

Chapter 6
TV Broadcasting of Road Cycling Races

Daam Van Reeth

1 Introduction

Soon after the start of television, sports federations and TV broadcasters found out the mutual gains in broadcasting sports. Broadcasters were looking towards the future of this novel medium and aired sports as a means of stimulating demand for television, while federations and event organizers quickly understood how live broadcasts could be useful in popularizing the sport and connecting to new audiences. The 1936 Summer Olympics marked the first live television coverage of a sports event in world history. In total, 72 hours of live transmission went over the airwaves to special viewing booths in Berlin and Potsdam (http://www.tvhistory.tv). In the United Kingdom, TV broadcasting of sport started with a Wimbledon tennis game in June 1937. There were around 2000 TV households in London, and they became the first people in the United Kingdom to watch a live sporting event from the comfort of their living room. In April 1938, England versus Scotland provided the world's first television pictures of a soccer match. The United States' first televised sporting event, a college baseball game between the Columbia Lions and the Princeton Tigers, was broadcast by *NBC* on 17 May 1939. Other sports were soon to follow. On 22 October 1939, the first American football game was broadcast, and the first ever television broadcast of a hockey game occurred on 25 February 1940. Three days later, for the first time, a basketball game was broadcast on American television (http://www.americansportscastersonline.com).

TV coverage of road cycling started shortly after World War II. On 25 July 1948, little known Italian rider Giovanni Corrieri outsprinted his French rival Lucien

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Teisseire to win the final stage of the 35th Tour de France. At the finish line, in the velodrome of the Parc des Princes in Paris, there was a strange new object that would change the face of professional road cycling forever: a television camera. For the first time in history, French citizens could comfortably witness from their home seats a glimpse of the racing action from the Tour de France live as it happened. It was the start of a new era for the Tour de France, and TV coverage of the race has come a long way since that experimental first broadcast in 1948. During the 1950s, the popularity of the Tour de France grew resulting in the first live coverage from within the race in 1958 on the legendary Col d'Aubisque (Thompson, 2006). French television began to pay for the right to cover the race in 1956 (Viollet, 2007). From 1963 onwards, there were daily live broadcasts of the Tour as the reduction in the size of the cameras allowed the filming of the last 30 km from motorbikes. The arrival of the motorbike in the peloton fundamentally changed the way people saw the race. The TV viewer had access to an event that the roadside spectator could not see (Wille, 2003). Over the years, technological innovation made it possible to cover larger parts of the race and to produce increasingly better images broadcast in ever more countries around the world.

In the early 1960s, Belgian television started broadcasting the Ronde van Vlaanderen. Because of technical reasons related to the length of the TV cables that were used at that time, initially only the final 600 m of the race were shown. But by 1963, for the first time, mobile cameras on motorbikes and a helicopter could be used to capture in-race images of the Ronde van Vlaanderen. Other European countries like the Netherlands and Italy also started live transmission of cycling classics and the Tour de France in the 1960s and 1970s. In the following decades, television coverage of cycling races expanded in duration and scope. Non-European coverage of the Tour de France started in the 1980s with summary broadcasts in the United States and in Japan. The Tour became one of the most-viewed multiday sports events when TV channels in Australia, China and Latin American countries began live transmission. *Amaury Sport Organization* (*ASO*), the Tour de France race organizer, claims over 100 networks around the world now broadcast the race in 190 countries (ASO, 2016). Decisive stages are viewed live by 20–25 million TV spectators worldwide (see infra).

The chapter proceeds as follows: The second section discusses the reasons behind the successful marriage of road cycling and television. Next, we explain how TV audiences are measured, and we discuss the complexities of understanding the actual TV audiences for live cycling broadcasts (Sect. 3). In Sect. 4, we present relevant data of TV audiences for major cycling races, and we offer an insight into cycling's TV audience. Section 5 summarizes the findings of four empirical academic studies on TV audience data for cycling. Next, we discuss the recent significant rise in TV attention for women's cycling (Sect. 6). Some thoughts on the economics of TV broadcasting rights are presented in the penultimate section, while we conclude with a discussion on a few challenges for the future (Sect. 8).

2 The Successful Marriage of Road Cycling and Television

In modern-day society where consumers have a broad range of entertainment platforms, sport has the power not only to attract TV viewers but also to retain them even outside of TV primetime. A major sports event usually guarantees broadcasters high TV ratings because live sport is amongst the best television can offer. TV viewers witness in real time the action and the suspense of the game as well as the drama and stress it brings along. They see the joy and the anger of the players and hear the cheers and whistles of the spectators. But unlike characters in movies or soap series, the players are real persons who put on an authentic fight and to whom the outcome is as uncertain as it is to the TV viewers. In sports broadcasts, good behaviour is not always rewarded, and in the end, 'the bad guy' may win. All these sentiments mirror the emotions people experience themselves in everyday life. Such a transfer of feelings is absent from most other television broadcasts. Moreover, sports broadcasts are becoming increasingly visually attractive. Multiple cameras capture every aspect of the competition. Close-up images and overview shots show the athlete's effort and the spectators' reactions, while razor sharp replays allow TV viewers to study all of the action in detail. Finally, much more than other TV programmes, sports broadcasts encourage social watching. People join each other at home or in a bar not only to watch but also to discuss all the action.

Road cycling is a successful example of this happy marriage between sport and television. First, in contrast to their counterparts in stadiums and on closed tracks, road cycling fans can enjoy the live action of the competition only for a few minutes. While a spectator at a soccer match might not always get the best view of the action, he would at least know the score, and he would be able to see how the game proceeds from the kick-off to the final whistle. A cycling fan, however, will be able to thoroughly enjoy the intense excitement of a racing peloton for a brief moment only. He will have to turn to media platforms next, in order to find out how the race develops and to know the winner of the event. Professional road cycling can therefore only be enjoyed in full through access to real-time media, and TV is still by far the number one medium to this use. TV viewing and live attendance of cycling races are therefore complementary goods rather than substitutes (Van Reeth, 2013).

Second, although at other major sports events, such as the Olympic Games or the FIFA World Cup, TV viewers are nowadays treated to professionally make promotional clips of the hosting city or region as well, in most instances, there is no natural connection between the live sports action and such promotional images. With road cycling, this is different. Cyclists do not only compete with each other; they also have to overcome the obstacles the route imposes. To guarantee the best possible coverage of how the race develops, helicopters and motorbikes carrying cameramen follow the cyclists through cities and over mountain passes.

With the exception of sports like city marathon running or off-road car races like the Dakar rally, this natural blending of live action and complementary roadside showings of the scenery is present in almost no other sport. As a result, road cycling is one of the best-watched sports by non-sports fans. In France, for example, the attractive TV images are a major incentive to watch a Tour de France live broadcast for 61% of the viewers, while the actual race and the competition are only a major incentive to 32% of the spectators (www.sportlab-consulting.com). For many who tune into the Tour de France, it is not (just) about the bike race. They rather see Tour de France TV broadcasts as an opportunity to discover beautiful French regions from the sky and to spend some of their summer vacation on a virtual visit to France. Danish Tour de France broadcaster *TV2* made this very clear with the catchphrase 'we bring the Alps to the Danish summer towns' (Frandsen, 2017).

Cycling races therefore offer an ideal opportunity for promoting tourism. The Giro d'Italia slogan 'La corsa più dura del mondo nel paese più bello del mondo' ('The toughest race in the world's most beautiful place') quite much hints at this promotional aspect of cycling events. Since 2011, every year, the official Giro d'Italia promo is a videoclip which alternates race images with helicopter shots of monuments, cities and landscapes. The Tour de France represents a similar yearly showcase for the monuments, cities and landscapes of France. Because it offers municipalities and regions along the route such invaluable exposure to a broad audience, every year, over 200 cities and villages apply for the right to host a Tour de France stage start or finish, an amount far in excess of the 30 or so opportunities (Long, 2012). The promotional value of a region is also taken into account when designing the race route. Tour de France director Christian Prudhomme explained the new La Mauselaine climb in the 2014 Tour de France as follows: 'La Mauselaine is a wonderful place for the Tour de France. The view on the lake of Gérardmer will deliver beautiful TV shots as well as a very exciting race' (Cyclingnews, 2013a). Similarly, Javier Guillén, race director of the Vuelta a España explained that the Vuelta is much more than a sporting event: 'We have to introduce the country's geography and gastronomy as part of our offering. We have to be a great televisual spectacular that takes place on public roads' (Cyclingnews, 2013b). Because of this growing promotional aspect, more and more cycling races are covered on TV from start to finish. The 11th stage of the 1990 Tour de France, finishing at L'Alpe d'Huez and won by Gianni Bugno, was the first stage ever to be broadcast in full (Turgis, 2008). It would take another 27 years before all Tour stages got a full distance coverage, which is the case since 2017. Other races follow this trend: in 2021, four of the five *Monuments of Cycling*, the longest races on the cycling calendar, got a 6–7-hour complete coverage.

The aesthetic integration of live action, landscapes, landmarks and cities is bolstered by other types of informative material made available to the media. A historical guide to the Tour, a tourist guide to the visited regions and a commentators' book are sent to international broadcasters in advance of the event. Cameramen in helicopters and on motorbikes have a detailed road book at hand that details every camera shot that needs to be taken along the race route. During live broadcasts, *France Télévisions* and *ITV*, amongst others, have an extra commentator ready to highlight the region's points of interest. In partnership with tourism agencies, for each stage, a local tourist attraction webpage is made available as well on the official Tour de France website (www.letour.com). One could in fact conclude that, as

Fig. 6.1 Tourist information during live TV broadcast of 2021 UCI Road World Championships. (*Source*: Screenshot from Belgian television broadcast 21 September 2021)

a Dutch newspaper headlined, in a way, the riders have become actors in a movie about France (Trouw, 2021). In some races, information in English is projected on the TV screen at the moment the peloton crosses major tourist sites. Figure 6.1 shows a screenshot of tourist information on the belfry in the Flemish town of Bruges, displayed during the live TV transmission of the 2021 UCI Road World Championships.

Third, unlike, for instance, football games, most road cycling races are not scheduled as a primetime evening event. Consequently, cycling races can be easily programmed for unproductive broadcast hours, particularly on weekday afternoons. To a European broadcaster, the afternoon Tour de France broadcasts are a welcome and well-watched alternative to the repeats of old TV series that often fill the afternoon TV slots in the dull summer period. It should be noted though that in an attempt to maximize TV viewership, opening and closing stages of the Tour de France, the Giro d'Italia and the Vuelta a España are now regularly scheduled as close as possible to primetime in the (early) evening.

Television coverage of road cycling suffers from a few weaknesses as well. First, broadcasts of cycling races have an uncertain duration because although the distance is known in advance, the time it will take cyclists to cover that distance cannot be predicted beforehand. Race tactics and the stage profile, but also weather conditions, will determine the average speed at which the race is actually run. Typically, the road book of a cycling race will therefore include a 'slow', an 'intermediate' and a 'fast' time schedule. The difference between the two extremes can be from half an hour up to 1 hour, creating problems to TV broadcasters who obviously prefer a tight TV schedule that can be prepared well in advance. A second weakness relates to the way a race develops. During long broadcasts, there may be extended periods of little or no excitement, for instance, when the peloton is riding at a steady pace with no real breakaway attempts or when a race leader has gained enough time on the chasing riders to secure the stage win. It is impossible to predict beforehand what part of the race is going to be the most interesting. When a TV broadcaster chooses to transmit only the last hour of the event, there is the risk of missing out on some of the decisive actions early on in the race. When the choice is made to broadcast a much larger part of the race or even the entire event, there is the risk that for hours nothing much happens and that there is no intense battle for victory. These problems should not be overrated though. Many other sports, such as tennis or Formula One, also face problems of uncertain duration and loss of interest when, for instance, a dominant player or pilot creates a points or time advantage that secures the win.

3 The Complexities of Understanding TV Audiences for Cycling Broadcasts

At a sports event that takes place within a closed environment, like a stadium or a race track, the attendance can be fairly accurately recorded based on the amount of tickets sold. In contrast, it is much harder to determine the number of TV viewers for a live sports broadcast. Yet, when compared to live attendance, television viewership provides a much more effective way to analyse the worldwide popularity of sports competitions. For major cycling events, TV audience ratings are indeed the main indicators of interest and are used to set prices for commercials, evaluate sponsorship decisions or devise political arguments to enrich public debates. Since TV ratings present sensitive information on the global success of a sports event, the value of TV broadcasting rights depends closely on this information as well (Bourdon & Méadel, 2014).

Press releases and popular press articles often claim multimillion or even multibillion global TV viewership for sports events. For example, according to the local organizers, the 2019 UCI Road World Championships, a 9-day-long event in Yorkshire (United Kingdom), drew a record global audience of 329 million people in 124 countries (https://www.cyclist.co.uk/news/7660/yorkshire-world-championships-sees-record-breaking-television-audiences). Similarly, governing body World Rugby reported that the 2019 Rugby World Cup in Japan was watched by over 850 million people, making it the most-viewed rugby union tournament ever (https://www.digitaltveurope.com/2020/03/12/rugby-world-cup-breaks-records-with-857-million-viewers/). Such claims are, however, seldom substantiated with hard evidence nor is it usually made clear what the numbers really stand for. Therefore, taking for granted the raw numbers that are communicated in popular press can be very misleading if one wants to understand the real TV audiences for live sports broadcasts. The confusing and conflicting information on Tour de France TV viewership available on the Internet illustrates the point. *ŠKODA*, one of the Tour's major sponsors, claims the race is watched worldwide 'by 1.4 billion television viewers' (ŠKODA, 2019). Sports marketing agency *Repucom*, now owned by *Nielsen*, counted almost two billion viewers in 2013: 'The Tour de France accumulated more than half of the total cycling audience on TV (1982 million)' (Repucom, 2013). A much higher number was reported by the Tour of Yorkshire, the British county that hosted the Tour de France start in 2014: 'A worldwide television audience of 3.5 billion people' (Tour de Yorkshire, 2014). On their website in 2016, race organizer *ASO* even claimed a four billion worldwide TV audience (ASO, 2016). Since the size of television audiences is the basis for the pricing of sports broadcasting rights, TV commercials and sponsorship, from an economic point of view, a 2.6 billion difference between the lowest and highest proclaimed Tour de France TV audiences is disturbing to say the least.

To check the reliability of such claims, we need to understand the techniques that are used to measure TV viewing. In most countries, TV audiences are estimated based on information obtained from a carefully selected panel of households. The sample is representative in terms of socio-demographic variables such as age, sex, residence, income, education and family size. In every panel household, all TV viewing is monitored automatically by a so-called people meter, a device attached to the household's television set. To determine the number of viewers, residents and their guests just have to register their presence while watching TV. At night, the people meter uploads the information to a monitoring institution, like *Nielsen* in the United States, *BARB* in the United Kingdom or *Médiamétrie* in France. In most countries, the viewership data are released the next morning as 'overnight' or 'VOSDAL' (*viewing on same day as live*) ratings. In some countries, 'final' or 'consolidated' data are released a week (+7) or a month (+28) after the original broadcast date to also include time-shifted viewership. Since sports broadcasts rapidly decline in value as you move further away from the live event, the underestimation caused by ignoring time-shifted viewing is likely to be marginal. People prefer to watch sports broadcasts in real time because once the result is known, most of the pleasure of watching the competition is lost. Dutch (www.kijkonderzoek.nl) and UK (www.barb.co.uk) data indeed show that time-shifted viewing for, for example, international football games at major championships is small (1–2% only).

With such efficient techniques in place, why then is it so difficult to determine the exact TV interest for a cycling race? Part of the problem follows from the fact that there are at least four different TV audience metrics that are used interchangeably in press releases and popular media, often without much nuance. The 'average TV audience' of a programme is calculated as the sum of the audiences for each minute during the programme, divided by the duration of coverage in minutes. It can be expressed either as a number of people or as a percentage of a potential audience, in which case it is usually called a 'TV rating'. The potential audience is mostly defined as 'all the people in a TV market with access to a television set' (Gratton & Solberg, 2007). TV ratings are standardly used in the United States, while in Europe the average TV audience is the most common metric. This variation in practice is probably the result of the availability in America of data for regional markets of different size, enabling comparisons between them.

An alternative TV audience metric is a programme's 'peak audience': the highest audience recorded at any minute during the programme. Depending on the game or race developments, the peak audience for a live sports broadcast can occur early in the programme (e.g. at the start of a Formula One race), in the middle part (e.g. in a football game when the viewership interest drops once a team has built a convincing lead) or, as is the case in most cycling races, towards the end. A third TV audience metric, the programme's 'reach', measures how many people watch a programme for a given minimum amount of time, e.g. 3 or 5 consecutive minutes. Finally, the 'share' of a programme is the programme's TV audience expressed as a percentage of the total TV audience at that specific moment. It differs from a TV rating because it compares the numbers of viewers for a programme with only the number of people watching TV at the time of the broadcast of the programme, and not with the entire potential audience.

As an illustration, Fig. 6.2 presents Norwegian TV viewership for stage 20 of the 2019 Vuelta a España, on *TV2 Zebra* (blue) and *Eurosport* (red). The broadcast on *TV2 Zebra* started at 12h00 with initially fewer than 10,000 viewers. As the race developed, the audience sevenfolded to a maximum around 17h30. The average audience of the broadcast is found by averaging the TV audiences for all particular minutes of the duration of the broadcast and equals about 25,000. Since the Norwegian television population amounts to about five million, alternatively, the average TV audience could be reported as a TV rating of 0.5%. That is to say, on average, 0.5% of the Norwegian population with access to television watched the live broadcast.

The peak audience is the highest audience recorded at any given moment of the broadcast. It corresponds with an audience of 70,000 at 17h29 when Slovenian rider Tadej Pogačar won the stage. The share of the broadcast totalled 8.3% which implies that close to one in ten Norwegian TV viewers on the afternoon of 14 September 2019 were watching the Vuelta a España broadcast. Neither the share nor the reach of the broadcast are observable from Fig. 6.2.

Although the TV audience concepts might appear straightforward, one still has to be very cautious in analysing the reported numbers, especially when comparing TV audience data across sports or between countries. Average audience data, for

Fig. 6.2 Norwegian TV audiences for stage 20 of the 2019 Vuelta a España. (*Source*: TV 2 Norway)

example, are entirely determined by the broadcaster's choice of the length of the programme. This complicates the comparison of international TV audiences for sports with an uncertain duration, such as professional road cycling. For example, if Norwegian TV had broadcast only the final hour of the race, average audience would have been 70% higher, i.e. 42,500 (Fig. 6.2). Clearly, depending on programme length choices made by the broadcaster, a certain TV interest with the public can lead to very different reported average audiences. The popularity of, for example, cycling broadcasts is therefore easily underestimated with long broadcasts or, conversely, overestimated with short broadcasts. This is highly relevant since in some countries live Tour de France broadcasts can last up to 6 hours (e.g. Belgium, Denmark), while other countries have shorter broadcasts of only the final hour or so (e.g. Germany). Some countries (e.g. France, Italy, Spain) even switch channels during the race broadcast. Such split broadcasts can easily lead to misleading conclusions. French television, for instance, usually starts its Tour de France coverage on *France 3* around noon and switches channels to *France 2* at 3 p.m. for the final part of the race. In 2021, the Tour de France average audience equalled 2.36 million on *France 3* and 3.42 million on *France 2* (Pure Médias, 2021). The latter number is usually communicated widely, while a time-based weighted average of both audiences (about three million) is much more meaningful.

A paradox then emerges: the shorter the broadcast, the higher the average audience and thus the perceived TV popularity of the event. This demonstrates why it is difficult to compare average TV audience figures between markets where cycling is hugely popular resulting in long TV broadcasts, like Flanders, and other countries with much shorter live coverage of races. Therefore, a better way to compare international TV audiences would be to count viewing minutes. A German 1-hour broadcast averaging one million viewers (60 million viewing minutes) can then be balanced much better against a Danish 4-hour broadcast averaging half a million viewers (120 million viewing minutes). The International Cycling Union (UCI) started to use this concept in 2018 when it announced TV viewers watched nearly 50 million hours of the 2018 UCI Road World Championships (UCI, 2018). This is a much more reliable number than the unrealistic 250 million TV audience mentioned on the local organizer's promotional website (Innsbruck-Tirol Roald World Championships Organizing Committee, 2018).

The problem with understanding the audience share metric basically arises from the fact that an event's audience share is strongly impacted as well by conditions not at all related to the actual interest in the event. An identical number of TV viewers for a cycling race on 2 consecutive days will indeed lead to a different market share depending on the number of viewers for substitute programmes on competing TV channels. For example, on rainy days, afternoon Tour de France broadcasts might have a smaller share because a large number of kids are staying at home watching children's programmes on TV instead of playing outside. Audience share is therefore a less adequate measure to evaluate the popularity of a sports event.

The comparison of international TV audiences via reach can also lead to misunderstandings. First, it should be understood that reach is highly dependent on the minimum number of consecutive viewing minutes needed before being included in the measure. The 2014 FIFA World Cup Final reached 914 million TV viewers if a threshold of only 1 minute of viewership is used. It becomes significantly smaller though as the minimum number of consecutive minutes increases: from 841 million (3+ minutes) to over 695 million (20+ minutes) to 632 million (30+ minutes) (Kantar Media, 2014). Therefore, although often missing, the minimum time frame used is a crucial element in any communication on the reach metric. For example, using a small time frame of just 1 minute allowed *France Télévisions* to claim that an impressive total of 42.4 million French citizens, well over half of the population, watched the 2021 Tour de France (Le Figaro, 2021). In popular press, these numbers were eagerly quoted without much nuance suggesting the Tour de France was a huge TV success. But let us put these numbers in perspective. The total broadcast time for the Tour de France was well over 6000 minutes. Most people in France having a TV at home are likely to have seen at least one of these 6000 minutes, if only by zapping or by watching the news.

Second, it is crucial to distinguish between 'gross reach' and 'net reach'. Gross reach, often called cumulative reach, is defined as the sum of all audiences who have watched any of the broadcasts of an event. But since the same viewers are thus counted multiple times, this is an unreliable measure, and it does not provide any insight into the actual number of people watching TV coverage of a sports event. For example, if in France the first part of a Tour de France stage on *France 3* generates two million viewers and the second part on *France 2* three million, gross reach would be five million. This is, of course, a meaningless number and would be like pretending that if the first half of the Super Bowl had 100 million TV viewers and the second half 120 million, the event reached 220 million people. In spite of its misleading message, organizers of professional road cycling races do often include such gross reach figures where audiences for all broadcasts and all stages are summed, sometimes claiming bigger TV audiences than actually possible. Therefore, it is better to use net reach (or unique audience), which is the sum of all audiences who have watched a programme but excluding all viewership duplication. In our example for France, net reach would be three million if the *France 2* TV audience consists of the initial two million audience that was already watching the competition on *France 3* and one million extra viewers that only watched the final part of the race on *France 2*.

4 TV Audiences for Cycling

4.1 The Quest for the 'Real' TV Audiences of a Cycling Race

The issues with a correct understanding of TV audience metrics are not just academic. Even important stakeholders have an unrealistic view on the public interest in cycling races. For example, in 2015, team manager Patrick Lefevere claimed that the Tour de France had 3.5 billion TV viewers. He continued that if just ten million of those viewers would be willing to pay €5 for a tracking app, cycling teams could earn €50 million a year (De Morgen, 2015). How realistic was his eye on that money?

We already demonstrated the variety in the stakeholders' views on the TV popularity of the Tour de France, from 1.4 billion (sponsor) to over 3.5 billion (host region) to 4 billion (race organizer *ASO*). But even the smallest estimate of 1.4 billion, tenfold the Super Bowl audience, is a huge exaggeration of the real viewership. So what is a reasonable estimate of the actual worldwide Tour de France TV audience? The answer can be found in the details of a *Repucom* report where it is explained how total TV audiences for sports events are a virtual cumulative sum of audiences of four types of broadcasts: live broadcasts (= programmes that contain live action of a sports event), sports broadcasts (= sports programmes airing regularly or irregularly with a focus on a certain event), sports magazine broadcasts (= regular daily or weekly sports programmes with summary broadcasts of different sports) and news broadcasts (= sports items broadcast within news programmes). News broadcasts accounted for an impressive 60% (or 1181 million viewers) of the total Tour de France TV audience in 2013. Sports magazine broadcasts represented 13% (266 million viewers), and sports broadcasts were responsible for another 11% (226 million viewers). Consequently, Tour de France live broadcasts accumulated 309 million TV viewers, merely 16% of the virtual 2 billion total audience (Repucom, 2013). As the Tour de France counts 21 stages, the per stage audience in the 15 major cycling countries included in the *Repucom* report is actually about 15 million. This is a small fraction only of the multibillion audiences claimed by *ASO*, but it is in line with the race's worldwide TV audience of 20–25 million unique viewers per stage observed by Van Reeth (2019).

The practical relevance of this type of research became clear when a critical article on the real Tour de France TV audience was published in the French newspaper *Le Monde* in October 2016 (Gayant, 2016). It prompted the race organizer to modify the information on the website. Since November 2016, the inflated virtual number of four billion Tour de France TV viewers has disappeared from any *ASO* webpage or public communication. The Giro d'Italia race organizers *RCS Sport* have done better. In a promotional document for the Giro d'Italia, a best-practice example can be found (Fig. 6.3). Already in 2013, *RCS Sport* acknowledged the worldwide live Giro d'Italia per stage TV audience was 'just' 4.7 million, while it amounts to about 37 million if all broadcasts, including highlights shows and news programmes, are included. The much larger 97.8 and 775 million numbers are found by multiplying the per stage audience by 21, the number of stages (RCS Sport, 2013). The UCI also implicitly acknowledged that live audiences and accumulated audiences are very different. While for years the UCI only published inflated accumulated TV audiences for its World Championship Races, in the 2013 UCI Annual Report (UCI, 2014a) for the first time, a clear distinction was made between the race's accumulated audience (181.94 million) and the live audience (17.55 million). Unfortunately, this open communication on realistic TV audiences, initiated by then UCI President Brian Cookson, seems to be discontinued when David Lappartient took over UCI presidency in 2017.

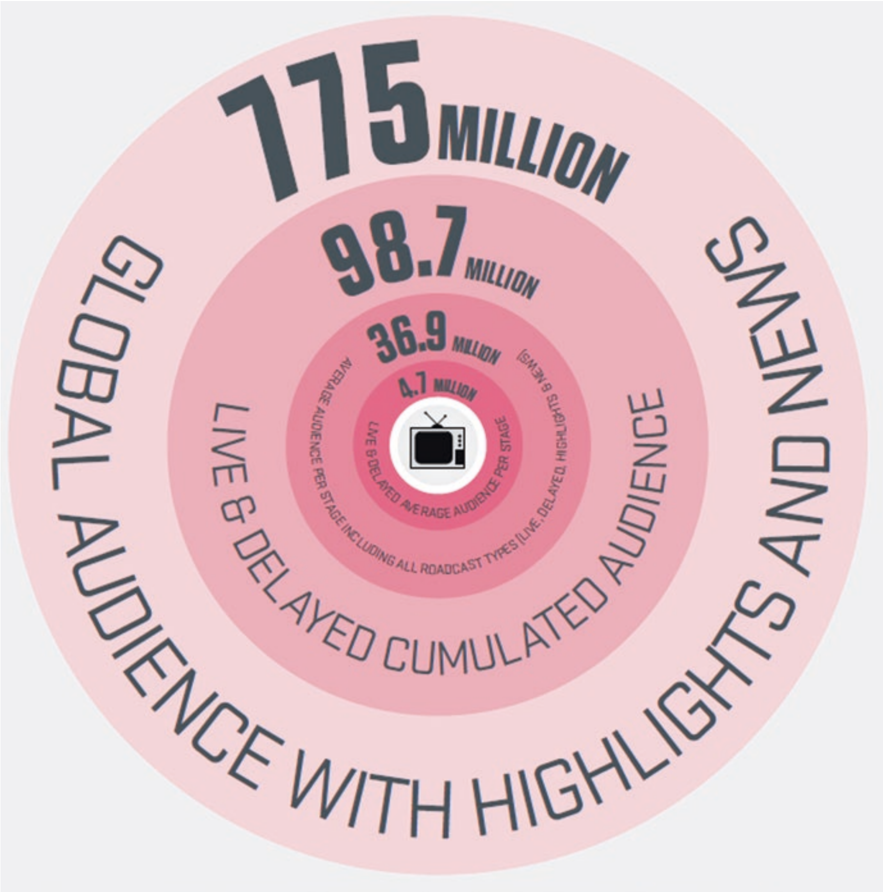

Fig. 6.3 Giro d'Italia TV audiences. (*Source*: RCS Sport (2013))

Race organizers understandably prefer to communicate virtual multibillion cumulative audiences instead of more accurate but much smaller unique audiences for live broadcasts. Still, one could ask whether stakeholders who invest heavily in cycling races, such as sponsors, governments and localities, are aware of the fact that over half of the supposed TV audience consists of persons whose only connection to the sport is at best a 1-minute clip of the event they just happened to watch in a news broadcast. We feel that more race organizers should follow the best-practice example of *RCS* and present realistic TV audiences to stakeholders and the public, with a better distinction between the event's global unique reach and the actual per stage average live audience.

Because it proved almost impossible to receive reliable and detailed viewership data from official cycling bodies or race organizers, we started to collect data ourselves from websites that publish official TV audience data measured by well-established monitoring companies. We also contacted multiple broadcasters who in most cases were kind enough to share with us their audience data for research purposes. This resulted in what is probably one of the largest datasets on worldwide TV viewership for cycling races with now well over 10,000 observations for the 2000–2021 period, including close to 6000 on individual Tour de France stages.

4.2 Public Interest in Live TV Coverage of Cycling's Major Races

Table 6.1 presents summary statistics on TV audiences for all Tour de France editions since 2010 for a dozen countries with daily live coverage. With close to four million TV viewers on average per stage, France has the largest audience. Germany, Italy and Spain are the other countries to also record an average one million plus audience. In the United States, Tour de France TV interest was about 350,000 a year in the 2010–2021 period but was much higher in the Armstrong years with a peak of 1,743,000 TV viewers on average per stage in 2005. Although we have no official data to substantiate the claim, Colombia is said to be the only other country in the world with a multimillion Tour de France TV audience. In the United Kingdom, the Netherlands and Belgium, the audience is between half a million and a million, and we can quite confidently reckon that elsewhere in the world, viewership is always below half a million, even in well-populated countries like Russia or China.

The Tour de France's relative popularity by country is better measured by the percentage share of the population that is following the event. Belgium has by far the highest interest: 7–8% of the Flemish population watches live coverage of the

Table 6.1 TV audiences for live broadcasts of Tour de France stages, 2010–2021

	Approximate average per stage			Audience for best-watched stage
TV market	Audience	Percentage of population	Market share	(Excluding Eurosport audiences)
France[a]	3,900,000	5–6%	35–40%	6,210,000 – Stage 15, 2013
Germany[a]	1,500,000	1–2%	10–15%	2,310,000 – Stage 15, 2017
Italy[a]	1,400,000	2–3%	15–20%	2,420,000 – Stage 18, 2017
Spain[a]	1,200,000	2–3%	8–13%	4,000,000 – Stage 17, 2010
The Netherlands[a]	850,000	4–5%	40–45%	1,950,000 – Stage 2, 2015
The United Kingdom[a]	700,000	1%	n.a.	1,192,000 – Stage 21, 2015
Belgium – Flanders	500,000	7–8%	60–65%	920,000 – Stage 18, 2011
The United States	350,000	0.1%	n.a.	n.a.
Denmark[a]	300,000	5–6%	50–55%	830,00 – Stage 19, 2011
Australia	275,000	1%	n.a.	1,110,000 – Stage 21, 2011
Belgium – Wallonia	225,000	6–7%	25–30%	400,00 – Stage 19, 2011
Norway[a]	140,000	2–3%	35–40%	360,000 – Stage 21, 2015
Sweden[a]	40,000	0.5%	5–10%	110,000 – Stage 15, 2017

Source: Own calculations
[a]*Eurosport* audiences included in the approximate average per stage data

Tour de France on a daily basis and so does 6–7% of the Walloon population. France and Denmark are the other countries with over 5% of the population tuning in for the race. Remarkably, in Spain and Italy, two core countries of road cycling, out of 100 persons, only 2 to 3 are watching the Tour de France live. The somewhat smaller interest in both countries can in part be explained by the fact that lots of Spaniards and Italians prefer to watch their home *Grand Tour* instead and because both in Italy and in Spain the summer holiday month is actually August, not July. Looking at Tour de France viewership as a percentage share of the population also demonstrates the small TV interest in the event outside of the Continental European countries. In the United Kingdom and in Australia, only 1 in 100 persons watches the race, while in the United States, it is 1 in 1000. Availability is a huge issue here as well, of course. It is not only about a race being actually broadcast in a country; it is also about on what sort of channel it is broadcast. Smaller TV viewership in some countries might mean that people are not as much interested in watching cycling or that TV broadcasters are not as much interested in buying and broadcasting it.

More or less similar results follow from an analysis of the market share of live Tour de France broadcasts. In Flanders, almost two out of three persons in front of a TV set on a sunny afternoon in July are watching the Tour de France. Denmark comes second with a market share of just over 50%, while in the Netherlands, Norway and France, the share is about 40%. In countries with a rich cycling tradition like Spain and Italy, the Tour de France market share is below 20%.

For most of the European countries in Table 6.1, *Eurosport* TV audiences are included in the per stage average as well. Across Europe, the overall *Eurosport* TV audience for the Tour de France is approximately 1.1 million per stage. *Eurosport*'s major markets are Germany (now about 200,000 daily viewers, but 10 years ago when public service broadcaster *ARD* did not broadcast the Tour de France, it was over 400,000), France and Poland (100,000–150,000 viewers) and Italy and the United Kingdom (50,000–100,000 viewers). In Spain, the Netherlands, Sweden and Romania, Tour de France TV viewership on *Eurosport* is between 20,000 and 40,000. When compared to the Tour de France audiences on competing generalist or public service TV channels, *Eurosport* does very well in Germany with viewership that equals approximately 20% of the *ARD* audience. In Italy and the United Kingdom, *Eurosport* reaches 5–10% of the Tour de France TV audiences on *RAI* and *ITV*, respectively, while in all other countries the share is below 5%. It is important to keep in mind though that for most countries, *Eurosport* audiences are averages for full-stage coverage, while data for generalist channels often refer to the broadcast of only the final couple of hours. Figure 6.1 already illustrated the significant impact of shorter and longer broadcasts on average viewership.

As explained before, to better take such different broadcast lengths into account, it is useful to look at the total viewing volume per country as well. In 2018, *ASO* communicated that live broadcasts of the Tour generated 1.1 billion hours of TV viewing. France generates about a quarter from the viewing volume total (250–300 million viewing hours), while viewership volumes in Spain, Germany and the Netherlands are between 60 and 80 million hours in total. Flemish viewership volume (40 million hours) is more than half of German viewership volume, although it is at least ten times less populated.

A 1.1 billion-hour viewing volume equals about 52 million hours per stage. If the broadcast length of all stages would be 4 hours, an average live audience of 13 million people per stage would be the result. A shorter average broadcast length of, for example, 3 hours would lead to 17.3 million TV viewers per stage. Since in most countries broadcasts last at least 3 hours, it is safe to conclude that Tour de France viewership for live broadcasts is between 15 and 20 million persons worldwide.

Figure 6.4 presents a historical perspective on global Tour de France TV audiences for the 13 TV markets of Table 6.1. We first focus on the global audience excluding *Eurosport* viewership. The 2011 Tour de France was the best-watched edition with over 11.5 million TV viewers, while the 2012 edition was the least-watched with only 8.8 million viewers. The low audiences from 2012 to 2014 mainly result from the fact that German public service broadcaster *ARD* did not broadcast the Tour de France during that period. The recurring doping affairs were cited as the main reason for this decision, but it is much more plausible that doping was a convenient argument to get out of an expensive contract. *ARD* resumed its broadcasts of the Tour de France in 2015, although limiting coverage to 90 minutes per stage. Since 2015, the global audience, excluding *Eurosport*, has remained stable at about ten million TV viewers worldwide.

We also note some sort of seesaw pattern in the global viewership total. The average audience in uneven years, 10.5 million on average, is 11% higher than the 9.48 million average audience in even years. This seems evidence of the impact of competing mega-sport events that are only held in even years: the Olympic Summer Games, the FIFA World Cup Football and the UEFA European Championship Football. Because those mega-sport events were rescheduled from 2020 to 2021 due to the COVID-19 pandemic and to eliminate the impact of the *ARD* decision to temporarily stop broadcasting the Tour de France, we recomputed the averages without these distorting effects. The adjusted average audiences point to an even bigger viewership impact of 14%. In even years, viewership was 9.71 million on average, while in uneven years, it was 11.04 million. Our results support the

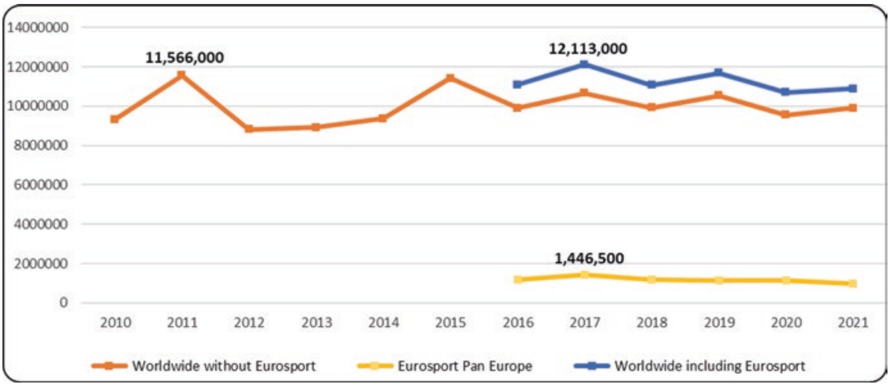

Fig. 6.4 Global Tour de France TV audiences 2010–2021 (13 TV markets and Eurosport). (*Source*: Own calculations)

opposition from Tour de France Director Christian Prudhomme and UCI President David Lappartient to the rumoured biennial FIFA World Cup project, which would lead to the organization of mega-sport events in uneven years as well: ‘We are concerned about the consequences for the cycling world and our flagship, the Tour de France. Every four years we see a small drop in audience when the World Cup starts’ (Archisport, 2021). It should be noted that the negative viewership impact occurs even when the competing events are held at a different time than the Tour de France. This suggests that there is a limit to the amount of live sport some sports fans (can) watch in summer. For example, families might reschedule their holiday from August to July when they prefer to watch the Olympic Games instead of the Tour de France.

Figure 6.4 also includes data on *Eurosport*’s pan Europe TV audience, but only from 2016 onwards. *Eurosport* viewership was the highest across Europe in 2017 when it totalled 1.45 million, resulting in a worldwide audience of over 12.1 million people for that year’s edition of the Tour de France. In recent years, *Eurosport*’s total audience was a bit lower at about 1.1 million per stage.

TV audience data for other cycling races are much harder to find, especially on a worldwide scale. In Table 6.2, approximate worldwide TV audiences are presented based on the aforementioned dataset on TV viewership for cycling races. For each

Table 6.2 Approximate worldwide live TV audiences for major cycling races

Race	Approximate worldwide live TV audience
Tour de France	15–20 million
World Championships (road race)	6–8 million
Paris–Roubaix	5–7 million
Giro d’Italia	4–6 million
Vuelta a España	4–6 million
Ronde van Vlaanderen	3–5 million
Liège–Bastogne–Liège	3–5 million
Milano–Sanremo	2–4 million
Il Lombardia	2–4 million
Strade Bianche	2–4 million
Gent–Wevelgem	1.5–3 million
Flèche Wallonne	1.5–3 million
Amstel Gold Race	1.5–3 million
World Championships (time trial)	1–2 million
Paris–Nice	1–2 million
Critérium du Dauphiné	1–2 million
Tirreno–Adriatico	1–2 million
Omloop Het Nieuwsblad	1–2 million
Kuurne–Brussel–Kuurne	1–2 million
All other races	<1 million

Source: Own calculations

Note: for stage races, the data refer to the average daily per stage audience. The audience for the best-watched stages will be somewhat higher race, an approximate viewership range is given because audiences can change importantly from year to year. Not only will viewership interest be higher or lower depending on, for example, race circumstances; there is also the importance of the channel broadcasting the race. In most cases, generalist channels have much higher audiences than sports channels.

Not unexpectedly, the Tour de France has the largest daily audience. At a distance, the World Championships road race (six to eight million TV viewers) and Paris–Roubaix (five to seven million) complete the podium of best-watched races worldwide. The other two *Grand Tours*, boosted by a million plus home audience, have four to six million daily viewers. In the past, the Giro d'Italia used to be much better watched than the Vuelta a España. However, in 2017 *RCS*, the organizer of most of the major Italian cycling races, sold its non-domestic European TV rights to *Discovery* (owner of *Eurosport*). As a result, in many countries, major Italian races were no longer broadcast on generalist channels resulting in much smaller TV audiences for, for example, the Giro d'Italia. The deal between *RCS* and *Discovery* also explains why two *Monuments of Cycling* (the Ronde van Vlaanderen and Liège–Bastogne–Liège) have an estimated live TV audience of three to five million viewers, while the Italian monuments and the Strade Bianche only have a two to four million audience. Table 6.2 lists all the races for which we have evidence that the worldwide live TV audience is at least one million. In theory, all other races should have smaller audiences, although we cannot exclude that some races have higher audiences locally. For example, the Vuelta a Colombia or the Tour of Qinghai Lake are likely to have million plus audiences in Colombia and China, respectively.

4.3 The Worldwide Interest in Cycling's Grand Tours

Audience targeting company *GWI*, formerly *GlobalWebIndex*, profiles consumers across almost 50 countries with a panel of 18 million Internet users (http://www.gwi.com). One of the questions in their quarterly surveys, namely, 'Which of these sporting events do you watch regularly on broadcast TV or online?', includes cycling's three *Grand Tours* in the list of options. The results of the survey allow a better understanding of the worldwide popularity of these races. It is important to keep in mind though that since only persons aged 16 to 64 using the Internet qualify for the panel, the set of respondents is not fully representative for the entire population of a country (Marcel Blijlevens, "personal communication").

Figure 6.5 projects on a worldwide map the percentage of Internet users watching Tour de France TV broadcasts. The higher the percentage, the greener the projection of the country, while countries that are missing in the dataset remain uncoloured. From a worldwide perspective, Colombia appears to have the highest percentage of Internet users interested in Tour de France TV broadcasts: over 42%. The relatively low Internet penetration in Colombia (65%) might have skewed this

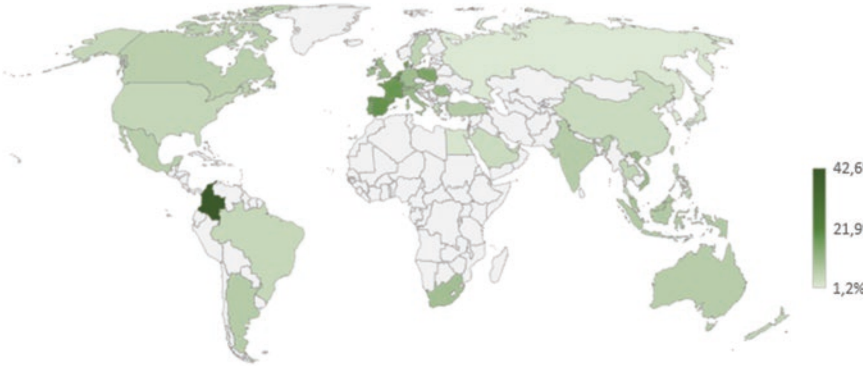

Fig. 6.5 Percentage of Internet users watching Tour de France TV broadcasts (2021). (Source: GWI 2021/Marcel Blijlevens)

remarkable result to some extent though. In France, Spain, Denmark, the Netherlands and Belgium, about 20% of Internet users declare to regularly watch Tour de France TV coverage. Outside of Europe, we find a much smaller viewership interest in South Africa (10%), Australia (7%) and the United States (5%), although UCI WorldTeams from these countries participated in the Tour de France in recent years. Note that these percentages are much higher than the ones presented in Table 6.1. This is because the self-declared interest in watching (some of the) Tour de France stages is measured here, while Table 6.1 shows the actual TV interest in all stages. The GWI numbers should therefore rather be looked upon as indicators of the potential reach of the Tour de France.

In Table 6.3, viewership interest in the three *Grand Tours* is summarized for 18 European and 18 non-European countries. The percentages for the Tour de France are slightly higher than the ones in Fig. 6.5 (e.g. 45.1% in Colombia instead of 42.6%) because online viewership is included here as well. In all countries, the Tour de France is the best-watched *Grand Tour*, except for Spain and Italy where, as expected, the local *Grand Tour* generates more viewership interest. In Italy, the difference is the largest with Giro d'Italia audiences 50% higher than Tour de France audiences and almost five times as large as Vuelta a España audiences. In Spain, the difference is smaller with almost equal Vuelta a España and Tour de France audiences and Giro d'Italia interest being about half of that.

Averaged across all countries, worldwide Tour de France viewership interest is about twice as large as Giro d'Italia and Vuelta a España interest. In most countries, the Giro d'Italia generates more attention than the Vuelta a España, but the overall difference is relatively small. The Vuelta a España receives higher viewership than the Giro d'Italia in a handful of countries only, such as neighbouring Portugal and Spanish-speaking Mexico.

Table 6.3 Percentage of Internet users watching Grand Tour TV broadcasts or online (2021)

European countries	Tour	Giro	Vuelta	Other countries	Tour	Giro	Vuelta
Belgium	*22.7%*	12.2%	10.5%	Colombia	*45.1%*	40.4%	36.2%
Spain	20.6%	12.4%	*21.0%*	Indonesia	*15.9%*	3.0%	2.5%
Denmark	*20.5%*	10.1%	9.1%	Vietnam	*14.9%*	2.7%	2.7%
The Netherlands	*19.5%*	13.1%	10.8%	Malaysia	*13.4%*	2.5%	2.2%
France	*19.2%*	5.3%	4.2%	South Africa	*12.0%*	2.8%	1.7%
Poland	*17.8%*	7.8%	5.2%	India	*11.7%*	4.1%	3.9%
Portugal	*17.7%*	11.7%	12.0%	Mexico	*11.6%*	4.2%	4.9%
Switzerland	*13.5%*	5.9%	3.7%	Argentina	*9.6%*	4.3%	4.3%
Ireland	*13.4%*	4.5%	2.9%	UAE	*9.2%*	2.6%	2.7%
Romania	*13.3%*	6.7%	4.4%	Thailand	*8.8%*	3.6%	4.0%
The United Kingdom	*13.3%*	4.3%	3.5%	Brazil	*8.5%*	4.5%	3.7%
Austria	*12.4%*	5.6%	2.6%	Canada	*8.4%*	1.5%	1.2%
Italy	12.3%	*19.3%*	4.0%	Australia	*8.3%*	2.3%	2.0%
Germany	*11.3%*	3.5%	2.0%	New Zealand	*7.2%*	2.0%	1.4%
Turkey	*11.1%*	4.2%	3.5%	The United States	*6.5%*	1.4%	1.2%
Sweden	*7.8%*	3.6%	2.3%	China	*6.2%*	4.0%	3.5%
Greece	*7.4%*	3.9%	1.7%	Israel	*3.9%*	2.4%	1.0%
Russia	*2.6%*	0.8%	0.8%	Japan	*3.7%*	1.2%	1.1%

Source: GWI 2021/Marcel Blijlevens

4.4 The Demographics of Cycling's TV Audience

It has often been assumed that road cycling's TV viewers are predominantly male and elderly, but hitherto little or no empirical evidence to sustain these claims was presented. Two detailed datasets, one on Norwegian Tour de France TV audiences and one on TV audiences for all cycling races broadcast on Flemish television, have made it possible to study more closely the demographics of cycling's TV audience.

Both the level of and the trend in women viewership of cycling races are remarkably similar in Norway and Flanders (Fig. 6.6). In both TV markets, women represented about 30% of the cycling audience in the early 2000s. A slow but steady growth towards a share of 40% took place up to around 2012. In the past 10 years, however, in neither of the two markets, the percentage of women viewers has increased further in a meaningful way. A 40% market share therefore seems to be some kind of upper limit on the women viewing potential.

Figure 6.7 presents information on the age of Norwegian and Flemish TV viewers for cycling races. Both the percentage of elderly viewers (aged 55 or higher) and the average age of all TV viewers show a clear upward trend over the past two decades, but the rate of change is much more brutal in Norway. In Flanders, the average age of the TV audience for cycling races increases by 4 months a year from about 54 years in 2000 to over 61 in 2020. The percentage of elderly viewers now equals 73%. In Norway, the average age of the TV audience was only 42 in 2003,

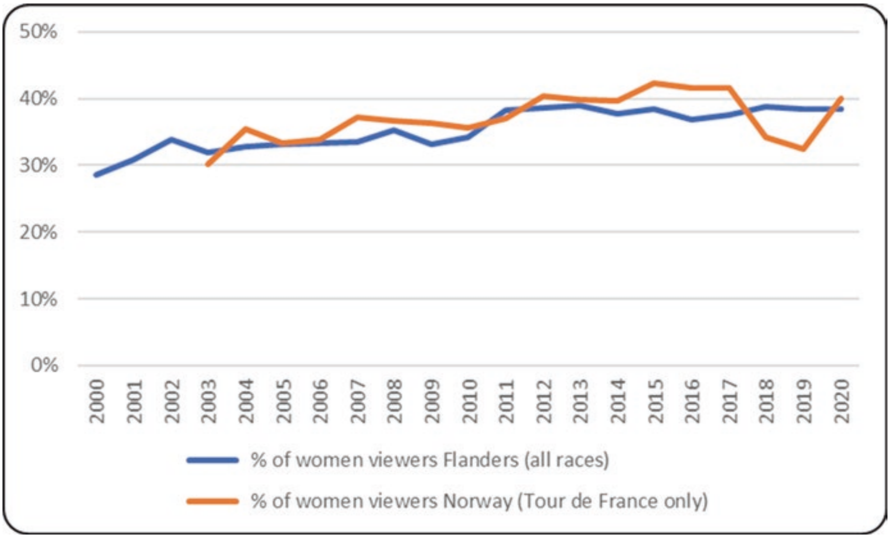

Fig. 6.6 Percentage of women viewers for cycling races in Flanders and Norway (2000–2020). (*Sources*: Datasets provided by VRT (Flanders) and TV 2 (Norway))

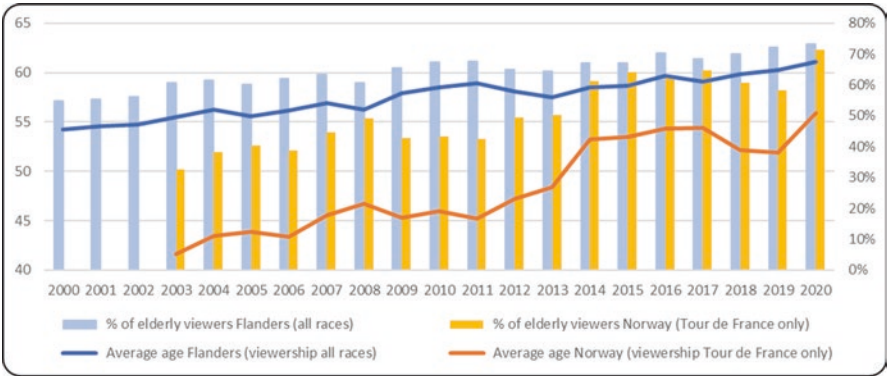

Fig. 6.7 Percentage of elderly viewers and average age of viewers for cycling races in Flanders and Norway (2000–2020). (*Sources*: Datasets provided by VRT (Flanders) and TV 2 (Norway))

and just 30% of the viewers was aged 55 or higher. The average age has since then increased by about 8 months per year, twice the rate in Flanders, to about 56 years. It is remarkable that while feminization of the cycling audience seems to have stabilized, the ageing trend shows no sign of slowing down yet, although by definition it will have to stop sometime.

In Fig. 6.8, all major cycling races broadcast in Flanders are positioned relative to each other based on the average age and the feminine share of their TV audiences. The horizontal axis measures the percentage of women viewers in the total audience

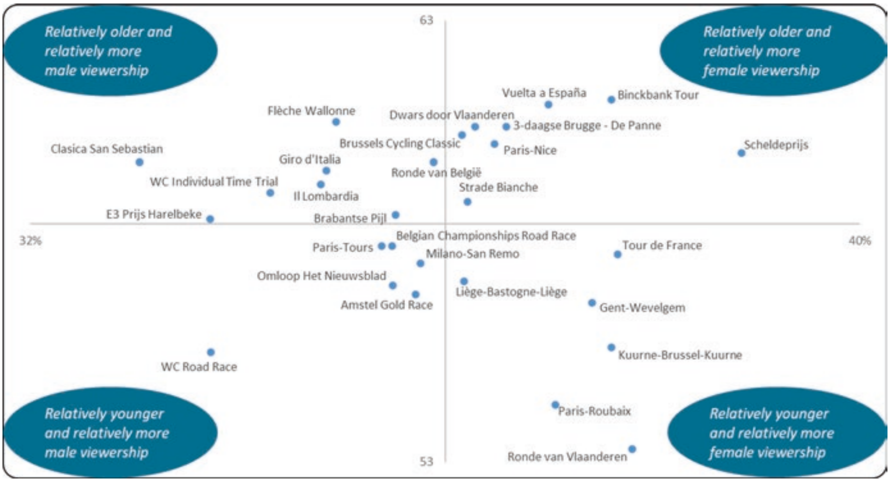

Fig. 6.8 Cycling races mapped by viewers' age and gender (Flanders, 2000–2020). (*Source*: Dataset provided by VRT)

from lowest (left, 32%) to highest (right, 40%), while the vertical axis reflects the average age of all viewers from youngest (bottom, 53 years) to oldest (top, 63 years). The Ronde van Vlaanderen, Paris–Roubaix and Kuurne–Brussel–Kuurne have a TV audience that is, relatively speaking, the youngest and with the highest percentage of female viewers. The opposite is the case for the Clásica San Sebastian with the relatively oldest and most male-dominated TV audience. The Scheldeprijs and the Binckbank Tour also have a rather elderly audience but with a relatively high share of women viewers. The road race at the World Championships has a very distinct position: it is the only race that combines a rather young with a relatively high male audience.

The audience composition also depends on circumstances unrelated to the actual interest in the race. Retired elderly people can watch cycling whenever they like, while professional or school activities limit viewing opportunities for younger cycling fans. This becomes clear in Fig. 6.8 as well: all races in the bottom half are held at the weekend or, in the case of the Tour de France, in the summer holiday period, when many people are at home. In the upper half, mainly races that take place on weekdays are found. There is also a strong correlation with the audience size. The average audience for all races in the upper left quadrant equals 171,590 only, while in the lower right quadrant, it is 684,660. The average audiences for the races in other quadrants are in between 287,348 (upper right) and 502,041 (lower left). The best-watched races in Flanders are thus the ones that have a relatively younger and relatively more female audience, while the least-watched races have the oldest and most male-dominated audience. This suggests there is a core of elderly male cycling fans that watch most of the races, while extra audiences are found with younger and female fans.

5 Empirical Research on TV Audiences for Road Cycling Competitions

In the past, empirical demand studies on sports events focused almost exclusively on live attendance. The attendance demand for sports competitions is therefore well researched. In contrast, the academic literature on sports events' TV demand has been relatively underdeveloped, mainly because reliable TV audience data were unavailable for a long time. This line of research has only witnessed a significant growth in interest since the publication of the seminal article by Forrest et al. (2005) in which the impact of outcome uncertainty on TV viewership for the English Premier Football League is analysed. It comes as no surprise then that academic research on TV audiences for road cycling competitions is limited as well. To the best of our knowledge, by 2021, only four papers have been published on this subject: Van Reeth (2013, 2019), Rodriguez, Peréz, Puente and Rodriguez (2015), and Rodriguez-Gutierrez and Fernandez-Blanco (2016). The key characteristics of each study are summarized in Table 6.4.

Van Reeth (2013) analyses Flemish Tour de France TV audiences based on data from 1997 up to 2012. The study is original relative to other TV audience research because both the average and the peak audience demand for a live sports broadcast are modelled, disclosing information on different types of viewers. The peak audience, the maximum level of interest in a cycling race at any given moment, captures the combined interest of the dedicated cycling fans, who watch as much as possible from the broadcast, and the more occasional or social cycling audience, watching only the most exciting or the most relevant parts of a cycling race, usually the closing minutes of the stage. As already illustrated in Fig. 6.2, viewership for cycling increases massively towards the conclusion of the race. French data for the 2021

Table 6.4 Empirical research on TV audiences for road cycling competitions

Author(s)	TV market(s)	Competition(s)	TV audience metric(s)
Van Reeth (2013)	Flanders	Tour de France (1997–2012)	Average audience (viewers) Peak audience
Rodriguez et al. (2015)	Spain (national and regional)	278 races (2007–2011)	Average audience (rating) Average audience (ln of viewers) Share
Rodriguez-Gutierrez and Fernandez-Blanco (2016)	Spain	Vuelta a España (2015)	Average audience (rating total) Average audience (rating men) Average audience (rating women)
Van Reeth (2019)	Denmark, Flanders, France, the Netherlands, Spain, Wallonia	Tour de France (2000–2018)	Average audience (viewers)

Tour de France indeed show that peak audiences usually exceed average audiences by well over 50%. Average audience figures use the whole length of the broadcast. They are therefore a better measure of the interest on the part of dedicated cycling fans, albeit still imperfect. For instance, as stages finish in the early evening, on working days, the peak audience is also influenced by workers who have finished for the day and have only the opportunity to watch the conclusion of the race but could nevertheless be dedicated cycling fans.

Van Reeth also studies to what extent live Tour de France TV viewing is determined, on the one hand, by information known long before the race takes place (e.g. the stage profiles or the day of broadcast) and, on the other hand, by information that only becomes public as the race develops (e.g. outcome uncertainty or the weather conditions). According to Van Reeth (2013), almost 60% of the variation in TV viewership is determined ex ante by the Tour de France route, as it is designed many months before the race is actually held. It's only on a much smaller scale that Tour de France viewership depends on the actual race circumstances. This observation is particularly relevant to race organizers since a well-chosen profile of the race route might increase TV viewership significantly. For instance, the all-absorbing media attention for the Tour de France made the Giro d'Italia and the Vuelta a España look for alternatives to attract larger TV audiences. As a result, spectacular stages on extremely steep mountain passes or on dirt gravel roads were introduced. But also Tour de France race organizer *ASO* does schedule the Tour de France route with the television viewing potential in mind. Important mountain stages are carefully planned, i.e. preferably at the weekend or, for instance, on the July 14 French national holiday. Rest days with no race action are always scheduled on a Monday or Tuesday, days without a huge viewing potential. Finally, the growing importance of television broadcasts and the lower TV audiences for time trial stages have likely played a part in the decision to systematically reduce the number of time trial stages in the Tour de France. Until 1995, a Tour de France typically included at least four (and sometimes even up to six) time trial stages, while every Tour de France since 2014 only has had at most two such stages. On two occasions, in 2014 and in 2020, there was even just a single time trial stage.

In a second paper on Tour de France TV audiences, Van Reeth (2019) further explores how TV audiences for individual stages can be forecast accurately by merely looking at the stage profile and contextual information such as TV channel and day, information that is publicly known long before the competition takes place. Based on historical viewing habits for 5 European countries that represent a global TV market of 150 million people, of which about six million watch the Tour de France, the 2015, 2016 and 2017 per stage average TV audiences were predicted. Although the accuracy of the forecasts changed from year to year and could be very different across TV markets, in most cases, the predictions easily outperformed forecasts based on naive models. Averaged over the 336 individual stage forecasts, the overall prediction error was just 0.8%. The findings illustrate that in the case of the Tour de France, accurate TV audience forecasts are possible already by the end of October, 8 months before the actual start of the race, when the profile of the next Tour de France is announced. Such information is extremely relevant to many stakeholders in cycling. It is useful to broadcasters and sponsors in the price negotiations for commercial air time during live Tour de France broadcasts, which typically take place in the months leading up to the event. But the findings have a huge economic value as well to media companies that spend billions on sports broadcasting rights deals worldwide. Since a change in TV audiences can be worth millions, reliable audience predictions are crucial for evaluating the effectiveness of such investments. Finally, the results can also support local or national governments in assessing the promotional impact of subsidizing major cycling events.

Rodriguez et al. (2015) analyse Spanish TV audiences for 278 cycling races broadcast between 2007 and 2011 and use three audience metrics: two versions of the average audience (as a rating or as the natural logarithm of the number of viewers) and the share. The basic model includes all cycling races on all Spanish TV channels (both regional and national), while other models use subsets of (1) cycling broadcasts of stage races and (2) broadcasts on the regional channels of the Basque Country and the Asturias. Using newly developed indicators, the authors show that competitive balance and outcome uncertainty are significant determinants of TV audiences for cycling. Thus, rating, number of viewers and share increase when the competition is more balanced, when the stage is mountainous and when the leader is Spanish. In addition, significant effects were detected for the region of residence.

Rodriguez-Gutierrez and Fernandez-Blanco (2016) provide a totally different approach. Rather than looking at average TV viewership, they study the minute-by-minute variability in TV interest during the broadcasts of each of the 21 stages of the 2015 Vuelta a España by analysing the behaviour of riders and the type of route at each moment during the broadcast. They show that TV audiences increase when the race leader is climbing or descending a mountain pass. As far as the behaviour of riders is concerned, a breakaway that includes riders classified amongst the top ten in the general classification increases TV audience significantly. Related to broadcasting features, there is a negative impact of advertising on TV audiences, even when commercials only appear on half of the screen without impeding viewers to follow the race. Although the authors have information on the TV ratings for men and women viewers separately, they basically limit their analysis to the ratings for the whole sample of viewers.

6 TV Broadcasting of Women's Cycling

Under UCI rules, one of the conditions for races that are part of the Women's WorldTour is the guarantee of live television coverage of at least 45 minutes. The UCI did not enforce this rule in a strict way in the past, which implies that until very recent times even some major women's races, like the Flèche Wallonne, did not get live TV coverage. For a long time, women's road cycling has indeed been virtually ignored by TV broadcasters. Up to 2014, in most European countries, at best three women's races a year were being covered live on TV: the World Championships road race, the National Championships road race and, every 4 years, the Olympic road race (Elles font du vélo, 2016). Other top women's races just got a short summary broadcast at best, before or after the men's competition had finished. The introduction of La Course (2014) and the Madrid Challenge (2015), broadcast to a worldwide audience under the umbrella of, respectively, the Tour de France and the Vuelta a España, was the first sign of change. Since 2016, more and more women's races received live coverage. In Flanders, the number of races broadcast on public service broadcaster *VRT* increased from on average just 2 a year between 2000 and 2015 to 10 in 2018 and, in spite of the COVID-19 pandemic, 14 in 2020. On other channels, a similar rise in attention paid to women's cycling was observed. *Eurosport* – as the home of cycling – has been one of the frontrunners in the promotion of women's cycling. In 2018, the sports channel covered on its platforms 15 out of the 22 Women's World Tour races, 4 of them live across all territories. A cumulative total of five million viewers was reached (Voxwomen, 2018). By 2021, in some European countries, the coverage of women's professional road cycling has increased to about a dozen races being broadcast live on major public service channels and many more either broadcast on smaller (niche) channels, like *La Chaine l'Équipe* (France) and *Rai Sport* (Italy), or being streamed.

Covering women's cycling live is one thing, but what about the public's interest? In 2020, at least four women's races had a European TV audience of over a million viewers. The World Championships road race was watched live by almost 2.5 million TV viewers in Italy, France, Spain, the Netherlands, Flanders, Sweden and Switzerland. For both La Course by le Tour de France and the Ronde van Vlaanderen, at least 1.5 million TV viewers were recorded, while the individual time trial at the World Championships had a combined audience of at least 1.1 million TV viewers in the aforementioned countries. These viewership numbers should be looked upon as minimal estimates of the real TV interest in those races because adding audiences from other (albeit mostly smaller) TV markets will further lift the total.

In 2020, Flemish TV audiences for women's cycling were 70% up versus 2019. The Ronde van Vlaanderen recorded the highest audience ever in Flanders for a women's race with over 730,000 TV viewers. Just five men's races had higher TV audiences in Flanders that year. The most remarkable viewership result for women's cycling in 2020, however, was that on Dutch national broadcaster *NPO1*, the women's version of the Ronde van Vlaanderen was 41% better watched than the men's version: a difference of 160,000 viewers. The same thing happened in early 2021 when the Dutch TV audience for the women's Omloop Het Nieuwsblad was more than twice the audience for the men's race. The excellent audiences for these women's races were the result of an experiment by *Flanders Classics* and broadcaster *Sporza*. The COVID editions of races like Gent–Wevelgem and the Ronde van Vlaanderen adopted a new time schedule in 2020. The men's race was programmed to finish first, over an hour early on the scheduled finish time of the women's race. Without competition from an ongoing men's event, the final of the women's race could be showcased much better. The viewership data suggest this experiment was welcomed by cycling fans and it is a clear indication of the viewing potential for top races in women's cycling. The success of the 2020 editions prompted *Flanders Classics* to continue the experiment in 2021 and 2022.

One of the crucial questions when organizing men's and women's races at the same event remains whether or not these races should be held on the same day. The recent solid ratings in Flanders and the Netherlands for the races by *Flanders Classics* confirm that if women's races are broadcast at a proper time slot, i.e. not as an appetizer to the men's event, people will watch. Both races can therefore be organized on the same day, as long as the women's race is not scheduled to finish in the morning, as has been the case with some La Course editions, or in the early afternoon in competition with the men's race, as has been the case with many classics races until very recently. There are cost savings as well in having races on the same day. The race route needs to be secured for a single day only, and some TV production costs can be shared, e.g. costs related to the instalment of fixed cameras at the finish zone or at crucial race parts of the race. But to properly cover the women's race, some costs should still be made twice, e.g. the expenses on helicopters, motorbikes or personnel, such as TV directors, commentators and technicians. Organizing both races on separate days will not only lead to higher costs; it will also likely result in the women's race getting the least interesting day of broadcast. The women's finals of most Grand Slam tennis tournaments are played on Saturday, while the men always get to play their final on Sunday. This results in higher ratings for the men's final because much more people watch TV on a Sunday afternoon. Similarly, when organized on separate days, in road cycling, men's championship races or major classics are held on a Sunday, while the women's races are programmed on Saturday, never the other way around. This explicit prioritization of men's competitions has largely disappeared in most winter sports, where men and women in, for example, biathlon, skiing or ice skating get the best timeslot alternately, resulting in more or less equal viewership interest in men's and women's events.

Viewership for women's races is not only hugely dependent on how race organizers prioritize the timing of these races; it also strongly influenced by the channel's choices of the broadcasters. In partnership with *GCN*, *Eurosport* invested in an extensive coverage of women's road cycling in 2020. However, opposite to what was the case for men's racing, almost all women's competitions were available exclusively on the *Eurosport Player* or via a *GCN pass*. As a result, women's road cycling became more of a niche product for fans, and some major women's races that got wide TV exposure in previous years became less accessible to the broader public in 2020. *Eurosport* changed its strategy in 2021 when coverage of women's cycling was treated again on a more equal basis with men's cycling. But also public service channels do not always act in the best interest of women's cycling. In 2020, Italian broadcaster *RAI* first aired the women's Strade Bianche on the small sports channel *Rai Sport* and subsequently switched to the well-watched generalist channel *RAI2* for its coverage of the men's race. Similarly, only one stage of the Giro Rosa was broadcast on *RAI2* and was watched by 319,000 Italian TV viewers on a Monday. The other eight stages were all broadcast on *Rai Sport* for much smaller audiences.

With respect to the demographics of the TV audiences for women's road cycling races, we only have detailed information for Flanders. Unlike what could be expected, relative to viewership for men's races, the Flemish audience for women's races appears to be older (3% more viewers in the plus 55 age category) and more male-oriented (1.5% more male viewers). Apparently, coverage of women's cycling first and foremost serves the needs of the current (old and male) devoted fans of cycling who want to watch as much racing as possible. Therefore, at least for now, a larger coverage of women's cycling does not seem the miracle solution to attract new audiences. A worldwide survey in 2021 by *Nielsen* indeed revealed that along with football and basketball, cycling is amongst the sports with the least interest in women's competitions by fans. Only 10% of the cycling fans are interested in women's races exclusively, while for most other sports the fan interest in solely the women's events is 20–30%. Conversely, while for most other sports the fan interest in just the men's competitions is about 20%, for cycling, it is 40% (Nielsen, 2021).

7 The Economics of TV Broadcasting Rights for Cycling Races

The organizers of Danilith Nokere Koerse are quite open when it comes to their finances. The race is an important semi-classic in the build-up to the Flemish WorldTour classics Gent–Wevelgem and the Ronde van Vlaanderen. Yet, instead of receiving any TV money, the organizers pay public service broadcaster *Sporza* €49,000 production costs to secure live coverage of their event. Only a small part of that money (€14,000) is recouped through the sale of the international media rights to *Eurosport* (Lagae, 2021). Similarly, the Tour of California is rumoured to pay US broadcaster *NBC Universal* upwards of $250,000 for its annual time-buy (Rapha, 2019).

Sponsors of road cycling events are, obviously, primarily concerned about their return on investment. The main question to them is where the race will be seen. If organizers cannot give a proper answer on exposure, they have a problem. However, apart from the *Grand Tours* and the majority of the WorldTour competitions, most races face difficulties in selling TV broadcasting or media rights. Consequently, to secure the exposure the sponsors expect, they decide to bear (part of) the production costs of media coverage themselves. The cases of Danilith Nokere Koerse and the Tour of California are therefore by no means exceptional, as a spokeswoman for *Eurosport* explained: 'For some races we do buy the rights, but for some other races, we just offer the exposure' (Voxwomen, 2018).

The difficulties in getting exposure met by smaller races form a stark contrast to what is the case for the Tour de France. In 2010, Race Director Christian Prudhomme declared: 'Newspapers created the Tour de France, radio made it popular, television made it rich' (McKay, 2011). The value growth of the TV broadcasting rights is certainly impressive. The first TV rights payments for the Tour de France date back to 1956. For the footage of Tour de France images in the daily evening news programme, *RTF* – as *France Télévisions* was called at the time– was charged a fee of five million-old French Francs, which equals about €7000 today (Viollet, 2007). Interestingly, the motivation for the charge did not originate from the value of the event itself, but was rather seen as a compensation for the loss in newspaper sales that was expected to result from such TV coverage (www.memoire-du-cyclisme.eu). When live coverage of stages became possible in 1961, the race organizers demanded one million-old French Francs per stage (€30,000 in total), but out of cost savings, *RTF* decided to broadcast just four stages.

Sixty years later, the global Tour de France broadcasting rights are estimated at €80 to €90 million. The bulk of the TV money, close to €30 million a year, is paid by *France Télévisions*. *France Télévisions* also serves as the host broadcaster, producing the feed for the race. Due to its outdoor and mobile nature, TV coverage of the event requires the deployment of planes, helicopters and vehicles on the road. As a result, there are high production costs involved with Tour de France live broadcasts. Total production costs are estimated between €10 and €15 million a year. According to a document from the French government, for the 2000–2003 period, *France Télévisions* received 3% of the Tour de France's non-domestic broadcast rights as a compensation for this producing role (Le Guen, 1999). Such an arrangement might still be in place today, but we have found no recent evidence to support this assumption.

In 1950, European public service broadcasters had formed the European Broadcasting Union (EBU). The first non-domestic broadcasting rights to the Tour de France were sold to the EBU in 1968, making live race coverage available outside of France through the Eurovision network. Additionally, in 1992, a non-exclusive deal with *Eurosport* was concluded. The deal gave the Tour de France also exposure in European countries where public broadcasters had shown little or no interest in broadcasting the race. Both deals have been renewed ever since.

Non-domestic broadcasting rights are much cheaper than French domestic rights. Via EBU, Spanish *TVE* transfers €4.2 million a year to race organizer *ASO* (Palco23, 2021). German *ARD*, one of the rare European public broadcasters to opt out of the EBU contract, was charged €2.5 million when it resumed its coverage in 2015. This was a bargain compared to the €7 million a year it had to pay for the 3-year 2009–2011 deal (Spiegel International, 2008). It has often been said that getting rid of the expensive fee was in fact the major reason for *ARD* cancelling live Tour de France TV broadcasting in 2012. In the United States, *NBC* is estimated to pay between €1 and €2 million, although some sources (Velonews, 2019) mention a seemingly unrealistic $8 million fee for the deal that ends in 2023. The 10-year deal Australian broadcaster *SBS* struck in 2013 is thought to be worth €1.2 million a year.

For the Giro d'Italia's non-exclusive domestic broadcasting rights, Italian public service broadcaster is reportedly paying €10 million a year while also producing the feed for the race (Sportspromedia, 2021a). The deal expired in 2020 and an agreement was reached in extremis to extend it by 1 year. Negotiations on a new deal between *RCS* and *RAI* were still ongoing by the end of 2021. The international broadcasting rights to the Giro d'Italia and the other *RCS* races were sold to *Discovery* in 2017. The deal was renewed in 2021 securing *Discovery*'s exclusive global media rights for the Giro d'Italia across all its *Eurosport*, *GCN* and *Discovery* + properties until at least 2025. From Italian press, we learn that the

Discovery deal is worth €5 million a year, which implies that total Giro d'Italia media rights revenue equal at least €15 million (OA Sport, 2019).

In Spain, public service broadcaster *TVE* renewed its domestic broadcast partnership for La Vuelta in 2021, signing a 4-year deal to produce the live coverage of the event until 2024. According to Spanish press, the deal that gives *TVE* multiplatform rights is worth €2.5 million a year (Sportspromedia, 2021b).

The Ronde van Vlaanderen is rumoured to generate €600,000 to €800,000 TV revenue, while Gent–Wevelgem receives about €250,000. Therefore, although *Flanders Classics* is one of the major race organizers, its overall TV broadcasting revenue is relatively small: between €1 and €2 million. *Flanders Classics* has recently engaged *Infront Sports & Media* (part of the *Wanda Group* imperium) to better commercialize its media rights in package deals.

Consequently, the global sum of media rights for professional road cycling competitions is somewhere in the region of €110 to €120 million a year. A small football competition like the Belgian Jupiler Pro League already generates a similar amount of media revenue (Inside World Football, 2020). In 2021, the worldwide value of sports media rights was estimated at $52.1 billion (SportBusiness Consulting, 2021). Professional road cycling thus seems to account for a marginal share of about 0.2% of the global media rights only; which is even far behind golf, the sport that is in tenth position with global media rights of $1.1 billion.

When measured relative to actual viewership for live coverage of the race and excluding the *Eurosport* TV audiences, French TV is paying about €8 per Tour de France TV viewer, American *NBC* between €3 and €6 and Australian *SBS* and Spanish *TVE* about €4, while *ARD* has negotiated the best broadcast rights deal with a price just over €2 per viewer (Fig. 6.9). Spanish *TVE* also seems to have made a good deal for the Vuelta a España with an estimated price of €2 per viewer, while

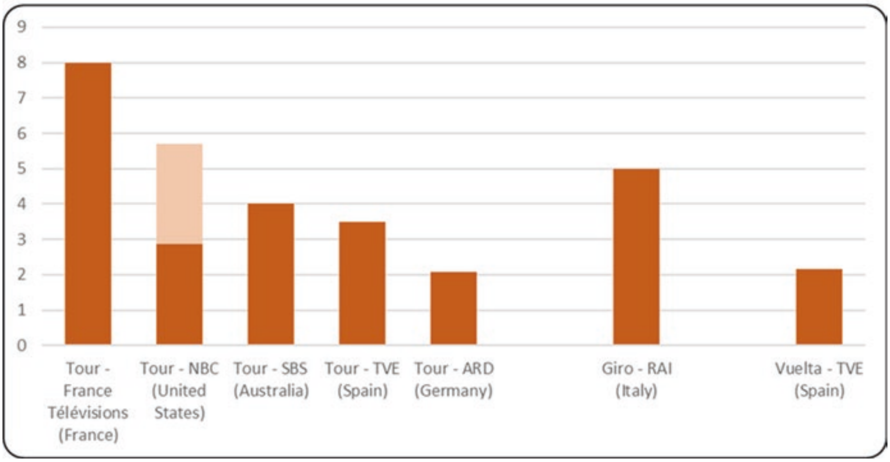

Fig. 6.9 Estimated price per viewer to broadcasters for Grand Tour broadcasts. (*Source*: Own calculations)

Italian broadcaster *RAI* pays about €5 per viewer for its live Giro d'Italia coverage. Figure 6.9 makes clear as well why *NBC*'s rumoured $8 million rights fee is a hoax in all likelihood. It would imply an exorbitant price of about €20 per American TV viewer, making the deal at least four to five times as expensive when compared to what all other countries pay, except France.

Unlike *RCS* with its exclusive *Discovery* deal, Tour de France race organizer *ASO* has consistently hinted that it values consistency over cash. The three major deals that *ASO* has in place for already many decades now – with *France Télévisions*, with EBU and with *Eurosport* – have recently been renewed once again until 2025. The continuing symbiotic relationship between the race organizers and the EBU becomes clear from the mutual comments on these deals. *ASO* Managing Director Yann le Moenner explained: 'We are thrilled to continue our partnership with the EBU and its members, which have always been committed to offer a large exposure for cycling all over Europe, through a perfect combination of generalist free-to-air channels and sports thematic channels' (EBU, 2020). Similarly, EBU's Director General Ingrid Deltenre commented before: 'the Tour de France is extremely important to our members and their viewers. As cycling's flagship event, the Tour has been a key element of the EBU's sports rights portfolio many times over the years, and we're proud to continue this tradition. Crucially, this contract ensures the race can be seen on our members' free-to-air channels [until 2025]' (Sportcal, 2013). It is no secret either that the French government has always protected the Tour de France as an event of national interest. It finances the race by assuming most of the policing costs, and it has blocked efforts by foreign investors to acquire any stake in the event. The consistency over cash approach and the underlying public service ethos taken by the organizers is the logical consequence of a particular view on the Tour de France being a French heritage event.

As a result, the pool of Tour de France broadcasters has been remarkably stable over time. In France, since 1985, all Tour de France stages have been broadcast on *France 2* and *France 3*. Similarly, in Belgium and in the Netherlands, TV coverage of the Tour has always been on the countries' public service channels since the very start of the live broadcasts in 1968. Danish channel *TV2* has been covering the Tour de France live since 1990 (Frandsen, 2017), while *SBS* has been the sole Australian broadcaster already from the earliest summary programmes in the 1990s. In Germany, public service channel *ARD* has been the long-time Tour de France broadcaster. There are long-term engagements from commercial and privately owned broadcasters as well. In the United Kingdom, *ITV* has been transmitting the Tour since 2001. Previously, it was broadcast by *Channel 4* (The Guardian, 2001).

Such long-term broadcaster relationships are remarkable since, unlike one might think, coverage of cycling races does not guarantee TV companies a profit, especially when they have to bear the production costs themselves. For example, in 2014, French broadcasters *France 2* and *France 3* recorded a net loss of about €25 million with their coverage of the Tour de France (Toutelatélé, 2014). That year, the total costs amounted to €35 million (€25 million broadcasting rights fees and €10 million production costs), while advertising revenue did not exceed €10 million. Such losses can only be justified when sports broadcasts have a promotional value, i.e. when they create larger than usual audiences for the channel. This is usually the case. For example, only 3% of all sports broadcast time on British television is provided by the *BBC*, but the public service broadcaster accounts for 41% of all TV audiences for live sport (SportBusiness International, 2017). The choice for loss-making broadcasts of expensive sports events is sometimes motivated by the consideration that such coverage is essential for the channel's identity (Frandsen, 2017). This explains the long-term commitments most TV channels have vis-à-vis the Tour de France, making it one of the few sports events that people in many countries easily associate with a particular national TV channel.

8 The Challenges for the Future

In this chapter, we explained how professional road cycling has all it takes to be successful in the media. At the same time, we observed that cycling's television audience is rapidly ageing and that on a worldwide scale its broadcasting rights are marginal. In the final section of this chapter, we discuss three important challenges for the future.

8.1 Safeguard the Visibility and Reach of Professional Road Cycling

Sports channels, such as *Eurosport* or *ESPN*, have become much more relevant over the years. As event organizers and league owners seek lucrative exclusive TV rights deals with such niche broadcasters, an important dilemma between 'money' and 'market' arises. The more money organizers (try to) make from selling TV rights, the less people (may) get to see the sport, threatening the long-term interest in the sport or the event. For example, as a result of the deal between *RCS* and *Discovery*, the worldwide TV audiences for some major Italian cycling races have plummeted. This became very clear in 2021 when in France one of cycling's biggest classics, Milano–Sanremo, could only be watched via the *Eurosport Player*. As a result, viewership was less than 2% of the year before when it was still broadcast on French public service sports channel *La Chaine l'Équipe*: 20,000 versus 1,073,000. It is contradictory to try to modernize road cycling in order to look for extra viewers while presently throwing out of the window hundreds of thousands of them in countries like Spain, France and Italy.

Race organizers like to emphasize that multinational sports channels like *Eurosport* export their competitions to a much larger number of countries. But *ASO*'s claim that the Tour de France is broadcast in 190 countries (ASO, 2016) creates a highly misleading view on the event's popularity. The number of TV markets where cycling fans can watch Tour de France stages on a daily basis is much smaller. When media rights are sold to a pan-international broadcaster (e.g. *Discovery*), all territories that are reached by that broadcaster are included, although the race is not necessarily broadcast in each of these TV markets. Furthermore, in some territories, viewership for sports channels is so low it becomes meaningless. Although the first stages of the 2016 Giro d'Italia cycling race were broadcast in 41 European countries, the average number of viewers in some countries was extremely small: e.g. 80 viewers in Cyprus and 14 in Iceland (Nielsen Sports Netherlands, 2016).

It is often thought that online viewing has a strong impact on TV audiences for road cycling. However, the surge in the sale of new TV sets in the build-up to major sports events like the Olympic Games suggests people still prefer high-resolution TV screen pictures over low-quality small screen images for watching live sports action at home. Online viewing does offer extra viewing opportunities though for people at work or travelling, but data from the Netherlands and France show its impact is still marginal. The 2021 Tour de France was watched through online platforms by the equivalent of 8950 Dutch viewers. This is just 1.4% of the 644,000 average TV audience for the regular TV broadcasts of the stages. In France, the Paris–Nice stages were watched on average by 876,200 persons. The equivalent audience for second-screen viewing on laptops, tablets and smartphones on the platforms of *France 3* and via the *Eurosport Player* totalled 41,000 (4.6% of the linear TV audience). There can be no doubt that the vast majority of live sports viewing still happens the linear way. Some misunderstanding about the impact of place-shift viewing stems from the fact that it is 'a mile wide but only an inch deep'. The number of people reached through digital media can be very high, especially when measured by clicks, but the time of viewership is often rather limited. For instance, in the Netherlands, the number of Tour de France streams started was 56,000 per stage, but the average duration was half an hour only.

Finding the right balance between the traditional linear programming of cycling races and offering over-the-top (OTT) media services directly to cycling fans via the Internet is one of the main challenges to the sport. But professional road cycling could learn from the changes in Formula One since *Liberty Media* acquired the commercial rights in 2017. It is one of the better examples of a sports organisation using linear programming to guarantee a wide audience and a sustained popularity and an OTT service to offer a more in-depth product to a fan base willing to pay a premium to maximise their enjoyment of the sport. The *Netflix* series *Drive to Survive*, an enhanced social media presence, and new broadcast graphics are all tools to make Formula One appeal to as many people as possible. Through its OTT service, more knowledgeable fans are offered multiple camera angles, live timing and pit radios during live races, supported by exclusive shoulder programming and an extensive archive. We feel this is the way to go forward in professional road cycling as well, but it requires vision, leadership and consensus amongst all major stakeholders, not the strongest quality in road cycling today.

8.2 Embrace Efforts to Reach New Audiences

The ‘Tour de Tietema’, the Hammer Series and the *Netflix* series *El Día Menos Pensado* are three recent initiatives that try to popularize cycling by reaching out to new audiences. Unfortunately, instead of embracing such initiatives, the conservative nature of professional road cycling soon reared its ugly head.

One of the interesting side stories of the 2021 Tour de France was *ASO*’s blocking of all Tour de France *YouTube* content created by ‘Tour de Tietema’, allegedly because they were shooting videos on the Tour de France without having paid for any media rights. For several years already, Bas Tietema and his team popularize road cycling with non-cycling fans and younger generations by shooting alternative cycling content, such as fun videos and spectacular community-based activities. Apparently, *ASO* did not fully realise how the ‘Tour de Tietema’ videos were promotion for the Tour de France rather than pirate content. Before being taken offline, the *YouTube* videos were viewed 3.2 million times for a total of 281,100 hours (up 76% on 2020). About 40% of the subscribers to the *Instagram* account and 35% of the *YouTube* viewers are under 25, while only 5% is over 55 (Bas Tietema, “personal communication”). ‘Tour de Tietema’ demonstrates it is possible to broaden road cycling’s fan base by reaching out to younger audiences through new formats, although its audiences were dominantly male (90%). Such initiatives are needed and should be promoted instead of blocked.

In 2014, 11 cycling teams created the Velon Group with the aim to make cycling better to watch, easier to understand and more marketable. One of the more concrete results of the project was the launch of the Hammer Series in 2017, a series of cycling events in which teams compete against each other to determine the winning formation, instead of individual riders. Each Hammer Series event consists of three races with a separate challenge: a sprint race, a hilly race and a team time trial chase. The new format leads to some spectacular races with solid on-site audiences as well in Stavanger (Norway) and in Limburg (the Netherlands), but cycling’s stakeholders did not follow. TV broadcasters showed little or no interest, and conservative voices in the cycling press denounced the team focus in the event claiming ‘this is not what cycling is about’. The events never got a proper spot on the already overloaded UCI racing calendar, and in 2019, the friction with the UCI escalated when Velon filed a Complaint to the EU Commission for ‘UCI’s discrimination and anti-competitive behaviour’ (Cyclingnews, 2020). The legal dispute led to Velon’s decision in March 2020 to suspend the Hammer Series after just six events, de facto creating the status quo that conservative forces at the top of cycling were looking for.

In 2019, *Netflix* produced *El Día Menos Pensado* (‘The Least Expected Day’), a documentary about the *Movistar Team* with an exclusive behind-the-scenes look at the riders and the team staff in the 2019 cycling season. The six-part series was well watched, and a second and third series on the 2020 and 2021 seasons, respectively, followed. *Team Jumbo–Visma*’s documentary *Plan B: The Fall & Rise* on the team’s performance in the 2021 Tour de France can be watched at a price of €4.95 in what the team calls the ‘first digital cinema owned by a sports team’. It was a follow-up to the 2020 Tour de France documentary on the team, *Code Yellow*, which was aired on national Dutch television. These documentaries show the operational and strategic decisions of cycling teams in good and bad days. It was welcomed by fans, but rather than appreciating the open-minded approach, some cycling journalists uncritically used the contents of the documentaries to quickly make a point. For example, in certain analyses, the personal decision by Tom Dumoulin to pause his career in early 2021 was unfairly linked to some of his comments in the *Code Yellow* documentary taken out of context. Similarly, the *Netflix* series has unjustly fuelled press articles on the proclaimed 'poor' *Movistar* team tactics. We hope that this ill-considered use of the open storytelling from some cycling teams will not fully reinstate the more secretive approach that characterizes most other cycling teams.

8.3 Create a Valuable Product

When in 2021 long-time professional cyclist Dan Martin missed the Flèche Wallonne for the first time in his career, he tweeted how, as a TV viewer, he suddenly realized how boring the race actually was, while to the riders it is one of the most intense races of the season (Fig. 6.10). This illustrates how even key actors in the sport, the riders and their teams, are not always fully aware on how road cycling races resonate with the public.

To better adapt professional road cycling to the needs of today's television audiences who have at their disposal many alternatives, we think a transformation of the sport is essential. It requires innovative ideas on how to modernize cycling races (the core product) as well as on how to make cycling broadcasts (the derivative product) more exciting.

Let us first turn to the core product. Many of today's cycling races are too long and the outcome is far too predictable. In the flat stages of a *Grand Tour*, television viewers have to watch for hours a race where nothing seems to be happening. At the start of the 2014 Tour de France, English newspaper *The Guardian* warned its readers: 'For the TV viewer there can be no more demanding sporting event than the Tour de France. The concentration, dedication and sheer stamina required to stay

Fig. 6.10 Twitter message by Dan Martin. (*Source*: Twitter)

the course of a six-hour broadcast in which little of interest happens until the last 10 minutes is the sofa spectator's greatest challenge' (The Guardian, 2014).

All types of road cycling races that currently exist have already been around for a very long time, and little effort has been made into developing new race formats, except for the above-discussed and ill-fated Hammer Series. We encourage a brainstorm on new race formulas and race rules and kick-off with two creative ideas ourselves. First, introduce substitutions during stage races. A team could, for instance, enrol nine riders in a *Grand Tour*. For each stage, depending on the type of stage and the fitness of the riders, seven of these nine riders are selected by the team manager. Just like it is the case in championship tournaments in any other team sport, such a system would allow a team manager to allocate much better the riders of his team to their best use or give an injured or ill rider the chance to recover for a couple of days. Because the teams would now be able to field seven riders in all stages, it could theoretically lead to more balanced races and crashes eliminating riders would have smaller consequences to the teams. Obviously, only riders that take part in all stages would qualify for the overall classifications, but others can still look for stage wins and other prizes. Second, especially in short stage races where time differences between the top riders are usually limited, a pursuit race could be introduced as the deciding event for the general classification. In such a race, the best classified rider starts first, and his opponents subsequently take the start with a delay equal to the time differences in the general classification. For practical reasons, only a limited number of riders (e.g. the top 20 or the top 40) would qualify for this final stage. A pursuit race has the potential to be much more attractive and tactical than a classic time trial stage, and as result of the reverse starting order, the rider that crosses the line first will also be overall winner of the stage race. La Course experimented with this type of racing in 2017, but van Vleuten's dominance made it an inadequate test case.

How can cycling races be better translated into good TV broadcasts that are able to capture and hold the attention of cycling fans? The 2021 Road World Championships in Flanders were covered by Flemish public service broadcaster *VRT*, one of the best on the job in the world. The way the races were captured and covered was of the highest quality from a technical point of view. But unfortunately, in the time trial races as well as in the road races, an opportunity was missed to tackle one of the sore points in cycling broadcasts today – the limited information transfer of the race action to the TV viewers – and an opportunity to set a new standard in this respect was missed. In time trial races, the intermediate or finish times of riders are still compared only relative to the best time at that moment in the race with an indication on the virtual position. However, it would be much more informative to the viewers if data was presented that put the rider relative to his direct opponents, with rider names and times rolling over the screen, as in the case in most other sports that use times, e.g. alpine skiing or biathlon. The time of a rider in tenth position can then be compared to the riders from, for example, 7th to 13th position. It was also remarkable that in both the time trial race and the road race at the 2021 World Championships, TV commentators had much more race information at their disposal than TV viewers could see on their screen. For example, during the road race, the position and time differences between all riders were electronically recorded after every lap when they crossed the finish line. This information was available to journalists via a direct feed, but not to fans watching the race on TV. Like in biathlon or in MotoGP, we think in cycling races the relative positions of the (most important) riders should be regularly projected on screen. The data are there; there is no longer the excuse of the technology.

Another example of where there is room for improvement is the post-finish production of the race. At this moment, the only sort of standard for the international TV feed seems to be that the winner gets interviewed by the home broadcaster, either in English or in the winner's native language, often concluded with a final question being asked in the other language (i.e. the winner's native tongue or English). This is followed by the coverage of the podium ceremony, although many TV channels will already have stopped broadcasting by then. Seldom there are interviews with other riders, which often results in the amateurish collection of post-finish quotes from these riders by mobile reporters or in pop-up studios. We propose a better uniform post-finish production procedure across all races, where, for example, the top contenders are interviewed collectively about what happened in the race. Such instant collective interviewing is much more attractive to fans of the sport and enhances storytelling.

Technical improvements have also enabled a much better filming of cycling races over the years. Still, TV viewers are mostly following the race from the same 'distance' as before, i.e. images come from a motorbike or from a helicopter. Today's TV viewers desire much more proximity and engagement. As has been demonstrated in motorized sports, this can be realized by using shots from on-board camera, listening in on radio communication between pilots and team staff, and geolocation. In 2012, Jean-Maurice Ooghe, former Tour de France TV Director, said that he hoped to see some changes in the way races are broadcast: 'I think that the developments should be sound recording in the peloton; on-board cameras, both in team cars and on bikes, and the geolocation of riders. We have to get to the point where all the riders can be located at all times' (UCI, 2012). Also former UCI President Cookson considered this as an opportunity: 'One of the biggest challenges is the need to evolve while staying true to the essence of your sport. How do you embrace innovation in order to make the spectator and viewer feel even more engaged? We will look at technology such as cameras on bikes and in team cars to see how they can be used to enhance the viewer experience. Imagine being able to share the view of Chris Froome as he rose up Mont Ventoux or came up the Champs Elysees. And why stop at cameras - what about having microphones on bikes?' (UCI, 2014b). These observations date from 10 years ago. Although indeed meanwhile some steps have been taken, we feel the progress is much too slow and not matching the evolution observed in some other sports.

At this moment, only the *Grand Tours* and a handful of top classic races receive the bulk of all media money. Media interest and thus licensing rights will only increase if professional road cycling becomes a more valuable product media companies really want to pay for. There is no doubt that professional road cycling could benefit from some proper out-of-the-box thinking. But radical changes to a sport can only be implemented successfully if all stakeholders are consulted in the design of new race formats and better TV broadcasts. This calls for a global pact between all parties, in which a balance has to be found between tradition and innovation.

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Chapter 7
The Tour de France: A Success Story in Spite of Competitive Imbalance

Wladimir Andreff and Jean-François Mignot

1 Introduction

The Tour de France is one of the world's largest annual sport events. The 3-week race includes a publicity caravan, it attracts host cities and sponsors which are willing to pay to be present in the race, and its individual stages (and their landscapes) are watched by a mass of TV viewers. Although cycling races are usually not lucrative, the Tour de France organizer's balance sheet reveals that the Tour has been profitable since the 1980s (Mignot, 2016). How can this economic success story be explained? Most sport economists are used to turn to tournament theory and a contest's competitive balance and outcome uncertainty as major reasons for success. However, fans of the Tour de France are seldom surprised by the name of the final winner of the race, usually not even by the riders sharing the podium. Thus, explaining the Tour's success by competitive balance must be checked carefully.

Following the introduction, this chapter shows how the Tour de France has been a successful managerial and economic model (Sect. 2): it is a well-designed and well-managed sport event, with a modern financing model which is founded on TV broadcasting rights, like other mega-sport events. Fundamentally, the quality of the show of the Tour seems well explained by tournament theory (Sect. 3). However, if one focuses on competitive balance, it appears that the success of the Tour is likely not due to a high competitive balance, but instead holds *in spite of* static and dynamic competitive imbalance (Sect. 4). The conclusion stresses that the increasing

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economic success of the Tour since the 1980s is likely not caused by more competitive racing, but instead by better broadcasting of the event (Sect. 5).

2 The Tour de France: A Successful Managerial and Economic Model

A top sport event offered for free will automatically attract a significant demand. Beyond this basic and quite obvious cause of Tour de France attractiveness, its management and design are also explanations of its success. This is partly due to the Tour basically sticking to a modern model of professional sport finance.

2.1 A Well-Managed and Well-Designed Sport Event

The Tour de France is managed by *Amaury Sport Organization* (*ASO*). *ASO* also organizes other professional cycling races, such as Paris–Roubaix, Paris–Nice, and the Critérium du Dauphiné, as well as golf tournaments, track and field events, car races, and horse-riding contests. Professional road cycling accounts for close to 70% of *ASO*'s revenue, mainly because of the success of the Tour de France (Desbordes, 2006; Van Reeth, 2019a). Since *ASO* is a privately owned company, it aims at profit maximizing and designs its strategy accordingly.

A first strategic tool consists in multiplying the number of trophies within a race. In the Tour de France, this process started in 1919 with the introduction of the yellow jersey for the leader in the race and lasted until 1989 when the number of trophies stabilized, respectively, rewarding the best rider overall (yellow jersey); the best climber (polka-dot jersey, created in 1933); the best sprinter (green jersey, created in 1953); the best young rider, i.e., any cyclist less than 26 years of age (white jersey, created in 1975); and the best-ranked team. From time to time, other trophies appeared and vanished again. By creating "different races within the race," *ASO* attempted and succeeded in making the Tour de France a more vivid contest with multiple opportunities for duels between riders or teams competing for a given trophy and changes in the tactics adopted by riders or teams during the course of the race. Given that cycling is a strategically complex sport, fans may be interested in who will win and also how (see Chap. 10 on strategies in road cycling competitions).

Two other factors that attract people to watch riders on the Tour de France roads are linked together. The first one is the riders' performance; the second one lies in the hardness of the race. Based on the number of racing days and the number of rest days per racing day, the Tour de France became much harder after the 1920s with the number of racing days stabilizing up to about 20, while 1 rest day per 10 racing days became the usual ratio (Mignot, 2014). Before the 1920s, the number of stages was usually 15 at most, and the riders enjoyed at least 1 day of rest after each stage. The overall riding distance was 2428 km in 1903 and rose to a maximum of 5745 km in 1926. Since then, the distance shortened to about 3500 km on average. Thus, compared with the initial era of the so-called road's convicts (*les forçats de la route* in French), riders now spend more days on the roads and have less often time to rest. However, this has been made feasible by reducing the average stage length from over 300 km until 1926 to less than 200 km since the 1960s. Consequently, the average duration of a stage, i.e., the daily time actually spent by riders on their bikes, fell from 10 to 16 h before the 1930s to 4–5 h in the 2000s. The race also became harder due to the introduction of mountain stages. The first mountain ever climbed in the Tour de France was the Ballon d'Alsace in the Vosges region in 1905. A handful of years later, high-mountain stages in the Pyrenees (1910) and the Alps (1911) were introduced. However, the number of passes over 1000 meter height in a given Tour de France has not increased significantly on average since the 1920s.

Apart from the physical hardness of the Tour de France, it is also the increase in riders' performances that has made the Tour attractive to spectators. The overall average speed of the yellow jersey winner was between 25 and 30 km per hour (km/h) until the late 1930s. Since World War II, it has steadily increased. From 25.7 km/h in 1903 to 42.3 km/h in 1999 (the fastest Tour ever) is an improvement of 65%. Part of this acceleration is due to technical progress affecting riders' bikes such as the introduction of derailleur gears, the increase in the number of gears, lighter bikes, profiled wheels, etc. (Calvet, 1981; Andreff, 1985). Improvement of the road surface, shorter stages, multiple stakes, and high-effort intensity in the crucial parts of the race have also triggered both higher rider performance and increased attractiveness to spectators. Improved physical and medical preparation, better nutrition and sometimes doping may have played a role as well. Another index of riders' performance is the withdrawal ratio, the percentage of riders who do not finish the race (Mignot, 2014). This ratio decreased from over 70% in the 1920s to 40% in the 1930s and about 20% during the 2000s. The highest withdrawal ratio was reached in 1926 (as mentioned before the longest Tour de France ever held) with 126 withdrawals out of 162 riders (78%), meaning that year only 36 riders finished the Tour de France. In 2019, the lowest withdrawal ratio was recorded with 155 out of 176 riders finishing the contest; only 21 riders (12%) abandoned. Before 2019, when 198 riders were enrolled in the peloton, the second lowest withdrawal ratio was witnessed in 2016 with 174 finishing riders and 24 abandoning (12%).

Last but not least, the Tour de France is a sport event that is supplied for free to millions of spectators along the roads. However, the demand for it is not infinite. The demand is rationed by various constraints such as the date and location of a stage or the hosting capacity of a geographical site (like the slopes of the Mont Ventoux or Alpe d'Huez), limiting the number of spectators. Nevertheless, from an economic point of view, a free sport event is likely to draw a huge attendance. Indeed, 10–15 million spectators per year attend the race over the course of 3 weeks. This is significantly more than the biggest mega-sport event in the world, the FIFA World Cup with a stadium attendance of 3,441,450 people in Brazil in 2014 and 3,031,768 in Russia in 2018. Moreover, since not all spectators can attend the Tour, they also demand a storytelling which was first supplied by newspapers, then through radio broadcasts, and eventually through TV broadcasts.

Overall, the proportion of adults in France who claimed they personally liked the Tour de France went from 59% in 1964 to 44% in 2010 and then 49% in 2011–2014 (IFOP, 2014). In 2011, the share of adults who claimed they like the Tour de France was close to 50% not just in France but also in Italy and Spain, but it was much lower in the UK (35%) and in Germany (28%) (IFOP, 2011).

2.2 A Modern Financing Model

The Tour de France has not always been a profitable business. Until the 1970s, financial deficits were common (Reed, 2003; Mignot, 2016). However, the deficits vanished with rising TV broadcasting rights. From the mid-1950s to the mid-2010s, the revenues of the Tour de France were multiplied by more than 50, and since the 2000s, most of these revenues have come from television rights (Fig. 7.1), dwarfing the revenue sources of host cities, the publicity caravan, and other sponsors.

The first Tour de France TV broadcast was the finish of the last stage at the Parc des Princes stadium in Paris in 1948, whereas the first TV broadcast of a mountain pass was at the Aubisque in 1958 (Chap. 6). Nowadays, the Tour is the major sport event in the French broadcasting market with well over 80 h of broadcast, ahead of the Roland Garros tennis tournament (77 h), Champions League matches, Formula 1 races, and the rugby Six Nations Tournament. In 2019, 35.4 million French TV viewers saw at least 1 minute of the Tour de France, which is about half of the nation's population (France Télévisions, Médiamétrie data). The average per stage

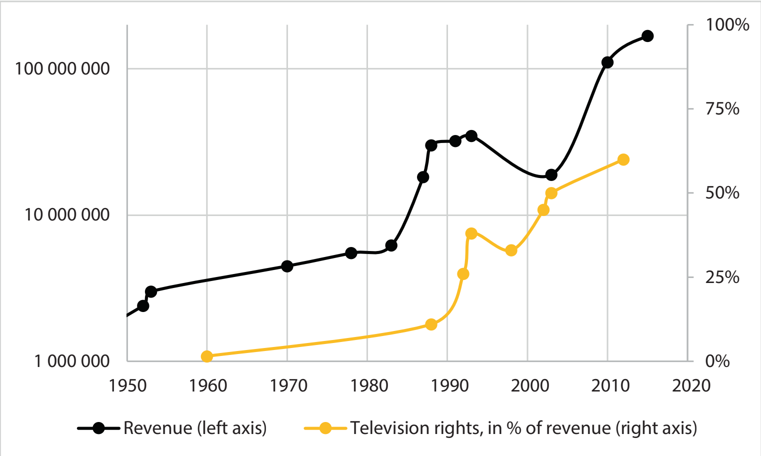

Fig. 7.1 Tour de France revenues, 1950–2020 (in 2020 euros). (*Sources*: Mignot (2016), and Bačik et al. (2021))

audience in France is between three and four million (Van Reeth, 2019b). Consequently, the Tour de France TV rights revenues have increased significantly over the years.

Chapter 6 explained how, from the 1970s on, the Tour de France was broadcast in more and more countries. Today, it is a global mega-sport event. Over 100 TV channels in 190 countries now broadcast the Tour de France, with live broadcast in 60 countries (www.aso.fr). As a result, the budget of the Tour de France has literally skyrocketed since the 1980s. From the early 1980s to the late 2000s, the operational budget of the Tour was multiplied by 20, primarily due to the growth of TV rights revenues that multiplied by 65 over the same period of time (Mignot, 2014; Fig. 7.1).

Table 7.1 illustrates the financing sources of the Tour de France. Basically, three types of income can be distinguished: TV broadcasting rights, marketing (merchandising included) and sponsorship revenue, and income from municipalities. The media success story is the basis for the solid economic foundations of the Tour de France because it provided 44% of its overall budget in 2010 according to *ASO* accounts. It is all the more so in 2019, when TV rights revenues have reached 55%. Just like in other professional sports, TV rights are now an important source of revenue, which compares to its share in the English Premier League finance in 2019 (59%). This is the result of an organizer's strategy of using its monopoly power over the Tour de France to increase these rights. From the 1950s to the 1980s, two-thirds of Tour de France revenue originated from marketing and sponsorship. This kind of revenue emerged in 1925–1929 when the Tour transformed from a race opposing individual riders into a race between opponent teams sponsored by commercial companies. Since 1930, additional sponsorship income was generated with the introduction of a publicity caravan, i.e., dozens of vehicles preceding the riders by a few minutes and distributing product samples to spectators. In 2019, a sponsor had to pay €37,000 for its brand exposure on four vehicles of the Caravane du Tour (publicity caravan) and an additional €6300 for any extra vehicle. The share of advertising and sponsorship revenue has declined in the past two decades to 51% of the budget in 2010 and 40% in 2019. Finally, each year, over 200 cities are a candidate for hosting a Tour de France stage arrival and/or departure, and those which are successful had to pay in 2021 €65,000 for hosting a departure, €110,000 for an arrival, and €160,000 for both. The first stage departure (*Grand Départ*) is much

Table 7.1 Revenue sources Tour de France and professional football leagues, 2010 and 2019

Revenue source (in % of overall finance)	Tour de France		English football Premier League[a]		French football Ligue 1[a]	
	2010	2019	2010	2019	2010	2019
TV broadcasting rights	44%	55%	51%	59%	57%	47%
Advertising and sponsorship	51%	40%	22%	27%	28%	41%
Municipalities[b]	5%	5%	0%	0%	2%	1%
Spectators (gate receipts)	0%	0%	27%	14%	13%	11%

Sources: Websites national football leagues and ASO (2019)
[a]Revenues from player transfers not included
[b]Municipal subsidies in football, stage cities in the Tour de France

more expensive for a city. Utrecht had paid €4 million in 2015, while Rennes eventually did not accept hosting the *Grand Départ* in 2021 with the excuse of too high a bill to be paid. However, because of the rising overall budget, the share of the contributions from these cities in the total budget of the Tour de France has decreased from 40% in 1952 to just 5% in 2010 and 2019 (Table 7.1). For more on the economic impact of hosting major road cycling events, see Chap. 5.

The Tour de France has thus also evolved toward a contemporary model of professional sport finance and developed from a so-called SSSL (spectators-subsidies-sponsors-local) model to MCMMG (media-corporations-merchandising-markets-global) model with regard to its major sources of finance (Andreff & Staudohar, 2000). In the MCMMG model, media, in particular through TV broadcasting rights, have become the most significant source of income for sports. Furthermore, alongside with sponsors and gate receipts (spectators) whose share in overall finance of sport events has shrunk, new sources of finance have emerged, including corporations (investment funds, big companies, Russian oligarchs, Middle Eastern oil sheiks, etc.), merchandising of nonsporting goods (e.g., T-shirts) under a club's or a player's label, and markets. With respect to the latter, we see that money is channeled into contemporary professional sport from two markets: a labor market for talent in which a club makes money in selling home-educated and trained talented players and a capital market that enables to trade a club's shares at the stock exchange and collecting money from the fans as shareholders. Most of these new sources of finance are global.

From Table 7.1, we also see that although the current Tour de France financing model is in line with big professional sport leagues such as the English Premier League and the French Ligue 1, it remains specific in a way too. For example, its TV dependence in percentage of overall revenue (55% in 2019) compares with football, while advertising and sponsorship (40%) is no longer the most important source of income to the Tour de France organizers. This may be interpreted as the Tour de France having moved from the SSSL to the MCMMG model. The absence of gate revenue has been compensated for by sponsorship money but primarily by increased TV revenues. In fact, the lack of gate revenue potentially deprives the Tour de France of up to one-sixth to one-quarter of overall revenue (like in English football). The share of public money received from municipalities is more important in the Tour de France than in European football, though it is now reduced to 5% only. At the end of the day, the profitability of the Tour de France is likely to be guaranteed as long as it will attract the media, advertisers, and sponsors, even without any spectatorship income.

3 The Tour's Success and Tournament Theory

There is a more fundamental reason why the Tour de France is such a successful sport contest: it fits with the recommendations derived from tournament theory. Tournament theory (Tullock, 1980) was first conceived to analyze the efforts dedicated by competing job seekers to get a job, and it was then adapted to sporting contests, namely, tennis tournaments (Rosen, 1986). Each participant is assumed to independently choose the quantity of resources (physical and psychical efforts) he is going to invest in view of winning the tournament and receiving the winner's prize. His winning probability increases with this quantity. Let V stand for the value of the winner's prize. Each participant i dedicates an effort e_i, and his probability of winning p_i depends on his share in the overall effort devoted by all participants, that is:

$$p_i = \frac{e_i}{e_i + e_j}$$

The financial gain of participant i is $\pi_i = p_i \cdot V - c_i \cdot e_i$ where c_i stands for the marginal cost of each participant i's effort or investment in the tournament.

The assumption that the organizer of a sport tournament acts to maximize profit implies that the goal is to attract as many spectators as possible by gathering high-quality athletes and by securing that these athletes dedicate maximal efforts to win. Therefore, the organizer must conceive incentives in such a way that athletes maximize their efforts and, consequently, produce a spectacular sport event. From tournament theory, it is mathematically derived that a tournament will be attractive if its incentive mechanism (through its prize structure) fulfills six prerequisites (Szymanski, 2003; Andreff, 2012). As *ASO* indeed aims at making a profit from organizing the Tour de France, the choice of an appropriate incentive mechanism is crucial, and it must be checked whether the Tour fulfills prerequisites (a) to (f) for a sport contest to be successful and attractive:

(a) When one competitor has a very high capacity to win, the tournament practically is without interest for other participants who will dedicate only a minimal effort. The organizer must avoid such competitive imbalance. The Tour de France has always tried to stick to this principle by enrolling several superstar riders every year. Whether the Tour fulfills condition (a) is debatable when one witnesses a rider winning the Tour five times like Jacques Anquetil, Eddy Merckx, Bernard Hinault, and Miguel Indurain – or seven times in a row, as in the case of the later disqualified Lance Armstrong. Condition (a) is not valid either when the yellow jersey winner is too much ahead of the second-ranked rider, like in 1952, when campionissimo Fausto Coppi won the Tour de France with a lead of over 28 minutes. This is why in 1952, when Coppi dominated the race as early as the tenth stage, organizers doubled the second-place cash prize so that riders fight for second if not first place. In fact, condition (a) raises the issue of competitive balance, which is addressed in detail in Sect. 4.

(b) Individual effort and aggregated effort of all the participants increase with the value of the winner's prize V. In the long run, the value of V has massively increased in the Tour de France (Chap. 2, Fig. 7.1). The total prize money in the Tour de France is over €2 million – exactly €2.288 million in 2021 (for a detailed analysis, see Chap. 3) – which fulfills prerequisite (b) compared with other cycling races, for instance, €1.499 million in the Italian Giro d'Italia 2021 and €1.116 million in the Spanish Vuelta a España 2021.

(c) Individual effort decreases with the number of participants. The size of the Tour de France peloton climaxed at 210 participating riders in 1986, it decreased to between 176 and 198 in the 1990s and 2000s, it stabilized at 198 in 2011–2017, and it has been reduced to 176 since 2018. Reducing the number of participants down to 176 since 2018 must have on average increased individual efforts of each rider. If *ASO* intended to further increase the number of riders, it could deteriorate this condition (c) in terms of riders' individual effort. Anyway, the maximum number of riders engaged in a professional cycling race is regulated by the International Cycling Federation (UCI). The only trade-off still open to *ASO* is between more teams with fewer riders each and fewer teams with more riders each. At the end of the day, the organizer chooses each year the number of teams and which teams are selected to participate in the Tour. This is not without conflicting interests between the organizers of the *Grand Tours* (*ASO*, *RCS*, and *Unipublic*) and the UCI, which claims that each *Grand Tour* must invite all the UCI WorldTeams (Rebeggiani & Tondani, 2008).

(d) Aggregated effort increases with the number of competitors. Such condition is a trivial by-product of condition (c). In the Tour de France, maximal aggregated effort is constrained by an exogenous factor which is the set of UCI cycling rules.

(e) Participants' efforts are more intense in a tournament with multiple prizes, where there are several prizes or trophies at stake, as soon as the competitors' abilities to win are different. This principle is satisfied in the Tour de France with offering prizes for final ranking trophies such as yellow jersey, green jersey, polka-dot jersey, white jersey, and best team final ranking as well as prize money for the best-ranked riders in a stage or the first riders at a mountain pass summit (Table 7.2). Since the prize money is distributed over multiple trophies, condition (e) is satisfied. In addition, the Tour offers some more specific prizes: the most aggressive rider prize rewarding the rider with the toughest fighting spirit in each stage and the super-fighter prize at the end of the Tour, the winners of intermediate sprints, a daily rent for the holder of each distinctive jersey, and special bonus prizes such as the "Souvenir Henri Desgrange" (€5000) awarded to the first rider reaching an ex ante specified pass. Prizes are diversified in view of stimulating any rider's effort at some point in the race.

(f) The effort will be more intense the wider the gap between the winner's prize and the prize rewarding the runner-up, the wider the gap between the prize for the runner-up and the prize rewarding the third-ranked rider, so on. This scheme is particularly relevant when the differences between the competitors' winning abilities are small. For instance, in most tennis tournaments, qualifying for the next round usually doubles the player's money prize, and the tournament winner earns twice the amount of money the losing finalist gets. It is nearly so with the yellow jersey final ranking in the 2021 Tour de France (Table 7.2). A rider doubles his money prize when he climbs in the ranking from the 10th to the 8th rank, then from the 7th to the 6th rank, from the 6th to the 5th, from the 5th to the 3rd, and from the 3rd to the 2nd rank; the winner more than doubles his gains (times 2.5) compared with the runner-up. Such incentive scheme is in tune with

Table 7.2 Tour de France money prizes in 2021 (in euros)

Position	Final ranking					Individual stage	Mountain pass by category				
	Yellow jersey	Green jersey	Polka-dot jersey	White jersey	Best team		"Hors"	1st	2nd	3rd	4th
1st	500,000	25,000	25,000	20,000	50,000	11,000	800	650	500	300	200
2nd	200,000	15,000	15,000	15,000	30,000	5500	450	400	250		
3rd	100,000	10,000	10,000	10,000	20,000	2800	300	150			
4th	70,000	4000	4000	5000	12,000	1500					
5th	50,000	3500	3500		8000	830					
6th	23,000	3000	3000			780					
7th	11,000	2500	2500			730					
8th	7600	2000	2000			670					
9th	4500					650					
10th	3800					600					
11th	3000					540					
12th	2700					470					
13th	2500					440					
14th	2100					340					
15th	2000					300					
16th	1500										
17th	1300										
18th	1200										
19th	1100										
20th–160th	1000										

Source: ASO (2021)

the lessons derived from tournament theory. The prize structure for winning a stage is similar with also approximately a doubling of the monetary reward for each rank improvement among the four best-ranked riders. The prize structure for the other trophies is less in tune with tournament theory. In the race for the green, the white, and the polka-dot jerseys, financial gains are not doubled when a rider improves his rank by one. These trophies thus clearly have a less incentive prize structure. If one *ASO* objective is to multiply the races within the race, this must not go as far as disturbing the contention for the yellow jersey. That is the reason why incentives are significantly lower (€25,000 for the green and polka-dot jersey winners, €20,000 for the white jersey winner) and less structured according to tournament theory for trophies that only appeal to specialized riders like sprinters or climbers.

It should be remarked though that this focus on prize money is not always relevant in the context of cycling races. There are also significant indirect financial and nonfinancial gains from winning, such as a salary increase, the terms of the next contract to be signed, and fame. Since, as was shown in Chap. 3, salaries are much more important than prize money for cyclists, this incentive could be higher than the pure prize money. Possibly less attractive for riders, the incentive scheme of the Tour de France is basically made to be attractive for spectators and TV viewers through its effect on riders' efforts and fighting spirit. For more on strategic behavior in road cycling competitions, see Chap. 10.

4 The Tour's Success and Competitive Balance

One of the fundamental reasons why some sport contests are so successful and attract large audiences is their high competitive balance. Is the Tour's success due to its competitive balance?

4.1 Competitive Balance and Competitive Intensity in Road Cycling

Competitive balance may contribute to the attractiveness of the Tour in several ways (Bačik et al., 2021). First, it generates "uncertainty of outcome" (Rottenberg, 1956) and spectators' feeling of suspense, which supposedly are at the origin of the demand for most if not all individual or team sport events (Szymanski, 2006; Humphreys & Watanabe, 2012). Indeed, if spectators knew the Tour winner in advance or when and how he would turn out to win, few people would still be interested. Second, competitive balance may make the Tour attractive indirectly, by increasing competitive intensity. When riders are more equal (high competitive balance), this tends to incentivize them to fight harder and take more risks to win or to gain a better ranking (high competitive intensity). In contrast, when a rider or team clearly dominates the race, riders have no hope of winning and no reason to fight, except perhaps to maintain their ranking.

As cyclists sometimes collude to share prizes instead of fighting for victory (low competitive intensity), Tour organizers have repeatedly tried to improve competition among riders in order to attract more spectators and thus increase the Tour's revenues and profits (Bačik et al., 2021). This is why they have decided to shorten the race to make it more attractive to attack and counter-attack. As the Tour started being broadcast live on the French radio (1930s) and on French television (1960s) and then around the world, television broadcast rights became the Tour's main source of revenues in the 2000s (Fig. 7.1). Organizers shortened the race in order to make stages more nervous and livelier and to attract more radio listeners and television viewers. In the same vein, organizers have included short, particularly intensive, mountain stages since the 2010s, once again to increase competition. Finally, competition among riders may have increased following the prize pool changes that occurred since the 1980s. Indeed, to intensify competition, since the 1980s, the organizers have tripled the total prize pool (Mignot, 2016). In addition, the share of the total prize pool that goes to the yellow jersey went from less than 5% in 1980 to close to 25% today, which should give lower-ranked riders more incentives to take risks to take the leader's place.

4.2 The Measure of Competitive Balance in Cycling Stage Races

In league sports, where each team plays one on one against each of the other teams, quantifying competitive balance may seem relatively easy. A match's competitive balance is measured by teams' probabilities of winning (the closer to 0.5, the more competitive the match), and the championship's competitive balance is measured by some indicator of the dispersion of teams' probabilities of winning (Andreff, 2012; Groot, 2008), such as the Noll-Scully index. Attendance at baseball games depends, among other things, on "the dispersion of percentages of games won by the teams in the league" (Rottenberg, 1956; Neale, 1964). However, this indicator does not make sense for cycling stage races such as the Tour de France, mainly because winning the maximum number of stages does not amount to winning the whole race. Conversely, a rider may win the Tour without winning a single stage, as shown by Christopher Froome in 2017 and Egan Bernal in 2019.

At the stage level, several indicators of competitive balance or related concepts have been suggested in literature (Bačik et al., 2021). Larson and Maxcy (2014) measure outcome uncertainty at the stage level through the likelihood that the stage winner was part of a breakaway rather than part of the sprinting peloton. They find that in the three *Grand Tours*, the use of two-way radio technology by riders and team directors in 1992–2010 was associated with a higher, not a lower, likelihood of breakaway success (especially in mountain stages), compared with the 1985–1991 period. However, the share of stages which are won by a breakaway rider rather than a peloton's sprinter is an indicator of the unpredictability of stages' scenarios, not an indicator of competitive balance among riders or teams. In Chap. 11, Cabaud, Scelles, François, and Morrow review the literature on competitive balance in cycling, and they introduce an interesting measure of competitive balance at the stage level called intra-stage "competitive intensity." However, computing this sophisticated indicator requires detailed within-stage data, which are not always historically available (Cabaud et al., 2015; Scelles et al., 2017).

At the race level, the level in which we are interested, other indicators have been used. Mignot (2014) computes the number of times the yellow jersey switched from one rider to another (per racing day) and finds that this indicator shows no clear long-term evolution. A second index is the final time difference between the yellow jersey winner and the second-ranked rider. This difference was often over an hour during the 1920s, but it has been reduced in the past decades to some minutes or even only a few seconds. Based on this criterion, we find extremely balanced Tours in 1989 (when Greg LeMond beat Laurent Fignon by 8 seconds only), in 2007 (23 seconds between Alberto Contador and Cadel Evans), in 1968 (38 seconds between Jan Janssen and Herman Van Springel), and in 1987 (40 seconds between Stephen Roche and Pedro Delgado). The same benchmark exhibits very imbalanced Tours in 1952 (28 minutes and 17 seconds between Fausto Coppi and Stan Ockers), in 1948 (26 minutes and 16 seconds between Gino Bartali and Briek Schotte), in 1951 (22 minutes between Hugo Koblet and Raphaël Geminiani), and in 1969 (17 minutes and 54 seconds between Eddy Merckx and Roger Pingeon). However, these indicators are entirely based on the performances of a few race leaders (Andreff, 2015). This is why we suggest computing new, more robust measures of competitive balance in the Tour.

Therefore, building indicators of competitive balance in a cycling stage race requires making several choices, for which we rely on the innovative indicators proposed by Andreff (2015), which are inspired by the Noll-Scully index and are based on the standard deviation of the distribution of teams' average times around the mean. Variants of these indicators were calculated by Bačik et al. (2021), and we report their results in the following paragraphs. First, as cycling has long been a professional sport and most riders have been riding for money and as the highest cash prize has always been the yellow jersey, Bačik et al. (2021) choose to measure a rider's performance through his general classification time (in case he was among the finishers). They thus leave aside other – lower – cash prizes such as the king-of-the-mountains jersey and the best sprinter's jersey, which today earn a rider €25,000 (Table 7.2), i.e., only 5% of what the yellow jersey winner gets.

Second, Bačik et al. (2021) choose to compute indicators of competitive balance not only among all riders but also among the "top five riders" (i.e., the best five finishers) and among "team leaders" (i.e., each team's best finisher). Indeed, although formally any participant may win the Tour, in reality, only a tiny fraction of riders are able to compete for the yellow jersey, which is why they focus on competitive balance among the top five riders. In addition, because of labor division within teams (Candelon & Dupuy, 2015), at most one rider per team usually competes for the yellow jersey (his teammates sacrifice their personal performances to help him win the yellow jersey), which is why they also address competitive balance among team leaders. Overall, these analyses give a relatively complete picture of the evolution of competitive balance.

Third, Bačik et al. (2021) choose to compute indicators of both static and dynamic competitive balance. While "static" competitive balance is the degree of parity among opponents in a single edition of the race, "dynamic" indicators measure to what extent the results of an edition of the Tour may have been predicted by the results of the previous edition. As is well known, several riders such as Jacques Anquetil, Eddy Merckx, Bernard Hinault, Miguel Indurain, Lance Armstrong, and Christopher Froome have won the Tour two or more years in a row. What is needed is an indicator based on more than a tiny proportion of riders. A simple indicator of static competitive balance is the share of riders who finished the race. The corresponding indicator of dynamic competitive balance is the share of finishers in year n who had already finished the race in year $n - 1$ (given that they had started). They also choose to measure competitive balance regarding race completion as well as final time.

4.3 *The Evolution of Competitive Balance in the Tour de France: 1947–2017*

ASO made some of the historical statistics of the race available (ASO, 2021). Bačik et al. (2021) collected these data along with additional data from www.tourfacts.dk and used them for analyzing competitive balance in the Tour de France. The collected data were organized in a database that is available in the form of a website, www.tdfrance.eu (Bačik & Klobučnik, 2013). These data include information on all participants in each Tour from 1947 to 2017, including information on riders such as Lance Armstrong who were disqualified after the official results were published. For each Tour, they have the following individual information: the name of each rider who started the race; the name of his team, whether he finished the race; and if so, his final time. Practically, the performance of an individual rider who finished the race is calculated as its delay behind the winner, in percentage of the winner's time. Below, we report the main results of Bačik et al. (2021).

4.3.1 Static Competitive Balance Regarding Race Completion

Since 1947, the number of riders has increased from 100 to close to 200, and more and more of them, from 50% in the late 1940s to 80% now, have been able to finish the race. These changes may have induced more competitive intensity among riders but perhaps not necessarily more competitive balance among them, especially if those additional starters tend to perform less well than the others. Over the same period, teams' finish rates have become more similar to each other, i.e., more concentrated around their mean, which indicates these rates now differ less from one team to another. Teams tend to finish the Tour with more and more similar shares of their riders left, which enables them to compete with each other on a more and more equal footing.

4.3.2 Static Competitive Balance Regarding Final Time

In the 70 Tours between 1947 and 2017, the top five riders' mean delay has always been inferior to 0.35% of the winner's time. In this sense, one might argue that the Tour includes a fair share of competitive balance – and perhaps also competitive intensity – among top riders. In addition, the top five riders' mean delay slightly decreased from the 1950s (when it was equivalent to 0.17% of the winner's time, on average) to the 2010s (0.08%). This means that competitive balance and intensity have slightly improved over time. However, these improvements have not started or accelerated in the 1980s, which means they most likely are unrelated to the 1980s increase in the number of riders and teams and change in prize structure (Table 7.2). At the same time, the dispersion (coefficient of variation) of the top five riders' delays has remained at a roughly constant level over the whole period, which means that once the slight decrease in the top five riders' mean delay is taken into account, top riders' performances have remained at the same distance to each other.

In contrast, team leaders' mean delay has tended to increase since the late 1960s, from 0.3% of the winner's time in the second half of the 1960s to 0.8% in the 2010s. This is coherent with the fact that fewer team leaders than before are now able or willing to compete for the yellow jersey – many of them actually compete for other prizes, including stage wins. Team leaders' delays have also remained at a roughly constant level of dispersion over the whole period (around 1 or a bit below), which means team leaders have not become closer to each other.

Overall, these results reflect a slight improvement in static competitive balance among top riders since 1947, but deterioration in static competitive balance among team leaders since the late 1960s.

4.3.3 Dynamic Competitive Balance Regarding Race Completion

From the late 1940s, more and more riders participated in consecutive Tours. In addition, evermore riders who participated in consecutive Tours were also able to finish both races, from 40% in the late 1940s to close to 50% in the 2010s. Thus, it became easier to predict from one year to the next who the Tour finishers would be. More importantly, the correlation between teams' finish rates in consecutive years has mostly been positive, which means that teams with a high finish rate in one year may be expected to also have a high finish rate the following year. However, since the 1950s, this indicator has been on a decreasing trend, which means that teams' finish rates tend to be less predictable from one year to the next.

4.3.4 Dynamic Competitive Balance Regarding Final Time

How predictable are the names of each year's best five riders? To answer this question, one may calculate the correlation between the delays of the best five riders of year n and the delays of the same individual riders in year $n - 1$ (if they already participated in the Tour in year $n - 1$, whatever their final ranking). This correlation has mostly been strongly positive (0.51 on average), which lends support to Andreff's claim (2015) that "cycling fans are not often surprised by the name of the final winner of the race, usually not even by the three riders sharing the podium." In addition, this correlation has not followed a clear trend over time, which means that top riders' performances have remained roughly as easily predictable from one year to the next as before.

How predictable are the names of each year's best teams? One may calculate the correlation between the delays of teams of year n (proxied by the delay of each team's best rider) and the delays of the same teams in year $n - 1$ (if they already participated). This correlation has also been mostly positive (0.39 on average), and it has not tended to decrease since the 1970s. In other terms, the performance of a team leader in a given year has remained as predictive of the performance of the leader of the same team the next year. This might not be as much of a problem as one might think though. Buzzacchi et al. (2003) have shown about the open soccer leagues of Europe that "as long as the contest within each season is close (e.g., measured by standard deviation of win percent), fans may be indifferent to dominance by a small number of teams over many seasons."

Overall, these results reflect no clear improvement in dynamic competitive balance among top riders or among team leaders. Riders' performances have not become harder (or easier) to predict from one year to the next.

4.4 Discussion

What do the results of Bačik et al. (2021) tell us about the evolution of competitive balance in the Tour de France? In static terms, teams have tended to finish the Tour with more similar shares of their riders left, while in dynamic terms, teams' year-to-year finish rates now tend to be less predictable from one year to the next than was the case before. In these respects, competitive balance has improved over time. More importantly, static competitive balance has improved among top riders, which means that top riders have tended to have more and more equal performances. Whatever the causes of this evolution, it is a major trend in Tour history. Static competitive balance among team leaders has deteriorated since the late 1960s, however. Finally, dynamic (year-to-year) competitive balance has not improved over time among top riders or among team leaders, which means riders' performances have remained relatively "easy" to predict from one year to the next. For the public, however, getting to know the teams and the names, faces, and voices of the few contenders who are most likely to perform and win in the coming years may be as much an advantage as a disadvantage. Overall, these findings are mixed: they combine improving competitive balance among top riders and deteriorating competitive balance among team leaders.

A common point of all these findings, however, is that none of the measurable indicators of competitive balance have changed much since the 1980s. This suggests that variations in competitive balance did not play a major role in the increasing economic success of the Tour since the 1980s. These results fit well with other results according to which variations in the success of the Tour de France depend little on the cycling dimension of the show. Poll data concerning French people's reasons for being interested in the Tour stress the importance of landscapes relative to sport matters such as competitive balance. In 2018, among the 27% of adults in France who declared that they were interested in the Tour, the most common reasons for being interested were that "the Tour is part of the French heritage" (61%) and "the beauty of landscapes crossed" (53%), more than "the sporting aspect of the competition" (31%) and "riders' efforts" (28%) (BVA, 2018). Similarly, from 1997 to 2012, Flemish Tour de France TV viewership has been shown to depend less on race developments such as competitive balance than on stage characteristics such as mountain stages and weekend stages (Van Reeth, 2013).

In an event as complex as the Tour de France, competitive balance is likely difficult to manipulate. Perhaps one of the few ways to increase competitive balance among Tour team leaders would be to reduce the number of riders per team, as has been done since 2018, which may both reduce and equalize resources available to team leaders (Van Reeth, 2015a). Similarly, Buzzacchi et al. (2003) have demonstrated that the closed leagues of North America (football, baseball, hockey) are much more balanced than the open leagues of Europe (soccer), in the sense that relatively more teams are likely to experience any given level of success in a given period of time. This is because of the greater extent of resource equalization measures used in North American professional sports, such as draft rules, roster limits, salary caps, gate revenue sharing, or collective merchandising.

If competitive balance is not what has driven more spectators to the Tour de France since the 1980s, then what is it? The most likely candidate is better-quality and longer television broadcasting. The proportion of the French population on the roadsides of the Tour decreased from the 1950s and 1960s to the 1970s and 1980s (Mignot, 2016), likely because the show has become even better on TV. The creation of additional private television channels in France and other European countries in the 1980s, including networks such as *Eurosport*, increased competition to get the Tour's TV broadcasting rights. This development also incentivized the channels to improve broadcasting quality in order to increase their ratings and return on investment. On the Tour, motorbikes and helicopters now carried multiple cameras which filmed scenic landscapes as well as close-up images of live race interactions and spectators' reactions (Van Reeth, 2015b). The increasing economic success of the Tour since the 1980s is likely not due to more competitive racing, but instead to better broadcasting of the event.

5 Conclusion

Each year, the Tour de France attracts millions of people along the roads and reaches a global TV audience. This results from its nice design, appropriate management, and modern model of finance based on TV rights revenue, but also from its good fit with tournament theory. However, the Tour's increasing economic success since the 1980s cannot be related to increasing competitive balance. Quite the contrary, the Tour de France is an economic success story *in spite of* competitive imbalance. The increasing economic success of the Tour since the 1980s is likely not due to more competitive racing, but instead to better broadcasting of them. While the birth of the Tour de France in 1903 was related to the development of French sport newspapers and its interwar success was related to live radio broadcasting of the race finishes, its current economic success seems mostly due to better-quality television broadcasting worldwide – another development in the sphere of the media, rather than in the race itself. In addition, social media might be the next step in bringing the Tour to the fans. Improvements in broadcasting continue to this day, as exemplified by ultralight on-board cameras that are fixed on some bicycles, enabling spectators to see, hear, and experience the same things as champions do.

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Chapter 8
Willingness to Pay for Professional Road Cycling Events

Willem I. J. de Boer and Ruud H. Koning

1 Introduction

Most large scale sport events, including major professional road cycling events, cannot be organized without some financial support from national or local governments. Public policy decision makers thus face a difficult problem: how should they value hosting or organizing such an event? This question is made even more difficult by the fact that a decision to bid for the organization of an event is made under considerable uncertainty, likely years before it actually takes place. The tools available to decision makers to value the event are limited.

Professional road cycling events are usually held on public roads, cover large distances, and go through many villages and cities. Unlike many other sport events, road cycling events come to the public instead of the other way round. As a result, cycling events affect many people, both positively and negatively. Some of these effects are tangible, such as the economic impact (Chap. 5), while other effects are intangible, such as personal joy or the environmental consequences.

The use of public roads makes road cycling events mostly nonexclusive: fans cannot be prevented from seeing the race. Moreover, watching the race from the side of the road is also—to a large degree—non-rivalrous: a fan standing at the side of the road does not prevent another fan from seeing the race from a different location. Consequently, professional road cycling events have the characteristics of a

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public good (Downward et al., 2009). Other examples of public goods are clean air and public knowledge.

One important intangible component of the value of organizing a sport event is utility derived by the visitors. Visitors of a cycling event appreciate the event, as is evident from their willingness to travel to see the cyclists pass by, and to spend time to do so. In most cases, road cycling events are free to visit, as fans can watch the race just by standing at the side of the road. Alternatively, they may watch the race on television at home. And, as we will see, even non-users (i.e., individuals that do not visit or follow a race in the media) can still derive value from the cycling event. However, in all cases no explicit economic transactions take place that can be used to value the organization of the event. Moreover, it is possible that local residents affected by the organization also derive disutility from the event, for example, when nearby roads are closed because of the cycling race.

In this chapter we discuss one method to value cycling events that can be used in ex ante decision making: estimation of the willingness to pay (WTP) by visitors and local residents. In the economics literature, WTP has been used extensively to value public goods. Detailed information is given in Portney (1994), Hanemann (1994), and Carson (2012), and a critical stance is taken in Diamond and Hausman (1994) and Hausman (2012). A recent overview of this method of valuing events is presented by Orlowski and Wicker (2019).

In the remainder of this chapter, we first provide a theoretical framework of willingness to pay (Sect. 2). We then proceed with presenting the outcomes of WTP studies, with a short introduction of WTP of sport events in general (Sect. 3), followed by a deeper exploration of research outcomes relating to professional cycling (Sect. 4). We end the chapter with some concluding thoughts (Sect. 5).

2 Theoretical Framework of Willingness to Pay

The theoretical foundation of estimation of willingness to pay is based on microeconomic utility theory. The assumption is that consumers maximize their utility function, where utility depends on all the goods that are consumed. One of those goods can be the (cycling) event under consideration. Of course, the consumption bundle that maximizes utility depends on prices, income, and preferences. A higher level of utility can be attained if income is higher. Also, the relative prices of goods determine the relative attractiveness. Finally, preferences tend to be specific to each individual: young people may have strong preference for music festivals, other people may prefer to watch sports on television, and individuals with a very strong preference for cycling may spend time and money to attend a professional cycling event. Willingness to trade off consumption of tangible goods against paying to attend a sporting event measures the value the sport fan attaches to the event. When goods are traded on a marketplace, preferences of consumers can be identified by analyzing their actual consumption decisions. The actual consumption decisions reveal the preferences of the consumers.

This approach of identifying preferences based on observed consumption decisions becomes complicated in the context of professional cycling events. The public good characteristic of a professional road cycling event means that fan demand may be expressed without any economic transactions. To measure the value of such non-market dimensions of a sport event, the contingent valuation method (CVM) can be used (Walker & Mondello, 2007). In the CVM, individuals are asked to state their willingness to pay for an event to take place. The CVM method originates from environmental economics, but has been widely adopted in other research fields, including sports economics. Basically, WTP is extracted from surveys that ask consumers which two alternatives they find equally attractive (i.e., provide the same utility). More formally, a consumer who disposes of an income y and faces prices p maximizes a utility function $U(x, \text{event}; p, y, \theta)$, with x the goods the consumer enjoys, and event indicates whether or not the event is organized. θ indicates the preferences of the consumer. Preferences usually depend on sociodemographic variables as age, gender, education, family situation, etc. A survey elicits choices that are considered to be similarly attractive to the consumer: one alternative is the case when the consumer retains all income y, but there is no sport event. Utility is then $U(x_{\text{no event}}, \text{no event}; p, y, \theta)$. The other alternative is that the consumer gives up some income (the willingness to pay) but enjoys the event. In this case, utility becomes $U(x_{\text{event}}, \text{event}; p, y - \text{wtp}, \theta)$. The hypothetical organization of the event results in two changes: income is reduced by the willingness to pay, and as a consequence the consumer reduces the consumption of some goods. However, the consumer may now derive benefit from the event. By asking the reduction in income that would make both alternatives (higher income with no event or slightly lower income with the event) equally attractive, a researcher can estimate the willingness to pay. Since this technique uses a hypothetical situation, the value of an event is based on stated preferences instead of on revealed preferences.

The nature of this approach implies that WTP will vary between individuals, even if it applies to the same event. Income may vary between consumers, prices faced by different consumers may vary, and certainly preferences will vary between consumers. This implies there is not a single WTP, but that WTP depends on income, demographic variables (taking a Saturday off to attend a cycling event is different for a fan who has three small children than for someone who is single and without children), and all other variables that influence preferences.

Taking the formal model above as an analytical framework, a more comprehensive interpretation of WTP can be developed. Consumers may enjoy an event because they have invested time to build up consumption capital to appreciate the sport (so the variable *event* incorporates consumption capital as well). Consumption capital may have been built up during earlier presences at similar events. In other words, even though the formal model above is static, the reported WTP may reflect such dynamic considerations as well. Not only local residents may express their preferences by stating positive WTP. Furthermore, non-users of the event (e.g., local and nonlocal residents who follow an event on television) may also express positive WTP, increasing the overall value of the event. Of course, also other values may be taken into account by respondents: investments in road safety may be necessary for a major cycling event, but may also or may not be valuable for future road use.

An important issue in the design of the survey to elicit willingness to pay is that the question is based on a hypothetical situation. Why would a respondent answer according to his or her preferences? It may be important to provide incentives to respondents so that they state their true preferences. Miller et al. (2011) show that studies with such incentives provide more reliable outcomes than studies without incentives.

A second important issue when applying this method is that the actual event has to be clear to the respondent. For some respondents, it may just be the cycling race itself, while for others it may include a side program, if any. Also, the financial consequences have to be clear: which income concept is reduced by the willingness to pay? Is it before tax income, after tax income, or an increase in municipal taxes? Answers from respondents are comparable only if they relate to the same interpretation of the question.

Contingent valuation is one approach to estimate WTP, having as main advantages that it can be performed ex ante and that it incorporates the preferences of both users and non-users. A clear disadvantage is that it is based on stated preferences, making the design of the questionnaire very important.

3 Willingness to Pay for Sport Events

Before presenting the specific research on willingness to pay for professional road cycling events, we first look into the knowledge of willingness to pay for sport events in general. This broader perspective is interesting because the research for cycling events is very limited. Within the literature on willingness to pay in sports, sport events was the context that has received the most interest of researchers (Orlowski & Wicker, 2019). Other contexts include (international) sporting success, membership fees for participating in sports, and the investments in sport facilities.

With regard to sport events, the most attention of willingness to pay research has gone to mega-events, such as the Olympic Games and the FIFA World Cup Football (Orlowski & Wicker, 2019). To host such events, often large public investments are necessary. In such cases, ex ante willingness to pay research can contribute to gaining an insight in the public's perception and support of a bid for the event. In recent decades, this perception of the public has become increasingly relevant (Streicher et al., 2017). While the costs of hosting mega-sporting events have skyrocketed (Kesenne, 2012; Short, 2018), economic research showed that the effects on a country's economic growth or employment have been absent or marginal at best (Cornelissen & Maennig, 2010; Coates & Szymanski, 2015; Kobierecki & Pierzgalski, 2022). Similarly, there is no evidence for other social benefits of hosting mega-events, such as increased sport participation levels (Mahtani et al., 2013; Mair et al., 2021). According to Maennig (2019) "positive intangible effects are usually the (only) significant effect of mega-sporting events found in academic studies."

Orlowski and Wicker (2019) compared the existing WTP studies. Average willingness to pay for mega-events varied between €4.26 (ex ante) for hosting the 2006 FIFA World Cup Football in Germany (Süssmuth et al., 2010) and £220 (€264) for citizens of London for hosting the 2012 Summer Olympics, in the form of ten annual tax increases of £22 (Atkinson et al., 2008). For other sport events, average WTP varied between €1.75 of Lisbon citizens to host the 2004 UEFA Euro Football in Portugal to NOK965 (€96.5) of local residents for hosting the World Skiing Championships in Trondheim, Norway (Andersson et al., 2004). However, it is very difficult to compare the outcomes of most of the studies, due to differences in the payment vehicles (tax or a lump-sum payment), payment period (annual or one-off), research period (ex ante or ex post), and methods (dichotomous, payment ladder, or open response), definitions, and contexts.

As a result of the diversity in approach and the relative limited amount of research on willingness to pay for sport events, there is not much consensus on the determinants of WTP (yet). However, in almost all studies a higher income level of the respondent seems to have a positive effect on both the chance of having a willingness to pay for large sporting events as well as on the amount, and WTP is higher for males than for females (Atkinson et al., 2008; Coates & Szymanski, 2015; Orlowski & Wicker, 2019; Bakkenbüll & Dilger, 2020). For other socioeconomic variables, such as age, education, or participating in sport, evidence so far is either mixed or not significant (Orlowski & Wicker, 2019).

4 Willingness to Pay for Professional Road Cycling Events

In this section we present the outcomes of the willingness to pay research on professional road cycling events. To our knowledge the only relevant published studies concerned the Ronde van Vlaanderen (Vekeman et al., 2015), the 2016 *Grande Partenza* ("big start") of the Giro d'Italia (De Boer et al., 2019), and the 2017 UCI Road Cycling World Championships (Denstadli & Solberg, 2018; Solberg et al., 2018). We also present the results of research on the 2015 *Grand Départ* ("big start") of the Tour de France (De Boer, 2022), which has hitherto not been published, and for a mass participation cycling event. For each of the events we present a description of the event, the research method, as well as the outcomes, including the significant determinants of WTP. The research features and results are summarized in Table 8.1.

4.1 Ronde van Vlaanderen

The Ronde van Vlaanderen is one of the biggest 1-day cycling events. Usually held in early April, it is the most important cycling race of Flanders (Belgium) and it attracts hundreds of thousands of spectators every year. The Ronde van Vlaanderen

Table 8.1 Overview of CVM studies estimating WTP

Event, year, place	Author, year	Target	Payment vehicle	Measurement period	Mean WTP	Significant WTP determinants
Grand Départ Tour de France, 2015, Utrecht (the Netherlands)	De Boer, 2022	Event visitors	Entrance to the event	Entrance fee	€9.84	+Age; +Appreciation of the event
Grande Partenza of the Giro d'Italia, 2016, Gelderland (the Netherlands)	De Boer et al., 2016 De Boer et al., 2019	General public Gelderland province (target 1) General public rest of the Netherlands (target 2)	Donation to the organizer of the event	Ex ante: 2 months before the event (both targets) Ex post (target 1): week after the event Ex post (target 2): 4 months after the event	Ex ante (1): €3.58 Ex ante (2): €2.38 Ex post (1): €4.45 Ex post (2): €3.67	+Visit; +Media; +Income; −Age
UCI Road Cycling World Championships, 2017, Bergen (Norway)	Solberg et al., 2018, 2021	General public Bergen and surroundings	Income tax increase	Ex ante: 3 weeks before the event Ex post: 3 weeks after the event and 1 year after the event	Ex ante: NOK133 Ex post: NOK155	Unknown
Ronde van Vlaanderen, no specific year, Flanders (Belgium)	Vekeman et al., 2015	General public Flanders	Income tax increase	Year-round	€10.30	+Male; +Age; +Active cyclist; +Intensive user; +Probability to be a spectator; −Living in arrival, departure, or village of the tour

is called the "high mass" of cycling and considered by many to be part of Flemish sporting and cultural heritage (Derom & Ramshaw, 2016; Vanreusel, 2006).

In 2009, as part of a large-scale social "participation survey," a representative sample (n = 545) of Flemish citizens was interviewed face to face about their willingness to pay for the Ronde van Vlaanderen. The research was set up as a stated-preference method applying CVM. The research question, aimed at valuation of the event in general, not for one specific year, used an increase in taxes as the payment vehicle and read as follows:

> Assume that due to cost increases, the Ronde van Vlaanderen is no longer profitable and will no longer be organized in the future. If everyone pays a similar amount, the Ronde van Vlaanderen can continue to exist. That amount will be collected through an increase in the income taxes. Are you willing to contribute annually … euro, by means of extra taxes, to ensure that the Ronde van Vlaanderen will continue to exist? (Vekeman et al., 2015)

The research used a double-bounded dichotomous approach (see, e.g., Bateman et al., 2002), in which the respondent was presented with a certain amount for their WTP on which he or she could respond by accepting or declining. Next, the respondent got a follow-up amount that was higher (in the case of acceptance) or lower (in the case of rejection) than the first amount presented. Hence, for each respondent there were four possible outcomes: yes/yes, yes/no, no/yes, and no/no. Three different scenarios were distributed roughly equally among the respondents: first €5, then €11 or €1; first €9, then €16 or €3; first €13, then €20 or €7. Several models were estimated with each different assumptions about the distribution of WTP (normal, truncated normal, and Weibull) and with different shifts in WTP when responding to the follow-up question. In the best fitting model (Weibull) the median WTP was €4.2 and the mean was €10.3. Persons that visited the event in the past (more than once) had a significantly higher WTP. Similarly, WTP increased with age. Men, individuals practicing cycling as a sport (but not those doing other sports) and persons living in the Flemish Ardennes, the region where the final of the race takes place, had a significantly higher WTP. However, persons that live in the Ronde van Vlaanderen departure or arrival city had a significant lower WTP. Interpreting the outcomes at the household level, Vekeman et al. (2015) estimated that the aggregate value of the Ronde van Vlaanderen was €24.3 million for the region of Flanders as a whole.

4.2 Grande Partenza of the Giro d'Italia 2016

The Giro d'Italia is the second most important multistage cycling event, behind the Tour de France. The event kicks off with a so-called Grande Partenza, which usually consist of two or three stages in the same region, often including an individual time trial. Cities or regions inside and outside Italy bid to the race owner to host the *Grande Partenza*, which can attract hundreds of thousands of spectators and generates much media attention (Van Reeth, 2019). In 2016, the province of Gelderland, in the east of the Netherlands, hosted the *Grande Partenza*, which consisted of one time trial and two stages in line. Over 3 days, this event attracted almost half a million cumulative spectators (De Boer et al., 2016).

Two months prior to the event, (ex ante) research was carried out on WTP by both residents of the Gelderland province and by other inhabitants of the Netherlands.

In addition, an ex post WTP measurement was carried out for residents of Gelderland in the weeks immediately after the event (De Boer et al., 2019) and 4 months after the event among residents outside Gelderland (De Boer et al., 2016). A stated-preference contingent valuation method was conducted using the Longitudinal Internet Studies for the Social Sciences (LISS) panel, a highly representative panel of the Dutch population. For the host region of Gelderland, 572 respondents conducted both the ex ante and ex post questionnaire, while 585 respondents from the rest of the Netherlands filled in both questionnaires. Participants were ex ante confronted with the following hypothetical situation and open-ended question:

> As a result of the bankruptcy of a major sponsor of the "big start" of the 2016 Giro d'Italia, the organization has a major shortfall in the budget for the event. To have the cycling race still take place in Gelderland, residents are asked to contribute. If the total contribution of the public is insufficient, the Giro Start will be moved to Italy. What is the maximum amount of money that you personally are willing to contribute to maintain the start of the Giro d'Italia in Gelderland? (De Boer et al., 2019)

This question was slightly amended for the ex post situation, by using the past tense. At the ex ante measurement, 30% of the respondents from Gelderland were prepared to contribute to the event, while this was 21% for respondents from the rest of the Netherlands. Average ex ante WTP for these groups was €3.58 and €2.38, respectively. In the weeks after the event, 39% of the persons from Gelderland had a WTP larger than zero and the average ex post WTP increased by €0.87 to €4.45. After the event, 27% of individuals outside Gelderland were willing to contribute to the event and the average WTP had increased by €1.29 to €3.67. For residents of Gelderland, (the intention of) visiting the event or following the event in the media was both in the ex ante and ex post model significantly and positively related to WTP. In addition, income was significantly positive related to WTP, while educational level was significantly negatively associated with WTP. No significant relationship with WTP was found for both cycling participation and doing sports in general. Interpreting the outcomes at the individual level and for adults only, De Boer et al. (2016) estimate total ex post WTP for the 2016 *Grande Partenza* of the Giro d'Italia at around €6.5 million for the Gelderland area and €50 million for the Netherlands as a whole.

4.3 Road Cycling World Championships, Bergen 2017

In September 2017, the 90th UCI Road Cycling World Championships were held in Bergen, Norway. The event is owned by the International Cycling Union (UCI) and the organization is awarded to a different country each year. In return, the host country, region, or city pays a fee to the UCI. In 2017, Bergen hosted an 8-day event that included individual time trials and road races for (elite) men and women, juniors (men and women), and under-23 men, as well as a team time trial for professional elite cycling teams. According to an evaluation by Solberg et al. (2018, 2021), the World Championships were considered a success for the general public, but a financial disaster from an organizational point of view, resulting in the bankruptcy of the local organizational committee in early 2018.

Using a representative composite panel survey, the population of Bergen and the surrounding municipalities were asked about their WTP for the World Cycling Championships. The survey was conducted at three moments: an ex ante measurement 3 weeks before the event ($n = 712$), a first ex post measurement 3 weeks after the event ($n = 450$), and a second ex post measurement in October 2018 ($n = 254$), to measure long-term effects of the event. For representativeness, the results were weighted by age groups. The research question included in the survey was the following:

> Assume that the politicians in Bergen and the neighboring municipalities decide that several major events will be held in the city every year. These will be financed through an earmarked tax. The events will be offered to the population in the municipalities at greatly reduced prices. How much would you be willing to pay in such an earmarked annual tax (with a maximum amount of NOK 1000 [around €100]) for major international championships, such as the Road Cycling World Championships? (Solberg et al., 2018)

Before the World Championships, 65% of the respondents answered that they were not willing to pay anything for the event, while around 20% had a WTP of up to NOK350 (around €35) and 15% had a WTP of NOK350 or more. In October 2017 this distribution was 52%, 33%, and 15%, respectively, and a year later, in October 2018, it was 57%, 26%, and 17%. Average WTP increased from around NOK133 (€13.3) 3 weeks before the event to NOK155 (€15.5) 3 weeks after the event. Solberg et al. (2018) conclude that the ex post WTP of the event was larger than the ex ante WTP, with the highest WTP shortly after the World Championships. Further analysis, including average WTP for October 2018 and on factors that may be related to WTP, was not (yet) available. However, the financial debacle of the local organizing committee, which became public in 2018, did not seem to have a large impact on the WTP a year after the event.

4.4 Grand Départ Tour de France 2015

In 2015, the *Grand Départ* of the Tour de France, professional cycling's biggest event, was in Utrecht, the fourth largest city of the Netherlands. The *Grand Départ* 2015 consisted of an individual time trial in Utrecht and a stage in line from Utrecht to Neeltje Jans (in the southwest of the Netherlands). Immediately after the first stage of the Tour de France, visitors of the event were asked the following question:

> The start of the Tour de France was free to visit. Suppose this was not the case, how much would you be willing to pay for granting one person access to the event? (De Boer, 2022)

The possible answers were categorized as follows: nothing/€1/€2/€5/€10/€20/€50/€100/other/I don't know. The research was conducted online and respondents were recruited via social media, mainly *Twitter*. Of the respondents ($n = 330$), 60% was male and 92% had visited the individual time trial. The average age was 40 years.

Over two thirds (68%) of the respondents was prepared to contribute to the event, while 24% did not want to contribute anything and 8% answered “I don’t know.” Excluding the latter category, the average WTP was €9.84. Additional regression analysis shows that WTP was significantly higher for male visitors of the event, as well as persons who appreciated the event highly (giving it a 9 or 10 on a scale of 1–10). However, WTP was not significantly related with educational level, practicing cycling as a sport or the amount of time spent at the event.

4.5 Willingness to Pay for a Mass Participation Cycling Event

Apart from the four professional cycling events, Whitehead and Wicker (2018, 2019) conducted WTP research on the long-distance Blood Sweat and Gears bike ride, a participation-based cycling event in North Carolina, USA. Different from the direct WTP approach in the aforementioned research, they investigated the participants’ willingness to travel (WTT) for future events. Using actual travel costs, they transferred the outcomes into estimates for willingness to pay. The hypothetical scenario included five additional distances traveled:

> Suppose that you had to drive further to get to Blood Sweat and Gears in 2016 compared to your driving distance in 2015. For example, you might move further away from Valle Crucis. Would you plan to participate in the 2016 Blood Sweat and Gears if you had to drive 30/60/90/120/150 more one-way miles? (Whitehead and Wickerx, 2018)

For each of the five additional distances, the response categories were: definitely no/probably no/not sure/probably yes/definitely yes. The resulting (conservative) estimates for the average WTP ranged from $41 (around €35) to $57 (around €48). Several logistic regression models were estimated to look for potential factor that influenced WTT/WTP. Satisfaction with the event and income were positively associated with the probability to travel (in all models), while increased travel costs were negatively associated with this probability.

5 Conclusion

This chapter described the contingent valuation method (CVM) that has been used in research to assess individuals’ willingness to pay for the organization of professional cycling events. Although CVM has become an increasingly popular method to assign a monetary value to public goods in general and to sport events in particular, the amount of research on WTP for professional cycling events has been limited. We found four studies that all used the stated preference of WTP in these events, with only two having (thus far) been published in a peer-reviewed journal. It is therefore difficult to draw general conclusions from this small body of literature. However, it is possible to make some interesting observations.

First, although all studies have used the direct approach of the stated preference using CVM as the research method, the main objective of the studies differed substantially. One study focused on the sporting and social value for the public of an annual event (Ronde van Vlaanderen), two studies investigated the ex ante and ex post nonmarket values of one-off events in a given region (the *Grande Partenza* of the Giro d'Italia in the province of Gelderland and the UCI Road Cycling World Championships in the region of Bergen), and a fourth study only looked at the value for visitors of a one-off event (the *Grand Départ* of the Tour de France in Utrecht).

Second, all research showed significant positive WTP, not only for persons that were involved in the events, e.g., by attending the event or following it in the media, but also for persons that did not have a (strong) connection with the event. This suggests that large-scale professional cycling events do have a positive public value. That being said, WTP seems to be significantly larger for persons who are more involved in the event than those who are not.

Third, the two studies that conducted ex ante and ex post research both have a higher average WTP after the event. The results suggest that hosting a (successful) event can "win over" doubters and increase the public value of the event. The case of the 2017 Road Cycling World Championships shows that even financial deficits and negative publicity related to the event may not severely harm that public value.

The limited number of studies on WTP for cycling events implies that more research is needed to be able to compare findings and draw general conclusions. In addition, other types of research designs (including willingness to travel methods) may strengthen the knowledge base and credibility of WTP studies. Large-scale cycling events attract strong audiences, but have seldom been able to attract income from the spectators (e.g., through entry fees). As a result these events are usually financed (in part) with public money, often on the expectation that the events will not only generate a positive economic impact, but good vibes and positive externalities to the local community as well. To verify and support this claim, both ex ante and ex post WTP research can play an important role. In addition, by, e.g., using the willingness to accept concept, future studies should also consider negative externalities, such as traffic congestion or environmental nuisance, to provide a more balanced picture of the intangible effects of the organization of cycling events.

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Part III
Personnel and Performance Issues in Professional Road Cycling

Chapter 9
Human Capital and Labor Exchange in Road Cycling

Daniel J. Larson and Jean-François Brocard

1 Introduction

The labor market of professional cyclists has experienced an important professionalization in recent decades related to the strengthened commercial structures of the teams, the complex organization of the rider race programs, and the increasing medical monitoring of riders. This evolution was accompanied by more formalized relationships between riders and team managers which developed as a consequence of the larger sums of money flowing into the market and cycling's historically high rates of roster turnovers. This chapter explores the economic issues specific to the overall labor market of professional road cycling.

First, the determination and development of road cycling human capital will be discussed (Sect. 2). This section highlights and reviews the small amount of literature related to the subject of human capital in professional cycling and offers some preliminary analyses in some cases where none exists. While Chap. 11 explores the specific considerations and complexities that go into modeling and measuring cycling performances, this chapter discusses the general components of the human capital stock of professional cyclists and the avenues for its development.

Second, the facilitation of the movement of the riders into the labor market via agent representation will be characterized and analyzed (Sect. 3). In this context, intermediaries or rider agents (hereafter RAs) emerged and thrived by representing riders in their relationships with team managers, but also with individual sponsors

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or criterium race organizers. The topic of RAs has, to our knowledge, never been directly or indirectly tackled in the academic economic literature. As a consequence, the findings of this chapter are based on a collection of information gathered from interviews with industry experts, such as current professional team managers, international and national riders' associations' managers, former riders, current licensed agents, and national federations' executives, and an exhaustive study of the existing dedicated secondary literature. These primary personal interview sources included eight individuals with an average of 14.3 years of experience working within the business of professional cycling, all of whom had direct experience related to cyclist agents over the past 5 years.

Third, current issues regarding the bargaining power imbalance and labor organization within the market for professional cyclists will be discussed. While there is substantial institutionalization of collective bargaining in other professional team sports, particularly in North America, the sport of cycling has struggled to develop these broader pooled labor market representations for athletes. In Sect. 4 we present some outlines on collective bargaining and rider unions and discuss the most recent developments in this respect.

2 Human Capital in Professional Cycling

Human capital is commonly defined as an individual worker's stock of personal abilities, knowledge, skills, and general productive capabilities (Mincer, 1974; Schultz, 1981; Becker, 1993). Human capital, under the right demand conditions, allows individuals to function as revenue-generating assets for an organization. In exchange for these "value creating" services, an organization pays a wage to the worker in return for their labor and in theory will choose to employ a worker if the wage does not exceed the marginal value of the worker's production.

The primary source of revenues for professional road cycling businesses in general, and for cycling teams in particular, is sponsorship (Chap. 3). The value of cycling team sponsorship agreements is derived directly from the publicly and commercially broadcasted races and those general images of the cyclists that the competing teams employ. Broadcasts naturally focus on race leaders and winners over the course of an event. Therefore, the supply of the cyclists' human capital, coupled with high levels of consumer demand to pay via their time and attention to view these performances, underpins the commercial viability of the sport (as is the case with most other professional sports). This revenue generation potential for an individual professional cyclist is based on his or her overall image and competitive capacity, which can be viewed as being derived from (1) innate or developed physical characteristics and (2) innate or developed cognitive skills used to employ productive racing strategies.

2.1 Physical Components of Cycling Human Capital

The physical components that allow a cyclist to generate revenue can be broken down into two nonexclusive categories: (1) physiological ability and (2) general attractiveness. On the one hand, spectators of a sport might be attracted to the physical skills and maneuvers on display, which would often require exceptional physical gifts, while on the other hand, the overall attractiveness of the participant, including but not limited to physical attractiveness and charisma, could concurrently drive and/or impair fan interest.

There has been extensive study of the physiological characteristics of professional road cyclists, largely in the exercise science literature, and several parameters have emerged as dominant predictors of productive capabilities (Olds et al., 1995; Faria et al., 2005b). Talent identification and performance prediction efforts have previously focused on overall oxygen uptake capabilities, i.e., VO_2 max (Nevill et al., 2005), as a predictor of cycling performance. This measure reflects an athlete's ability to process and use oxygen during maximal exercise. While this physiological characteristic has done well to identify the requisite ability to enter the elite level of the sport, it has at times proven unreliable in predicting competitive success at the highest levels (Menaspa et al., 2010). More recent efforts have now evolved into measuring functional power (i.e., Watts generated) across a variety of durations and at lactate threshold (the point beyond which performance at that the same work rate is unsustainable). The development and increased affordability of accurate cycling power measurement devices and simple blood lactate measurement techniques have opened the door to measurements that are more accurate in predicting cycling ability.

Newer assessments have taken into consideration peak power outputs, cycling economy, and cycling efficiency. These measures include but are not limited to power at onset of blood lactate accumulation (W_{OLBA}), power at lactate threshold (W_{LT}), lactate threshold as a percentage of VO_2 max, and peak power output at VO_2 max (Faria et al., 2005a). Economic analysis of secondary data of the cyclist production process has also highlighted the importance of body mass index (Prinz, 2005; Prinz & Wicker, 2012), which is a measure that logically interacts with these physiological function parameters, e.g., power to weight ratios (Faria et al., 2005a), to predict competitive outcomes. For example, any cyclist with a high power output (physiological capability) generally benefits from having a lighter, smaller body to propel up mountains and through the resisting air.

Much less studied is the role that physical attractiveness and charisma plays in the generation of sponsorship revenue for professional cyclists. Several studies have disclosed economic returns to attractiveness, with wage premiums found for individuals across several domains (Hammermesh & Biddle, 1994; Mobius & Rosenblatt, 2006; Scholz & Sicinski, 2015). There have been limited applications specific to sports, with a study of American football (Berri et al., 2011) as the only known examination. In addition to general attractiveness, professional cyclists do also have the additional ability to become a "media darling" by seeking to appear more often during broadcasted race events by frequently partaking in breakaway strategies, which draw the camera. Notorious examples of these “characters” include Jacky Durand in the 1990s and more recently riders such as Thomas Voeckler and Thomas De Gendt. These cyclists have all been described as “capturing the hearts” of the public for their breakaway endeavors. While this strategy does interact somewhat with the cyclist’s physiological capabilities, a cyclist still might generate greater value for a cycling team by intentionally appearing more often in early race breakaways in order to generate more camera time for their sponsor, even if it is to the detriment of their ultimate finishing position in the competition. This is because the breakaway strategy succeeds so infrequently. Nevertheless, a unique type of competitive personality can be viewed as part of an athlete’s personal stock of charisma, which appeals to cycling fans.

2.2 Cognitive Components of Cyclists’ Human Capital

The sport of cycling presents to its competitors an intricate game of strategy and nuance that exceeds that of nearly any other individual sport. The complex interactions that riders face with their individual competitors, competitor teams, environmental conditions, and among their own teammates present immense cognitive challenges to participants. Cyclists not only have to manage their own effort, energy levels, and pacing, but they also have to incorporate several other complicating factors. For example, a rider must understand and apply the basic principles of physics in order to optimize drafting and aerodynamics relative to other competitors. Additionally, the strategic choices of competitors must be anticipated and incorporated, which includes all of the individual riders’ motivations as well as the strategic decisions and directives made by the directors of the other teams. The ability to read a race situation, to make (or follow) strategic decisions (of team managers), and to respond with timely race tactics clearly demands well-developed cognitive capabilities within any given cycling competitor. Therefore, an athlete’s human capital stock that is related to these skills and any experience developed in managing these race situations would likewise be expected to improve his or her performance outcomes. These skills can develop within very specific race situations, or in a general sense through the accumulation of racing experiences at different competitive levels.

In addition to in-competition cognitive development, there can be learning and improvement in regard to training and preparation. Athletes with years of training experience will not only understand general training principles better, but they will also have learned much more about their own personal requirements and physiological responses to training, which can maximize their physical improvements and performances at key events. It is often these unique personal requirements and corresponding training specificity that lead cyclists to employ personal coaches outside of team organizations early in their elite-level careers (Larson & Maxcy, 2013).

2.3 Athletes

The human capital stock of a professional cyclist can be viewed as the combination of the individual's physical and cognitive capabilities at a given point in time. This stock could further be viewed as being composed of both innate components and those that can be developed through physical training and practice respectively. This section will first offer some descriptive context to professional cyclists' careers in general and then examine what is known about the relative contributions of genetics (nature) and development efforts (nurture) to a cyclist's total human capital.

2.3.1 Career Progression and Specialization

In many ways, the progression of a professional cyclist's career is a protracted revelation of their ultimate competitive capabilities. The concept of imperfect information in the labor market may also play a part not only in the contract offers athletes receive but also in their success and tenure at the highest levels of competition.

In terms of career length, cyclists at the highest professional level enjoy comparatively long-lived careers. As an example, of the 92 cyclists who retired from the WorldTour in 2012, the average total WorldTour tenure was 5.8 years, and their total professional cycling careers (at all levels) averaged over 9.5 years (cqranking.com). This compares to average career lengths in the National Football League of 3.5 years, 4.8 years for the National Basketball Association, and 5.6 years for Major League Baseball (Sandler, 2012). Examining the distribution of career lengths offers further insight into the workings of the labor market in terms of talent identification (Fig. 9.1).

Because the capabilities of racing cyclists are not as easily observed as those of athletes in other sports, there is an information asymmetry and/or employee-employer matching problem that must be resolved in the cyclist labor market (Larson & Maxcy, 2013). As such, cyclists are often signed to contracts on an annual or bi-annual basis, where teams are essentially able to institute a "try-out period" of probationary employment in order to better evaluate an athlete in terms of both skill and whether or not they will fit within their organization. The short contractual terms between teams and cyclists is reflected by the large proportion of athletes that have very short careers at the WorldTour level: more than a third exit in the first 2 years, and less than half stay at the top level for more than 5 years. However, for those that do demonstrate lasting ability, careers at the WorldTour level often exceed 10 years.

Racing cyclists are not homogenous in terms of specific skills and abilities. Cyclist workers perform a variety of specialized roles within a team. These specializations range from pure sprinters, who excel in flat races, to climbing specialists, who are also often team leaders in stage races where mountainous stages factor prominently in the overall outcomes. Some cyclists are designated team leaders and/or captains, while others are considered supporting riders. Other within team

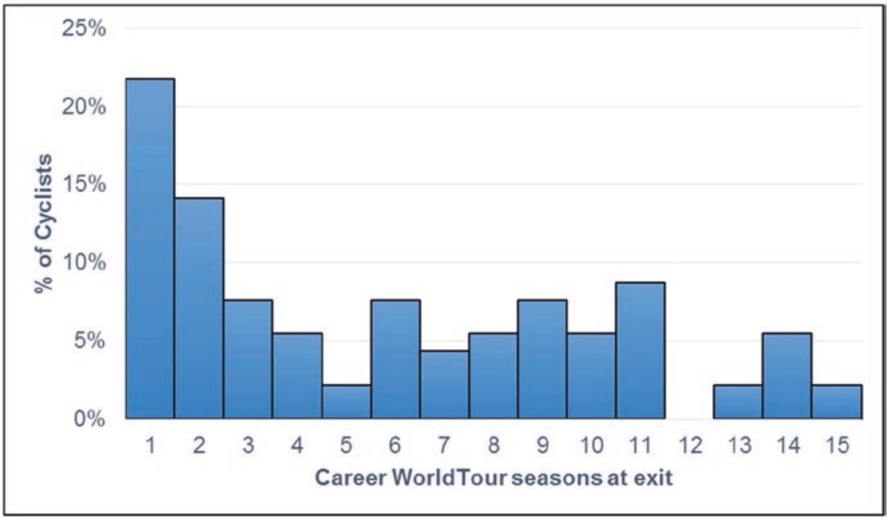

Fig. 9.1 WorldTour seasons at exit (2012 cohort, $N = 92$). (*Source*: Own calculations based on data from cqranking.com)

specialties might include "classics riders" who are specialists that excel in the single day events which feature relatively short steep climbs, and various other unique challenges, for example, races that follow narrow cobblestone roads. Additionally, some riders who fill a supporting role may also specialize in individual time trial events where the ability to maintain the highest steady work rates over extended distances (usually on relatively flat courses) differentiates the winners from losers. Each particular specialization corresponds to unique physiological capabilities that are derived both from genetic endowment and training, which is discussed below.

The general characteristics and capabilities that determine entry into the vocation are evident relatively early in a professional cyclist's career. However, the clarity of purpose and role typically becomes more solidified as the athlete's career progresses. For example, when sampling the specialties listed within the rider profiles on team websites, first and second year riders are much more likely to have three or more (sometimes contrasting) specialties listed, e.g., "Specialties and strengths: stage racing, time trials, one-day races," or simply be described as an "all-rounder," who can take on a range of different roles. Veteran riders conversely more often list only one or two specialties, e.g., "One-day classics" or "Sprinter," and they are almost never classified as an "all-rounder." This suggests the difficulty in assessing the potential of professional cyclists ex ante and the value of specific development efforts cyclists may make as they progress in their careers.

2.3.2 Genetics/Physiological Characteristics (Nature)

It should be noted that a very large portion of any athlete's human capital stock is largely endowed by genetics. While it may be contrary to the common "sportsperson ethic" that hard work and perseverance will ultimately lead to an athlete achieving their highest goals, the road to professional and elite-level performance is littered with the bodies of those who did not reach these high levels despite their exceptional sacrifice and commitment. Such is the survivor bias in many professional pursuits (Taleb, 2007). While a discussion of the inefficient investment in less than promising athletic careers is best left to the side, it is important to emphasize that all professional cyclists do enjoy baseline genetic endowments, which allow them to reach the pinnacle of their sport. For example, Taylor Phinney claimed a world championship in velodrome racing and the US Professional championships, but he was preceded by parents who were equally as successful. To abbreviate their many accomplishments, Phinney's mother was an Olympic champion in the road race, and his father was Tour de France veteran and stage winner. Other examples of familial links abound in the professional peloton, suggesting that genetics plays a large role in potential cycling performance. From a less anecdotal perspective, exercise scientists have attempted to analyze the genetic contribution to physical performance using twin and familial studies, and their estimates range widely from 20% to 90% (Bouchard et al., 1997). Others have suggested that genetic endowment could be estimated to explain roughly 50% of physical performance (Hopkins, 2001):

> Genes are responsible for about half the variation in physical performance between individuals in the population. Genes also account for half the variation in the response to physical training. Genes are probably even more important than training in explaining differences in performance between athletes. Talent identification and selecting an appropriate partner are therefore logical approaches to creating elite athletes.

Moreover, ongoing research seeks to paint a more definitive picture as genetic and DNA research techniques become increasingly accessible (Hagberg et al., 2001).

2.3.3 Development (Nurture)

Despite the clear importance of winning the "genetic lottery," there always remains a substantial proportion of sport performance that is determined by environmental factors, and in particular, the training regimes that may offer athletes the best opportunities to invest in their human capital stock. The ability of athletes to augment and/or capitalize on their genetic stock of innate abilities precisely defines the development of human capital. Investment in human capital can take place with varying degrees of interaction with innate factors and could include but may not be limited to physical training, psychological training, accumulation of competitive experience, and even formalized development programs.

Physical training plays a prominent and perhaps parallel role to genetics, in an athlete's production capabilities. This is evident from the seemingly excessive hours professional cyclists invest in training and preparation for competitions. Professional road cyclists, at the highest level of the sport, have self-reported training 30,000–35,000 km annually (Fernandez-Garcia et al., 2000).

Faria et al. (2005b) outline at least 12 primary factors that predict cycling performance. These include aerodynamics, drafting, rolling resistance, equipment configuration, gear ratios, peak power output, pedaling cadence, cycling economy, cycling intensity, muscle recruitment, pacing strategy, and altitude acclimatization. Of these, an individual cyclist would feasibly have the possibility of making human capital training investments in each of the four that comprise the physical domain: peak power output, cycling economy, muscle recruitment (gross efficiency), and altitude acclimatization, and two more that fall within the cognitive domain, drafting and pacing strategy. The potential for enhancing the physical elements of cycling human capital is discussed here. The cognitive factors will be discussed in the section to follow.

Exercise physiology researchers cite that the expected improvement in VO_2 max for an athlete moving from an "untrained" state ranges from 10% to 40% (Lortie et al., 1986). This initial conditioning stage emphasizes the getting "the foot in the door" concept discussed previously. However, once elite professional cyclists have achieved this "trained" state, there is little variation or improvement throughout the course of a competitive season (Sassi et al., 2008). Achieving the trained condition for VO_2 max appears to take place early on in the career of training for the athletes, and it is suggested that this condition persists through normal off-season breaks in training (Sassi et al., 2008).

If cyclists' VO_2 max levels were the full story in regard to physical condition, we would expect athletes to perform at their best throughout a competitive cycling season, and that the same competitors would experience similar performances relative to their peers throughout the year. However, this is not what is commonly seen in cycling results and cyclists often focus on vastly different events and racing programs. For example, in 2021 George Bennett focused his preparation on the Giro d'Italia, while his *Jumbo-Visma* teammate Primož Roglič focused on the Tour de France and the Vuelta a España. It is rare that a cyclist will attempt to, or even be able to, be in top condition throughout the year. This highlights a factor that is critical to the discussion of professional cyclist human capital in the physiological domain, namely, the transient nature of top-level competitive ability, sometimes referred to as "form." Riders are often referred to as being "in form" or "coming into form."

The concept of form could directly be related to the other main physiological predictors of cycling performance, namely, peak power output, cycling economy, and gross efficiency. These are the variables that seem to improve within a season's training and competition and likely compose the differentiation of athletes at the elite level (Sassi et al., 2008). While the requisite VO_2 max may be persistent and could be considered long-term human capital stock, cyclists must make specific training investments in their form, within a season, in order to produce at their best performances at their optimal moments.

Normal human physical limitations appear to prevent cyclists from maintaining training at their peak condition throughout a year, and when training necessarily wanes, form does so as well. While the discussions of specific training techniques are well outside the scope of this chapter, it can generally be stated that the training of the athletes within a season would necessarily be focused on generating peak power, improving cycling economy, and maximizing gross efficiency. For any specific athlete this would also require specificity to their specialization and team role. As a simple example of this, a cyclist who fills the role of a team domestique would not be likely to focus their training efforts on sprinting or short-term maximal power, they would instead train to improve their long-term sustainable power outputs. It is often the role of a coach to formulate this plan in alignment with the athlete's capabilities, specialization, and goals (discussed further in Sect. 3).

There is some evidence that altitude acclimatization improves cycling performance, both for competing at altitude (>1000 m) and at sea level (Hahn & Gore, 2001; Faria et al., 2005b). These acclimatizing effects typically require weeks of high-altitude exposure to elicit positive physical changes, which generally elicits an increased oxygen-carrying capacity. Nevertheless, this enhancement is even more transient than the within-year training effects discussed above. Most short-term acclimatization benefits are thought to disappear after only a few weeks at lower altitudes (Faria et al., 2005b). Yet, investments in altitude acclimatization are often undertaken by professional cyclists, and there is even a cottage industry in the production of altitude tents, beds, and hypoxic chambers (Inner Ring Cycling Blog, 2012a). In addition to or in substitution of these artificial measures, of which some critics question the ethics, many cyclists choose to live and train for important competitions in higher altitude locations to achieve more natural acclimatization. Some popular examples include Boulder (Colorado) or St. Moritz (Switzerland) (Bicycling, 2012).

Competitive experience may well be the primary source of cognitive human capital development for professional cyclists. As cyclists begin their competitive careers, they quickly learn and adopt heuristics by which to deal with common situations. They also typically develop into more analytically capable competitors as their careers progress. For example, riders quickly learn in their first races that they should not share equal riding in the wind with competitors who likely possess a faster finishing sprint, nor should they do the similar work of leading in the wind to the benefit of their competitors' teams. These simple rules of thumb may hold true in most instances, but they are not necessarily the best course of action in more complicated race situations, or in a "long game" strategic scenario (see Chap. 10 for an in-depth discussion of race strategies).

Development of the knowledge regarding a myriad of potential special situations, exceptions, and advanced game play characterizes race expertise. It is through repeated competitions that cycling athletes learn and are exposed to a variety of unusual circumstances and/or have more numerous opportunities to consider a multitude of strategic outcomes. While these advanced strategic racing skills are not likely to be the difference between achieving and staying in the elite levels of the sport, they would clearly offer more effective production in competition and would make a cyclist more valuable as an on-the-road team leader. Not only could this improvement benefit an individual rider in a comparative sense (competitive advantage), but broader improvements in strategic thinking across the whole cyclist labor market would ultimately lead to more competitive events, which would arguably be preferred by fans. This is in line with the classic interpretation of human capital development efforts as being focused on the quality of labor contributing to growth (Schultz, 1961).

If there is truly value in both physical and cognitive investments for employees, it stands to reason that firms might step in to provide training. In classic human capital theory, it is thought that individual laborers will seek and bear the cost of general training and developing transferable skills. Firms and organizations meanwhile would only invest in specific training or nontransferable human capital (Becker, 1993). There are several indications that this theoretical distribution of investment holds true for professional cyclists and their teams. First, there is evidence that cyclists often hire their own independent coaches, who provide them physical training programs (Larson & Maxcy, 2013). Second, there are a significant number of development teams at the lowest professional levels whose raison d'être is the advancement of their ranks to the highest level of the sport. Table 9.1 offers some recent examples from the United States.

It is important to note that the value of these teams for riders is derived from the fact that in professional cycling, these lower-tier teams are frequently allowed to compete with the higher-level professional programs, with the exceptions of the

Table 9.1 Recent US professional development teams

Team	Level	Development mission (from team website content or press profiles)
Hincapie Development Team (2015–2019)	Continental	"The focus is to develop young riders into top professional cyclists, and to continue the growth of the sport by supporting cycling's next generation."
Aevolo (2017–2021)	Continental	"Aevolo Cycling is a US-registered UCI Continental Cycling Team, focused on the development of Elite Under-23 riders."
Team Novo Nordisk Development (2021–2022)	Continental	"Developing riders for the highest level of racing is hard, time consuming work," began [team director] Holt. "But I am happy to say that the pipeline is alive and well and operating on all cylinders. In addition to the three devo riders that graduated to the pro team in 2021."
EF Education-NIPPO Development Team (2021–2022)	Continental	"As the official development team for the WorldTour squad of EF Education-NIPPO this is a fantastic opportunity for our riders to step up to the next level."
Hagens Berman Axeon Cycling Team (2009–2022)	Continental	"The Axeon Cycling team is a team for the next generation of professional cyclists." "The team exists to develop young (under-23) riders through to the very top of the sport. Over the last 13 years, Axel and his team have seen 39 of their riders graduate to World Tour teams."

WorldTour events, such as the Tour de France or Classics like the Ronde van Vlaanderen or Paris-Roubaix.

Cyclists, in addition to being members of commercial teams, may also participate in “National Teams,” those sponsored by national governing bodies. Riders selected for the national team may get access to higher-level competitions or specific international competitions. In most cases, these athletes also receive the benefit of direct coaching and physiological preparation, which is not as common on the professional development teams. For example, the USA Cycling Development Foundation boasts supporting over 3000 cyclists since 2009 and understandably highlights the dozen or so that have since achieved WorldTour status.

Many other nations including Australia and the United Kingdom have publicly funded development programs that have supported eventual WorldTour riders and Tour de France champions. The Australian Institute of Sport (AIS) expended over $7.3 million for the 2014–2015 season (Australian Institute of Sport, 2015), and the British National Cycling program reportedly averaged about $10 million annually leading in to the 2014 Olympics (Inner Ring Cycling Blog, 2012b). The former claims 2011 Tour de France champion Cadel Evans, and the latter’s alumni include sprinter and world champion Mark Cavendish, as well as 2012 Tour de France winner Bradley Wiggins.

2.4 Coaches and Directors

The cognitive human capital stock of professional cyclists is arguably evident in the post-competition careers that many former riders are able to pursue. The population of cycling coaches and directors is dominated by former competitors. For the sake of clarity, cycling coaches typically advise cyclists on training plans and regimes to prepare for competitions physically, while team directors advise and manage the athletes within the actual competitions. The former have been observed to be hired largely by the athletes themselves (Larson & Maxcy, 2011), while the latter are by definition employees of the cycling teams. Some teams may hire coaches internally, but Larson and Maxcy (2013) demonstrated that according to predictions derived from their economic theory, given the known parameters of cycling, team-hired coaches are the less likely outcome.

2.4.1 Experience as a Competitor

There is some spare empirical work directly related to cycling coaches, but the discussion of directors necessarily leans more heavily on theory in the absence of such work. Most of what is known about the cycling coach labor market has emerged from studies of the US cycling coach market conducted by Larson and Maxcy (2011, 2013), and the following discussions will refer frequently to that existing data and its secondary analysis. There is, however, no apparent literature that examines the labor market for cycling team managers and sport directors. Much of that discussion will therefore rely on industrial organizational theory and how it fits with the human capital concepts in competitive cycling.

The cycling coach and team director labor markets are comprised almost entirely by former competitors. Data from the Larson and Maxcy (2011) study suggests that this is true in general for the US cycling coach market, where 89.9% have some experience as competitive riders. Furthermore, for those US coaches that work with professional clients, this proportion jumps to 97.4%, who have an average accumulated racing experience of 16.9 years, including 3.2 years as professional riders. In addition, Larson and Maxcy (2011) examined the relationship between competitive experience and coaching success. They found a positive relationship between a coach's commercial success with professional clients and the number of years they had competed at an elite level.

While there hasn't been a similar analysis of the team director labor market, publicly available information can be easily referenced to provide an overview of this representation. For example, of the named team directors listed on UCI WorldTeam websites for 2015 (excluding general managers), at least 86% of them have experience as professional cyclists (procyclingstats.com). While clearly not causally definitive, this suggests a strong relationship between the experiences accumulated in competition and becoming a capable team director. Incidentally, the team director position has gained significant importance beginning in the early 1990s when two-way radio communications began to be adopted. In this transformation of the role, the team director's personal competitive experience could suddenly sustain its value in real-time competition.

2.4.2 Experience as a Coach/Director

Human capital development for coaches is also derived through the accumulation of coaching experience. Larson and Maxcy (2011) provided evidence that American coaches' years of coaching experience and coaching success are positively correlated. This value of this coaching experience was present at both the developmental and elite levels of cyclists. For example, they find that each additional year of coaching experience is associated with an average increase in clientele size of as many as 1.3 athletes (with slightly decreasing returns). For the subset of professional clients alone, a similar positive association is predicted, also with decreasing returns. Therefore, as one might expect, in addition to the value of their own past competitive cycling experiences, cycling coaches can also develop earning potential through job experience.

The development of human capital for team directors is a bit of a blind spot in the academic literature at this point. There has been no systematic or even anecdotal study of the progression of their career experience and its relationship to job performance. The measurement challenges alone for determining the effectiveness of a sports team manager prohibit the execution of such studies. This is a general problem that has begun to be tackled in the sports economics literature, but in most cases these studies relate to turnover effects on teams, rather than to a clear evaluation of individual managers' production (Audas et al., 2002; De Paola & Scoppa, 2011; Maxcy, 2013). The challenge arises in appropriately controlling for athlete quality and athlete contributions to production that is not attributable to the manager/director's actions. As an alternative route, a comprehensive study of team director salary data could yield useful evidence about the value of career experience, but this has also understandably been unavailable to date.

2.4.3 Traditional Educational Attainment

There is no clear evidence that traditional educational endeavors, for instance university study and degrees, contribute to the commercial success of practicing coaches. This includes both advanced graduate degrees and university degrees specific to exercise and sport sciences (Larson & Maxcy, 2011). This is peculiar in that knowledge of exercise science is that which is envisioned as being most valuable to the coach's cyclist clients. In this case, it might just be that experience with the implementation of individualized training programs and working with a multitude of practicing athletes would provide the most value to coaches in terms of human capital accumulation.

Despite the lack of empirical study of team directors, cycling team directors are believed to be rather unlikely to pursue advanced university degrees. This is due to both the competitive nature of the team director market, which might prohibit exiting the job market for the time needed to complete a degree, and the demanding travel itineraries that nearly all team directors endure. Nevertheless, this inference has yet to be confirmed or explored with a more in-depth study of the training and human capital investment choices among cycling team directors.

2.4.4 Formal Certification and Continuing Education

Formal certification efforts within the domain of cycling coaching have some predictive power when it comes to the likelihood of a US coach working with the highest-level athletes (Larson & Maxcy, 2011). The standards are structured such that coaches wishing to maintain or advance their level of certification must participate in USA Cycling sanctioned seminars. Coaches begin at a "Level 3" and advance with training. They additionally must maintain a relatively demanding level of continuing education activity in order to maintain their certifications. In terms of the payoff for these investments, coaches that advance to a "Level 1" certification are revealed to have significantly more professional clients than average among their clientele.

The certification of team directors is a more recent trend and the initiative to encourage certification of directors was spearheaded by the UCI. Since 2013, team directors at the WorldTour level have been required to pass a UCI administered examination (UCI, 2014). The requirement was introduced with limited resistance from team managers, and since 2016 the UCI has offered scholarships for female sport directors (UCI, 2019a). However, it is unclear whether the motivation to certify is derived from real human capital value-added or from the protectionist nature of the certification process. This again points to the need to examine the labor market of cycling team directors more closely.

2.5 The Future of Human Capital Research in Cycling

The components that make up human capital stock in cyclists are of a unique nature. The physical components of human capital in cyclists, as with other athletes, are transient in nature, and the athletes face rapid degradation of skills relative to their cognitive abilities. The stability of the cognitive components is evident by the persistent value of experience when cyclists retire from competition and move into coaching and director positions. The rapid depreciation of a cyclist stock of physical human capital contrasts with traditional human capital development interpretations that consider human capital development to be more or less permanent improvements in a worker's productive capability.

The capital quickly built in the seasonal training periods is equally as fleeting in erosion. For example, VO_2 max degrades in the absence of a normal training regime, while special training geared to achieve top condition for identified races may only persist a few months or less. Altitude acclimatization, which takes large time investments, can be lost very quickly once the practices stop. All of these investments require up-front costs of time and effort and a continuous repeated investment to maintain those levels of capability. The cyclist experience is not contrary to human capital theory, as most characterizations do acknowledge the possible degradation over time, but does require proper interpretations of "relatively permanent."

The investments by athletes are made if the payoffs are permanent enough to justify the costs. For cyclists and other athletes, it may be useful to study these training investments in consideration of the "half-life" of the productive benefits. This type of examination might offer more understanding of the theoretical value of training and education over various time frames. For example, insights regarding optimal or efficient continuing education strategies to maintain human capital levels might be derived. Perhaps perceptions may be garnered in regard to the development, maintenance, or rejuvenation of human capital derived from work experiences. Conceptions of training and detraining that are well established if not exhausted in the exercise science literature might have something more to offer in terms of human capital research.

3 Sport Agents in Cycling

3.1 Team Sport Agency Literature

In nearly all professional team sports throughout the world, the use of the services of an agent by professional athletes has become standard practice. As illustrations, more than 6000 agents of any sports were known to practice in the European Union in 2008 (KEA, CDES, and EOSE, 2009) and 86% of the 3456 labor contracts signed between 2002 and 2010 in French professional basketball leagues involved an intermediary (Brocard, 2012). The same trend can be observed in the North-American professional leagues where, for example, the NFL players' association registers 871 players' agents in 2022 (NFLPA, 2022).

Most of the sports economics literature on the intermediation on the labor market is dedicated to team sports agency, whether in North-American professional team sports (Mason, 2006; Shropshire & Davis, 2008) or in football in Europe. From a theoretical point of view, sports agents must be considered as "matchmakers," as described by Yavas (1992), whose main role is to create a match between two parties. The sports agent also has a valuable role during the negotiation process between clubs and players (Sobel, 1987). The intermediation on the labor market of professional athletes is theoretically justified by the asymmetrical information which offers a cognitive role to the agent in revealing private information (Brocard, 2008).

A large part of the dedicated literature is to be found in law and focuses on the regulations. The report commissioned by the European Commission in 2009 points out the diversity of the regulations in Europe concerning sports agents and the need for homogenization in order to enhance the overall efficiency (KEA, CDES, and EOSE, 2009). Widening the scope to North-American leagues, heterogeneity between NFL and French Ligue 1 regulations is also underlined (Baker et al., 2012), highlighting the difficulties in tackling this topic in a uniform way.

At the same time, sports agents are accused of contributing to the imbalances of the market as they symbolize and crystallize the excesses of professional sports (Gouguet & Primault, 2007). In particular, conflicts of interests which stem from special connections between some agents and the management of some clubs can generate excesses (Rosner, 2004), all the more when clubs pay sports agents, especially in European football. The question of which party should pay the agent is then of interest (Brocard & Cavagnac, 2012). The intermediaries build privileged relations with some clubs which are likely to grant agents an influence on the talent allocation in leagues. The level of market power in the hands of agents has been tested in French Basketball leagues (Brocard, 2012). This test infers that some top agents have the power to distort the talent allocation among basketball clubs of the professional leagues in France. In football, the empirical research report of Poli and Rossi (2012), based on a socioeconomic survey conducted over football agents in Europe, provides important insights of the state of the market. It especially underlines the concentration of the players' representation market in the big five European leagues and the lack of transparency in the player transfer and representation market.

While team sports agency has appeared as a research topic in law, and to a lesser extent in economics, the lack of similar research in the individual sports, and especially road cycling, can be observed.

3.2 Historical Background of Riders' Agents

The activity of a rider agent has taken place outside of international regulation until 2012, when the international governing body for cycling, the Union Cycliste Internationale (UCI), implemented their first dedicated regulations. An updated version of the regulations was published in 2019. These regulations aimed to increase the professionalism of agents, to standardize their functions, and to improve their monitoring. They were largely based on the 2008 International Federation of Association Football (FIFA) Players Agents Regulations and are a direct application to the sport of cycling. The main measure implemented by the UCI at the time was to control the access to RA activity through the organization of an exam and the delivery of a UCI certificate to successful candidates, which should eventually lead to the delivery of a license by a national federation. The activity of agents is of course also controlled through the implementation of relevant contract law regarding the conclusion of the contract between the agent and the rider and the performance of the contract. In addition, there are some national regulations specifically dedicated to riders' agents that exist in some countries such as France and Italy that will be discussed below.

Trying to date the emergence of RAs in cycling is challenging, since their missions have evolved over time, and the same can be said about defining them. Sports agents act, first and foremost, as intermediaries between sports persons and sports clubs or organizers of sports events with a view to employing or hiring an athlete. They bring together the parties interested in concluding an agreement concerning the practice of a sport as a remunerated activity (KEA, CDES, and EOSE, 2009). Historically, the individuals that can be considered the first RAs in the modern sense were used by riders to negotiate extra revenue from sources such as criterium invitation fees or individual sponsorship. Their role evolved alongside the professionalization of cycling and contemporary RAs render much more services. The 2019 UCI regulations outline an RA as "an individual who introduces, for remuneration, a rider and a UCI WorldTeam/UCI ProTeam/organizer with a view to signing a professional cyclists'/criterium contract" (UCI, 2019b). However, this definition, by focusing solely on the intermediary role, does not exhaustively outline all of the missions of modern agents. Indeed, out of the multiple services that one RA can currently render, we cite contract negotiation, sponsorship liaison and negotiation, media liaison, investment advising, financial planning, image management, superannuation management, estate planning, accounting and tax services, legal advice, handling social media accounts, website design, physical training advice, nutrition advice, etc. As a matter of practice, most contemporary agents provide a panel of services and do not only put clients in contact with teams. According to the information gathered through the interviews, the emergence of agents in their current form can begin to be assessed from the early 1990s, particularly in Belgium and in Italy, with a continuous development from there.

3.3 Riders' Agent Regulations: An Application to Cycling of Preexisting Regulations

3.3.1 International (UCI) Regulations

The activity of RAs long lived without institutional rules. The UCI implemented regulations in 2012. The control of the access to the profession implemented by the UCI in 2012 was mainly justified by the need for more professionalism among agents and by the need for a legal relationship between agents and cycling institutions. Indeed, observations showed that the ongoing professionalization of cycling required certain skills (e.g., legal expertise, knowledge of competitive regulations) that some active agents did not have. The UCI's summative examination was created to ensure a certain level of knowledge in specific matters, in order to provide a panel of competent agents to riders. In parallel, the certifications and licenses delivered by cycling institutions (national federations, the UCI) tie the agents to these bodies and give the opportunity to control and possibly sanction them. The implementation of these RA regulations in 2012 was an official recognition that the role RAs were playing in cycling was substantial enough to be looked after by the institutions.

The UCI implementation of the first riders' agent regulations followed the approval by the UCI Management Committee in October 2010 of a text intending to regulate the role of RAs. Faced with the reality of professional cyclists resorting to RAs to put them in touch with teams with a view to signing a riders' contract, or with an organizer with regard to signing a criterium contract, the UCI responded by regulating intermediaries mainly with the implementation of a licensing system. The UCI regulation therefore aims to both control the access to the profession and regulate the activity of RAs.

UCI Regulation of Access to the Profession

Since January 1, 2012, anyone wishing to represent a rider from a team in the first or second division must obtain a RA's license delivered from their national federation. However, this request will only be accepted for individuals who are already certified by the UCI. Indeed, the UCI organizes an examination once a year. The candidate must have sufficient knowledge of either English or French, an unblemished reputation, a clean police record, and no disciplinary sanctions recorded against him by the UCI or a national federation. The examination applies to sections of the UCI Regulations, as well as to the Joint Agreement and the regulation concerning the role of the riders' agents. The UCI issues a certificate when a candidate passes the examination. The certificate is valid for 4 years, is given to an individual, is strictly personal, and cannot be transferred. The certificate authorizes the successful candidate to request a license from his national federation. In case of specific domestic legislation (e.g., France, Italy), the candidate shall have satisfied all applicable legal requirements for such activities at a national level before being allowed to submit an application. The license is only issued by the national federation and shall be valid for a calendar year (January 1 to December 31). The federation is solely responsible for checking compliance with regulatory and legal requirements. The federation shall inform the UCI of all agents' licenses issued. As the expiry of the 4-year period approaches, the license holder can request the UCI for a renewal of the certificate for a further period of 4 years, subsequent to a study of activities conducted in the preceding period. Exemptions to the licensing system exist as these regulations do not apply to lawyers, parents, brothers, sisters, or spouses appointed by the rider.

Regulation of the Activity

The UCI regulations control both the conclusion of the contract between the agent and the rider, as well as the performance of the contract. The following summarizes the basic features of the regulations. As preliminary rules, licensed RAs can only:

- Contact a rider who is not, or no longer, under contract with a team or with a view to signing a contract for the period after the expiry or the rider's current contract
- Represent the rider with the objective of negotiating or signing a dependent or independent rider contract or a criterium contract
- Defend and manage a rider's interests

The contract between the agent and the rider must be written. It must contain at minimum:

- The names of the parties.
- The duration (cannot exceed 2 years, renewable in writing).
- The amount of remuneration: the commission received by the agent is a percentage of the fixed remuneration received by the rider under the terms of the rider's dependent or independent contract negotiated by the agent.
- The method of payment: either fixed fee payable at the start or payment divided into two. The regulations also imply that only the client of the agent, i.e., the rider, should pay the commission.
- The date and parties signatures.

The UCI provides a standard contract which is the sole document recognized as valid (UCI, 2019b). However, supplementary agreements can complement the standard contract. Licensed RAs are allowed to organize their activities in the form of a company. But any employees working with the RA are strictly limited to administrative tasks. The RA shall also provide an updated list of riders who are under contract.

The UCI regulations also provide a list of obligations for the RA:

- To respect UCI regulations
- To refrain from encouraging any breach of contract
- To keep official accounting records and files
- To discourage its client from using a substance and method of technique that is prohibited by UCI regulations
- In the event of indications that the client has breached the UCI's Anti-Doping rules: to renounce the representation of his/her client and inform the UCI of the potential breach

In parallel to these obligations, the regulations also provide a list of sanctions for the RA in case of any breach, applied by the UCI Disciplinary Commission: from a warning to the prohibition of exercising any activity related to cycling.

The implementation of these RA regulations is accompanied by an obligation for riders to only deal with licensed agents. Thus, the name and signature of the RA must appear on any contract. A list of sanctions is provided for the rider in case of any breach to this rule. In parallel, teams and organizers who want to contract the services of a rider are obliged to negotiate either directly with the rider or through the services of a UCI licensed RA.

However, in some countries, national regulations pre-dated the UCI regulations and currently coexist. France and Italy were identified as two countries where regulations specifically dedicated to riders' agents are different from the direct application of the UCI regulations at the national level.

3.3.2 French Regulations

The French regulations for RAs were implemented by the Fédération Française de Cyclisme (French Cycling Federation, FFC) in 2005. It stems from the "Code du Sport" (Légifrance, 2006) which is the document that contains all the applicable laws and decrees in the field of sports in France. Some of its articles provide a large regulatory framework for intermediaries which should be common to all professional sports. This "Code du Sport" implies that each federation implements its own agents' regulations, abiding by the rules set in the code and applying them to their sport's peculiarities. The FFC implemented regulations in 2005 (FFC, 2005), in coordination with the UCI. The regulations concern anyone who puts in touch, for remuneration, parties with a view to signing either a labor contract or a contract related to the remunerated exercise of cycling. As with the UCI, the FFC regulations also include controls to the access to the profession and regulation of the activity of RAs.

FFC Regulation of Access to the Profession

The activity can only be exercised by natural persons registered by the FFC and set a list of rules in case this licensed individual operates within a company. An exam is organized each year and successful candidates are granted a license that allows them to start a business in this activity. Candidates should comply with a list of incompatibilities and inabilities. This list mainly aims to prevent from registering anybody with criminal or disciplinary backgrounds and to avoid conflicts of interests. The exam is composed of two parts (FFC, 2015). The first part is common to every sport and mainly contains questions about social, tax, contract, or insurances law. Only the successful candidates to this part can take the second one, which is specific to each sport whose federation grants licenses. The second part of the exam organized by the FFC focuses on FFC and UCI regulations. Only the candidates who passed both parts are granted a license by FFC. The list of licensed agents is published on the FFC website (www.ffc.fr/la-federation/agents-sportifs/liste-agents-sportifs).

Regulation of the Activity

The FFC regulations control the conclusion of the contract between the agent and the rider, as well as the performance of the contract. Specifically,

- The contract shall be written and contain the amount of the commission accounted by the agent and the party which remunerates the agent. The FFC regulations cap the commission due to the agent to 10% of the fixed remuneration received by the rider. It also implies that the client of the agent, i.e., the rider, should pay the commission, but provides that in case of the existence of a mutual agreement, the co-contractor, i.e., the team or the organizer, can pay the agent's commission. However, it is strictly forbidden for RA to act on behalf of both parties interested in the same contract.
- The licensed agents shall permanently or on demand communicate to the FFC all the information related to their activity (e.g., accounting or legal documents, contracts signed with clients, etc.).

Any breach of these regulations leads to a disciplinary penalty that can range from a warning to the withdrawal of the license.

3.3.3 Italian Regulations

The Italian National Cycling Federation (FCI) also has dedicated riders' agents' regulations (https://legaciclismoprof.org/regolamento-procuratori). Its main features are the implementation of a licensing system with the organization of an examination and the delivery of licenses by the FCI. The commission due to the agent is to be freely set by agents and their clients, with a minimum set at 3%. A code of conduct is also provided.

The main specificity of the Italian regulations is to directly tackle the state of the competition on the agents' market and in particular the potential dominant position some agents could take advantage of. In order to prevent from dominant positions, the regulations cap the size of the clients' portfolio of an agent to 30 and provide with a list of sanctions (art 8.5). The Italian regulations also provide that licensed agents should pay €100 as a registration fee and an additional €100 per year and per represented rider to the Italian federation.

4 Riders Unions

4.1 Collective Bargaining in Sport

As with many other industrial contexts, e.g., manufacturing and factory labor, professional sports leagues can find themselves in a labor market position of monopsony. This is a condition where there are many sellers of labor services and effectively only one potential buyer. This is most clearly the case in closed professional leagues, such as the North American Major League Baseball, the National Basketball Association, the National Hockey League, and the National Football League, where league entry is restricted, geographic franchise restrictions are enforced, and reserve (draft) systems for players are implemented (Blair, 2011). The consequences of monopsony conditions in general can be reduced wages, poor working conditions, and restrictions in the quantity of labor employed relative to competitive market outcomes (Downward et al., 2009; Kesenne, 2014). In economic terms, straying from compensation (marginal cost) equivalency with marginal revenue corresponds to reductions in total welfare. Clear examples in team sports include salary caps and luxury taxes on team payrolls, effectively collusive price-fixing in the labor markets. While exploiting these monopsony positions is generally illegal for any business in the United States, as it is in much of the rest of the world, there are several antitrust exemptions that US professional sports leagues enjoy. These arise from both legislative action and judicial precedent, and they allow some level of collusive action in the labor market. While there are a variety of these exemptions which could be discussed, of particular relevance to the sport labor market is the exemption that arises from the National Labor Relations Act of 1935. This legislation protects the collective actions of workers, typically with respect to unionization and collective bargaining. The intent is to offset the bargaining imbalance with single (or unified) employers, specifically with respect to wages, hours, and working conditions. Furthermore, the act shields any "arm's length" negotiated labor agreements on those issues, which might otherwise run afoul of antitrust law, e.g., salary caps and floors, from antitrust liability. In this way, it is arguable that workers get their say in the choices between compensation policies and potentially reinvestment in the financial health/viability of the sports league. As such, the North-American leagues feature periodically negotiated collective bargaining agreements (CBAs) which reflect an increased balance of bargaining power in labor market negotiations. To that end, some would argue that the presence of frequent impasse conditions, e.g., a players' strike or a lockout, indicates this improved balance of negotiation power.

In many ways, the professional road cycling employment market has features that already exist or are moving the sport towards monopsony conditions. First, in terms of participation in the highest level of the sport, the Tour de France looms large, and there is clearly no alternative or substitute for that unique and valuable workplace. As such, the top athletes' spectrum of potential employers (teams) is restricted just to those with access or invitation to that event. The more those select teams collude on sport development and event access, the more the effects of monopsony will be evident. In that vein, multiple independent efforts have been undertaken by collections of the teams, and even the UCI itself, to "close" the league of cycling teams. Even at this point, teams are in increasingly in restricted-entry conditions as guaranteed-term WorldTour licenses and promotion/relegation policies are being implemented. Second, while there has thus far been little clear evidence of deliberate wage suppression in cycling, many issues with working conditions, and to a lesser extent working hours, have been coming to a head and could benefit from collective bargaining. Specifically, rider health and safety concerns have arisen due to high-profile accidents, severe injuries, and weather challenges. For example, the high-profile young cyclist Fabio Jakobsen was severely injured in a horrific finish stretch crash in the Tour of Poland on the heels of several years of competitors voicing safety concerns about the conditions (Marshall-Bell, 2020; Busca, 2021). These challenges and difficulties in establishing credible representation on these basic workplace issues may provide a proverbial canary in the coal mine with respect to labor representation overall. Such conditions make it increasingly arguable that collective bargaining and effective athlete unionization could help mitigate current and future challenges.

Nevertheless, in the case of professional road cycling, there are several obvious variances from the conditions that we see in North-American leagues which can add complications, raise new questions, and may preclude the development of effective collective bargaining and labor representation. The two main areas of concern this chapter will enumerate in the next sections are the conflict of the legacy versus contemporary athlete representation efforts (Sect. 4.2) and the multinational nature of the sport (Sect. 4.3). The following sections will present the historical perspective of the former and the complications of international labor and production for collective bargaining and labor antitrust issues in the latter.

4.2 The CPA, the UCI, and the Riders Union

The present UCI recognized iteration of collective professional cyclist representation was founded in 1999 as the Cyclistes Professionnels Associés (Associated Professional Cyclists). The nonprofit organization currently articulates goals that are quite similar to what one might see in many traditional athlete unions. They aspire to "safety, wage increase and prize money increase" and position themselves as a group representing the interests of the athletes, "…in the dialogue with the other key players of world cycling, such as UCI, teams, and race organisers" (CPA, 2022). However, despite its independent appearance, the organization does not operate as a direct representation of the cyclists, nor is it truly completely independent from the other major stakeholders in the sport.

"The Outer Line" (https://theouterline.com/) provides an independent perspective on both the competitive aspects and the structural issues facing professional road cycling. In addition to the Outer Line founders' corporate expertise and an extensive industry network, their information generation is often supported by academic researchers. On the website, thorough information and inquiries about the professional cycling industry overall have been published, and among these materials are in-depth analyses of the cycling labor market situation. Through their publications, it is clarified that the CPA is in fact an "association of associations," originally formed to coordinate national-level rider associations from France, Italy, Belgium, the Netherlands, and Spain (Maxwell & Harris, 2016). In a further review of the CPA performance relative to independence, Maxwell and Harris (2016) reiterate that the UCI acts as one of the primary funding sources for the organization, presenting a clear conflict of interest. Calls for truly independent representation have been fruitful in the ultimate creation of an organization named "The Riders Union" in 2020 (Maxwell, 2020).

The questionable reputation of the CPA as an independent and representative riders' union led to the creation of a rival organization, clearly dubbed "The Riders Union." A substantial number of professional cyclists, reportedly 350 initial signed supporters (Maxwell, 2020) and more than 200 dues paying members by September 2021 (Maxwell, 2021), established this new body to represent its members' interests directly and independently. This development did not arise uncontested. The UCI has thus far refused to formally recognize this group, nor have they allowed them a seat at the table in discussions with stakeholders of the sport. Both the UCI and the CPA have in fact moved to discredit and undermine the initiative. In terms of the former, UCI president publicly called the creation of the new Riders Union "fake news" (Benson, 2020). The CPA has gone so far as to brand and promote its primacy on its website: "The CPA, the only association for riders recognized by the UCI" (CPA, 2022). Even in the face of this resistance and dismissal, the Riders Union seems to have taken root and talks have begun with the UCI on recognition of rider-chosen representation and potential legal challenges. To that end, the CPA's block voting system (via national association) could be in violation of Swiss civil code (Maxwell, 2021). Specifically, to be compliant the riders must be able to individually choose on whether they wish to be represented by the CPA.

Although they had an earlier start and are concentrated on additional issues, such as addressing wage inequality and rider abuse, the women's cycling labor landscape has faced an entirely similar experience to the men's (see Chap. 13). In 2017 several women's cyclists created an independent representation group: "The Cyclists' Alliance" (TCA). This appears to have prompted the UCI to formalize an additional (competing) specific subgroup for women within the CPA. In doing so, and with follow-up statements, the UCI explicitly insists that the CPA is the sole recognized representation of all professional cycling labor regardless of gender. This puts the women's professional peloton in a similar position to the men's peloton, i.e., dual organizations claiming to represent their interests.

The fates of these competing cyclist representation entities will ultimately need to be resolved. The financing of the CPA largely relies on proportional "taxes" on athlete prize winnings, the Riders Union is structured as a more traditional union centered on revenue from member dues, while the financing of the TCA appears more heavily reliant on philanthropic and corporate sponsorship revenue streams (TCA, 2020). The financial strain on the riders and interested stakeholders will not necessarily be able to be sustained, at least concurrently across three separate groups drawing on resources, nor would the services to riders be equally effective considering inefficient duplication of activities. The ability to both satisfy the will of riders, and present a united (recognized) front to the sport's major stakeholders will be the prerequisites for a stable resolution.

4.3 Challenge of Globalization-Antitrust

As is extensively discussed in Chap. 14, professional road cycling has continued to internationalize, first among athlete nationalities, but increasingly in terms of team organizations and event organizers. This opens the question of how collective bargaining can occur across international borders as it becomes more and more necessary for the sport. As mentioned above, North-American leagues largely abstract from these concerns, since their jurisdiction for antitrust law is almost exclusively confined to the Unites States. Nevertheless, even these leagues have had to wrestle with the question of internationalization of both events and teams. These leagues have historically had to deal with concurrent jurisdiction issues, as well as newer questions related to international expansion. Of the four leagues, the NHL has had the most pressing concerns in terms of magnitude, as 7 of their 32 teams are located in Canada. Charbonneau (2015) analyzed these cross-national approaches especially with respect to collective bargaining and league lockouts. In this analysis it is noted that in the past, the NHL mostly ignored Canadian laws, but that going forward this approach would not be sustainable. The author highlighted that not only are there two nations involved, but that jurisdictional levels differ drastically, i.e., national-level regulations in the United States and provincial-level policies in

Canada. So, if a simple two-country concurrent jurisdiction case is already complex, what about the situation that professional cycling faces of operating in dozens of countries? An analysis and synthesis of all of the jurisdictional levels for the sport of professional cycling not only include national and provincial governance but also need to take the broader competition policy of the European Commission into account (e.g., Brandl & Bechter, 2019).

Labor law is largely a domestic concern and unlike other traditional businesses, professional sports like cycling may have to deal with dozens of sometimes conflicting labor laws. While there is some initial work in the general business literature about dealing with multinational collective bargaining (e.g., Cooke, 2005; Dorssemont et al., 2007; Ales & Dufresne, 2012), the takeaway is that increasing internationalization, cross-border operations, and collective bargaining add nearly untenable levels of complexity if only by the reconciliation of jurisdictions (Larson, 2011). In one particularly relevant treatment, Cooke (2005) uses game theoretic models to highlight potential strategic interactions among national unions which may lead to transnational union partnerships in the face of bargaining with multinational firms. This sounds much like the national-level rider unions banding together within the CPA, as an association of associations. However, the structure and performance of the CPA may not hold without the direct rider representation mentioned previously. This is an area where the study of the professional athlete context could be informative to the broader academic business literature, if only as a case study.

There are a few reasons why answering these collective bargaining questions is of increasing necessity. First, as the major events become more consolidated, bargaining power on the event side becomes increasingly concentrated. Second, as teams increasingly seek a "closed shop" in terms of member collusion and entry, the employment negotiation for the labor market may become power imbalanced. Finally, this will be an immediate concern as the introduction of a non-conflicted rider representation group with legitimate bargaining power, particularly against the UCI, introduces a clearer prospect of antitrust claims and litigation on behalf of the athletes. All three of these developments move the labor market context to a global frame, rather than the domestic. While the answer is not ventured here, the prospect for some changes in the labor market negotiation processes has nevertheless been identified.

5 Conclusion

The process of preparing labor for sports performances in cycling, i.e., developing professional cycling human capital, is complicated, multidimensional, and temporally sensitive. This chapter explored the timing, routes, and mechanisms for that development for the athletes as well as coaching and management. Concurrent with development and maintenance of those capabilities is bringing those labor services to the market. The cycling agent intermediary system is characterized by notable governing body regulation, both via the UCI and some nation-specific provisions, as well as observed concentration of representation with a limited number of well-connected agents. Notwithstanding any noncompetitive influences arising in the agency process, professional cycling can generally be considered a competitive labor market. Despite this, athletes in professional cycling have generally lacked collective bargaining power in what appears to be an increasingly concentrated and more deliberately "closed" system. The current state of the industry in relation to collective labor action is in flux, with multiple organizations claiming to represent labor interests. This will need to be resolved in order for the professional cycling labor market to function effectively in the future.

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Chapter 10
Strategic Behavior in Road Cycling Competitions

Jean-François Mignot

1 Introduction

Cycling is arguably one of the hardest sports, requiring tremendous amounts of strength, endurance, resistance to pain, and courage. However, as reputed specialists of the Tour de France noted, "God knows the Tour is also a matter of intelligence and tactics" (Chany & Cazeneuve, 2003; see also Baker, 2013). Why is there strategy, not just brute force, in cycling competitions? What are the recurring strategic interactions amongst riders? And what can economists learn from riders' behaviors?

Professional sport is an ideal setting to study strategy. First, sport usually provides well-structured and easy-to-model situations: they include a small number of players, each player has clearly identifiable opportunities of action, and each action includes easily measurable payoffs. Second, professional athletes are specialists in their sport's strategy—and so they should, given that they are playing for high stakes. Moreover, cycling may be one of the most strategically interesting sports, hence its nickname "chess on wheels" (Harper, 2012). Much more than in, for example, swimming or athletics (especially in the case of short-distance running, or throwing and jumping events), professional riders' performances crucially depend on their interactions with other riders. Most of the interactions between riders are not pure confrontation, zero-sum games, as is the case in boxing, fencing, martial arts, or tennis. Although riders are basically competing for a fixed-sum prize pool, the games they play are usually not constant-sum, if only because some strategies are more (or less) exhausting for *all* riders involved. In addition, in cycling, two rival riders may lawfully ally against some third rider, while such three-player interactions do not exist in football, basketball, or soccer. And cycling being an individual

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sport run amongst teams opens up opportunities of strategic behavior both within and between teams.

This chapter first provides an overview on the main reasons why bicycle races are strategic and not just a mere display of brute force (Sect. 2). Next, several game theory analyses of strategic interactions between riders are presented: attack timing strategy (Sect. 3), cooperation and noncooperation in breakaways and in the peloton (Sect. 4), three-player interactions (Sect. 5), and sprint strategy (Sect. 6). It is founded on examples of strategic interactions between riders that occurred in the Tour de France (Chany & Cazeneuve, 2003; McGann & McGann, 2006, 2008), the Giro d'Italia (McGann & McGann, 2011, 2012), the Vuelta a España (Fallon & Bell, 2013), and other races (Chany & Penot, 1997; McKay, 2012).

2 Why Is There Strategy, Not Just Brute Force, in Road Cycling Competitions?

Cycling involves strategy, i.e., each rider's best action depends on other riders' actions. A fundamental reason why this is the case has to do with air resistance, which gives riders the opportunity to accept or to refuse to cooperate. The fact that road races are run in a team format only intensifies this strategic dimension.

2.1 Air Resistance, Drafting, and Crosswind

"In competitive cycling on the flat, air resistance is by far the greatest force opposing the forward motion of a cyclist. Air resistance can be dramatically reduced by riding in the slipstream of another rider or vehicle. The following rider will then enjoy the low pressure area behind the lead rider" (Olds, 1998). "Drafting" or "slipstreaming," i.e., riding in the shelter of another cyclist or group of cyclists and staying out of the wind, indeed confers a very substantial second-mover advantage: the back rider is able to reduce his effort by up to 40% (Dilger & Geyer, 2009). Hence, spectators of road races can see that while at the front of the main group riders are spending substantial amounts of energy to maintain a high speed, certain riders at the back are freewheeling. More generally, the average rider in the peloton uses his energy more efficiently than the average rider in a breakaway, let alone a solo rider. As a consequence, a rider who somehow manages to spend relatively little energy may win a race against a stronger opponent who was unable to conserve as much energy. Therefore, two common strategies are available to riders: "cooperation," i.e., taking turns at the front and letting other riders ride in one's slipstream (at least for some time), and "defection," i.e., refusing to ride at the front. Most importantly, drafting enables riders to help each other and gain from that mutual help. Two riders may take pulls, i.e., take turns shielding each other from the wind. For instance, on the 11th stage of the 1985 Tour de France, French champion Bernard Hinault broke away from the peloton with Colombian climber Luis Herrera. While Hinault shielded Herrera from the wind on the flat, Herrera shielded Hinault in the mountains, enabling Hinault to safeguard his general classification jersey and Herrera to safeguard his king-of-the-mountains jersey and win the stage. Alternatively, a rider may draft as much as possible and shirk to gain from unilateral help.

Air resistance also varies with certain parameters in ways which help us to understand bicycle racing. First, air resistance is higher at a higher speed, which implies that drafting is more advantageous (and breakaways are less likely to succeed) on the flat than in the mountain. Because a straight and dry road increases speed, drafting is more advantageous in these conditions than on a winding, wet road. Drafting is not particularly advantageous in descents, though, because riding closely behind another rider dangerously increases the risk of a serious accident. Second, air resistance is higher in the presence of headwind, so drafting is also more advantageous in the presence of headwind. By contrast, crosswinds make it difficult to draft in the peloton, which is why attacks occur more often when there is crosswind. Third, as we learn from physics, when an object's linear dimensions increase by one unit, areas increase by this unit squared and volumes increase by this unit cubed. Consequently, when cyclists are on the flat and they must spend energy to overcome the air resistance of their body surface area, taller cyclists have a lower frontal drag (body area) relative to their muscular mass (body volume), which makes them more efficient than shorter cyclists (Prinz & Wicker, 2012). By contrast, when cyclists are in the mountain and they must spend energy to overcome the gravity of their mass, shorter cyclists have a lower body mass (body volume) relative to their lungs and muscles' capillary surface (body area) and aerobic power output, which makes them more efficient than taller cyclists (Prinz & Wicker, 2012). This is the main reason why certain riders are relatively stronger on the flat (they are called "*rouleur*" in French or "*passista*" in Italian), while others are better in the mountains (called "*grimpeur*" in French or "*scalatore*" in Italian). Air resistance is also lower at a higher altitude. This is why several world hour records were beaten in Mexico City, with an elevation of 2240 meters above sea level.

When the peloton is on a straight road heading north at a certain speed and a crosswind blows from the west, each rider faces air resistance coming from the northwest, a combination of pure air resistance coming from the north and actual wind coming from the west. In such a situation, a rider will usually not ride right behind his predecessor (as if there were no wind or only wind coming from the north or south), but instead he will position slightly to the right of his predecessor so that the latter shields him from the overall air resistance coming from the northwest. Thus, the peloton will form a diagonal "*echelon*" on the road, which reduces the share of the peloton's riders who can draft and spare energy. Additionally, when teammates form an *echelon*, they will laterally position on the road so that the rider at the back of the group is as close as possible to the right-side gutter or "*bordure*" because this prevents other teams' riders from benefiting from the back rider's shield against the air resistance coming from the northwest. In other words, teammates will exploit the fact that drafting is a club good, i.e., a nonrival but excludable good. For example, in the 13th stage of the 2013 Tour de France, this *bordure* strategy helped several contenders for the general classification gain time on race favorite Christopher Froome.

2.2 Cycling Races as Strategic Individual and Team Competitions

Road races are individual competitions in several senses. The general classification's winner is an individual person. Amongst *Grand Tours*, only the 1912 Giro was raced and won by teams, not individuals. Many riders and especially team leaders exclusively pursue their individual objectives and most cyclists also have a personal coach to monitor their physiological preparation, but they have no team coach (Larson & Maxcy, 2013). Certain stages such as individual time trial stages are even strictly individual competitions. However, road races may also be considered team competitions. The team general classification's winner is a team (the team's time is calculated on the basis of its best three riders per stage), and certain stages such as team time trials are strictly team competitions (the team's time is that of usually the fourth of the fifth quickest teammate). Most importantly, many riders do not race for themselves but for their team leader. Within each team, riders called "*domestiques"* (French for servants) or "*gregari"* (in Italian) are paid to help their leader, thus making for a more exciting if less egalitarian show. The fact that road races are team competitions opens up opportunities for strategic interactions, i.e., cooperation and defection, both between and within teams. Within teams, the diffusion of two-way radios between the team director and his riders has since the 1990s also increased the importance of team directors' strategic decisions (Larson & Maxcy, 2014).

As a result, a rider's individual performance is not determined by his individual characteristics only (a lower body mass index, better past performance, etc.) but also by team characteristics such as his teammates' performance and experience and his relative performance in the team. This is because team leaders profit from their *domestiques*' help. Thus, teams may be more efficient or less efficient in transforming individual riders' performances into team performance (Rogge et al., 2013). Even the great Luxembourg climber Charly Gaul was heavily handicapped by the fact that his "national" team included riders from various countries who were unwilling to sacrifice for him and reciprocally, until 1956, he was unwilling to share his Tour prizes with them. Since the 1970s, *domestiques* actually sacrifice their own chances more and more to help their team leader, as proven by the fact that in the Tour the increase in performance inequality amongst riders is entirely due to an increase in performance inequalities within, not between teams (Candelon & Dupuy, 2015).

Road cycling competitions are strategic because riders nearly always start together in a bunch, subdivided into teams, which enables them to draft each other and otherwise cooperate within and across teams. One-day races on a closed circuit (e.g., World Championships) or from one city to another (e.g., Paris-Roubaix) allow drafting and include an important strategic dimension: when should a rider draft or attack, when and with whom should he ally, and to what extent should he cooperate with those allies? Stage races (e.g., the Tour de France) include all these strategic questions but also require that riders formulate and sometimes modify a race strategy over about 20 stages. As Prinz and Wicker (2012) claim: "a promising avenue for rather unsuccessful teams would be to understand the principles of game theory. Certainly, given the nature of a repeated game (multiple stages), future research of the determinants of cycling success should implement a more game theoretical approach." In addition, road races are run amongst teams, and possibly under crosswind, which still increases their strategic dimension.

The only nonstrategic road cycling competitions are time trials. Although they must use aerodynamic equipment and position themselves on their bicycle to minimize air resistance, they cannot draft or otherwise cooperate, which means the strongest rider wins. However, the idea that road time trials do not include any strategic element may be disputed. First, in time trials in stage races, where riders start off in the general classification's reverse order (the last rider starts first and the leader starts last), informational advantages emerge. Starting later than teammates allows a rider to gather information on the route and adjust, for example, his equipment or his gear, and starting later than a rival allows a rider to know how much time he needs to gain or not lose to reach a given goal, which may motivate him to gain some amount of time or allow him not to take unnecessary risks. Second, starting off earlier may give a psychological advantage. A rider may try to start very quickly to demoralize his rivals who realize they lose time on him right from the start. Third, a rider may be better off not spending all his energy and deliberately losing time in a time trial if that makes him less threatening on the general classification and thus induces leaders to let him break away and win later stages or secondary prizes such as the king-of-the-mountains jersey. One of the greatest time trialists of the 1950s and 1960s, Jacques Anquetil, said: "I keep telling journalists my secret: in a time trial you have to start flat out, finish flat out and take a breather in between […]. Obviously that's not what I do but I still keep telling that's what I do. All my rivals end up trying" (Fournel, 2012).

2.3 Game Theory in Road Cycling

This chapter uses game theory to analyze interdependent situations (games) in which each rider (player) has to decide which action (strategy) to choose knowing that his best action depends on others' actions and also knowing that all riders face a similar situation (Aumann & Hart, 2002). A rider's choice of a strategy is then based on his preferences over his strategies' outcomes (payoffs), which may themselves be the result of their will to maximize their average placing, their victories, or their total lifetime income, including both fixed wages and cash prizes (see text box "What Are Riders Chasing After?"). Game theory helps analyze riders' strategic behaviors given their preferences. The games riders play are solved by finding their Nash equilibrium, i.e., a combination of strategies which are mutual best responses to each other, so that it is not in any rider's strict interest to unilaterally change strategy. An example of such mutual best response is given by Rik Van Steenbergen's victory in the 1952 Paris-Roubaix, when he outsprinted Fausto Coppi. In the last 20 kilometer, Coppi repeatedly attacked, but each time he was caught by Van Steenbergen. On Coppi's last attack, Van Steenbergen lost 15 meter, but he was finally able to catch up again. After his victory, Van Steenbergen declared that had Coppi attacked one more time—only once—he could not have followed him. When Coppi heard about Van Steenbergen's declaration, he said: "Had I had a bit of energy left, I would have attacked, indeed" (Chany & Penot, 1997).

What Are Riders Chasing After?

Few riders can hope to win a race or otherwise make a name for themselves, let alone gain a legendary record. As professionals, most riders aim at maximizing their income or, to some extent, their prestige. Many riders would not participate in cycling races or would quit if little or no money was involved. In 1913, after French champion Octave Lapize quit the Tour, he explained: "The Tour is not a good deal for me! In the team I am the only one fighting to make money and some of my teammates are demanding more money than they should. If I win the Tour, which is easier said than done, I will hardly earn 7000 francs. Track contracts [i.e., money given by velodromes to have riders participate in track races] will earn me much more" (Chany & Cazeneuve, 2003). After Lapize quit, his teammates could not hope to earn any more money, so they too quit the race. Similarly, when in the 1960s French champion Jacques Anquetil was asked by a journalist if he would be willing to race for a medal alone, and not money, he said: "No. Cycling is too hard a sport for me to be willing to race for a medal." In 1965, Jacques Anquetil deliberately chose not to participate in the Tour because the public was tired of his all-too-frequent and predictable victories. He said: "If I win the Tour de France a sixth time my criterium contracts will not get more rewarding. However if I do not win they will definitely become less rewarding. Don't count on me!" (Chany & Cazeneuve, 2003).

More generally, professional cycling is definitely a sport in which "money talks." In the 1962 Vuelta, once it turned out that Rudi Altig had a better chance of winning than his team leader Jacques Anquetil, Jean-Claude Annaert spoke for all of the teammates: "We'll help Altig if he shares the winnings in the same way Jacques [Anquetil] was going to. If not, we stand to lose more than a million francs, and he can hang out to dry in the days that remain" (Fallon & Bell, 2013). Altig promised to share his prizes, his team supported him, and they won. In the 1975 Giro, while Roger De Vlaeminck had already won four stages, a journalist from the *Gazzetta dello Sport*, Rino Negri, asked him if he would do better than Merckx. "That means seven stage wins. No, it's impossible for me," demurred De Vlaeminck. "100,000 Lire*?*", persisted Negri. De Vlaeminck shook his hand and the bet was on (McGann & McGann, 2012). De Vlaeminck finally won seven stages and his bet.

3 Attack Timing Strategy: When to Attack?

To win, a rider has to decide on what portion of the race to attack. "Attacking" means accelerating swiftly in order to break away (i.e., to prevent certain riders from drafting), gain time on the peloton, and possibly win. Attacking is costly, though. First, because an attack has to be abrupt or it will not enable the attacker to drop his opponents, attacking requires considerable energy. For any given average speed of a race, attacking and then riding slower requires more overall energy than riding at constant speed. Second, once the opponents have been dropped, keeping them at a distance also requires considerable energy if, as is usually the case, there are fewer riders in the breakaway than in the peloton, which means fewer opportunities of drafting. Consequently, riders who attack too hard or too often risk what is called meeting the man with the hammer ("*défaillance*" or "*fringale*" in French) and losing a considerable amount of time, whether on the day of the attack or, in stage races, in the following days. This is why no rider can afford to attack or ride in the wind all the time. Team directors, leaders, and other riders must therefore decide when to attack and forgo the benefits of drafting, both on flat and on mountain stages (Scelles et al., 2018). And in stage races, riders must also decide whether to attack early or late in the race. These questions are somewhat related to each other, however, because organizers usually position flat stages in the early part of a stage race and save mountain stages, where time gaps are the greatest, for the later part to keep up suspense for as long as possible (Van Reeth, 2013).

3.1 Flat Stage Strategy: When Do You Attack to Win the Stage?

On a flat stage, riders have to fight against air resistance, which strongly disadvantages breakaways relative to the peloton. In this context, a rider who hopes to win a stage has two basic options. He may stay in the peloton, draft for most of the stage, and spend his remaining energy to try to beat the other riders in the final sprint. These sprinters may thus win stages and the sprinter's jersey, but this strategy does not allow them to gain time on the peloton (for more on sprint strategy, see Sect. 5). Alternatively, a rider may spend his energy to try to break away and keep the peloton at a distance until the stage finish. Successful breakaway riders may thus gain some time on the peloton, and one of them would also win the stage. Riders concerned more about the overall standings could choose to employ these two strategies as well, either to save energy and prevent time losses in the first case or to try to gain a time advantage through a breakaway's success in the second case. So if a rider were to employ the latter strategy and attempt to break away on the flat, when and with whom should they attack?

As a rider decides when to attack, he faces a dilemma. If he attacks too early, he will get exhausted sooner and he will end up easily caught up by the peloton. And if he attacks too late, the peloton will make it much harder for him to break away in the first place because more teams with a sprinter will not want to lose the opportunity of the stage finishing in a sprint. If a rider attacks at the very end of the stage, sprinters themselves will easily beat him. If one were to compute the likelihood of breakaway success for each of the stage's kilometers at which a rider can launch his attack, the resulting curve would likely be inverted U-shaped. In the first part of the stage, the peloton lets most attackers break away. However, out of exhaustion or because of a lack of cooperation between the breakaway riders (see Sect. 3), these early attacks usually fail to keep the peloton at distance until the stage finish and breakaway success is very low. Late in the stage, where the increased proximity to the finish improves a breakaway's chances of survival, the peloton becomes increasingly more reluctant to let attackers break away and breakaway success is again very low. Late attacks often do not even succeed at breaking away for more than a few minutes. Overall, riders should draft in the peloton until they feel that in the remaining kilometers the peloton will not let them break away any more. At the last possible moment, they should preempt the peloton's decision and attack to escape the peloton using that latest available opportunity.

This interaction has the structure of a duel (Polak, 2008). A duel is a zero-sum sequential move game where two gunfighters, each with a one-bullet gun in their hands, stand at some distance from each other. Each in turn then chooses whether to make a step towards the other or fire. Gunfighters know each other's probability of hitting at every distance. The probability of hitting increases as they get closer and closer. If a fighter fires and hits, he wins (+1) and the other loses (−1). But if he fires and misses, he loses because the other will then get as close as he can and will fire and hit with certainty. When should they fire if it is in each fighter's interest not to fire too early (higher risk to miss) or too late (the other fighter might decide to shoot first)? The only Nash equilibrium (i.e., the combination of mutual best responses) of this game shows that it is in each gunfighter's interest to fire precisely at the moment when his likelihood of hitting by firing now exceeds his likelihood of not being hit later, i.e., when his chance of success equals his rival's risk of failure. This situation is similar to a market where each of two firms has to decide when to launch its new product: not too early or it will not sell, not too late or the other firm will have scooped the market. Each will launch its product once delaying its decision starts reducing its chances of winning the whole market.

Thus, a rider should attack, perhaps in cooperation with other riders, following a similar strategy: right before the moment when delaying the attack starts reducing his chances of winning the stage. The peloton may "wake up" and start chasing too late when riders are tired (e.g., the day after a hard mountain stage or right after the peloton caught up on a previous breakaway) or when they prefer to save themselves for future stages (e.g., the day before a hard mountain stage). Riders should also attack when certain teams will not cooperate to chase down breakaways, e.g., when these teams figure in the breakaway, when the breakaway does not jeopardize any team's leadership jersey, or when general classification leaders are waiting for each other to attack first. Optimal attack timing also depends on various stage parameters. In the presence of crosswinds or on winding, rough or wet roads, the peloton's air resistance advantage is less pronounced, so the peloton will prevent riders from breaking away from an earlier time point and riders should attack earlier. If the goal of the breakaway rider is not so much to win the stage as to get publicity for the team, he might as well attack early in the stage to get longer media coverage, as is often the case with smaller teams in the Tour de France.

When deciding on his attack timing, a rider may also try to profit from the peloton's possible off-guard moments. A rider's reasoning may go as follows: if the peloton is going to be more watchful before the next bend, I should attack right after it and vice versa (i.e., anti-coordinate). At the same time, the peloton may be willing to be especially watchful whenever the rider who seems willing to attack may believe that it is least watchful (i.e., coordinate). Thus, when a rider is deciding when or where to attack, he is effectively playing a "game of matching pennies" (or "cat and mouse") with the peloton (Table 10.1).

The "game of matching pennies" (like its three-strategy analog "rock, paper, scissors") is a zero-sum de-coordination game with no Nash equilibrium in pure strategies but one equilibrium in mixed strategies. Each player mixes his play by choosing one of two strategies with 0.5 probability. In such a game, a player cannot surprise the other without surprising himself, i.e., he must randomize his behavior. In professional road cycling, an attack is most likely to be unexpected when the rider is attacking from the back of an opponent or when the opponent is not on the watch, e.g., when he is talking to his teammates or team director. An opponent may also not be able to follow an attack if he is in the middle of the peloton or faces mechanical problems. In the 11th stage of the 1949 Giro, Fausto Coppi attacked Gino Bartali while he was eating and was about to stop to change a wheel. In the seventh stage of the 1974 Tour, as soon as Eddy Merckx heard about Gerben Karstens' tire puncture, he attacked and won the stage. Riders are also vulnerable right after they change to a higher gear, because at that time swiftly accelerating is harder. Opponents may profit from this to attack very hard using lower gears. More generally, as the "game of matching pennies" shows, the timing of a surprise attack must be randomized. Great champions such as Eddy Merckx and Bernard Hinault were known to be masters of psychology because they could attack at any time. Tennis players also play a "game of matching pennies": the server may serve to the right or left of the receiver, and the receiver has to anticipate left or right. The mixed-strategy Nash equilibrium of this game indicates that servers should equalize

Table 10.1 Attack timing strategy as a "game of matching pennies"

		Attacker	
		Attack early	Attack late
Opponent or peloton	Be on watch early	4; 0	0; 4
	Be on watch late	0; 4	4; 0

In this "strategic form" payoff matrix each row is one of the opponent's two choices and similarly each column is one of the attacker's two choices. In each cell at the intersection of these choices (or strategies), one finds two numbers. The first represents the opponent's utility level; the second represents the attacker's utility level. These cardinal payoffs go from 1 (least preferred outcome) to 4 (most preferred outcome) their probabilities of winning by serving to the right or left, and this is precisely what champions do (Walker & Wooders, 2001). For similar results about penalty kicks in soccer, we refer to Chiappori et al. (2002) and Palacios-Huerta (2003).

In the flat stages of *Grand Tours*, it seems that the structure of breakaways has changed since the 2010s. Before, we had significant groups of riders (in most cases four to eight riders) that got a large advantage, and then were chased by the peloton according to "Chapatte's law," the empirical pattern according to which a chasing peloton can take back 1 minute every 10 kilometer on a solo rider or on a small breakaway group. This has now changed completely. Sprint teams have found it easier to keep the time gap small, by riding a solid, but not too hard, pace instead of first going very slowly and then going very hard at the end. Furthermore, they control more strictly the number of riders in the breakaway and who is part of it. As a result, breakaways seem less likely to succeed than before and there is less interest in being part of breakaways, resulting in breakaways of now usually just one to three riders. In recent history, the fifth stage of the 2021 Tour de France was also the first flat stage without any breakaway at all. Instead, typical breakaway riders prefer to save their energy for stages where a breakaway is more likely to succeed, usually a hilly stage in the second of third week of the *Grand Tour*. In those stages, we now often have breakaways of groups of up to 20 riders gaining a time advantage of over 10 minutes, which happened less often before. This shows how nowadays we have two types of breakaway riders. Weaker riders from smaller teams who want to gain publicity for themselves or the teams now tend to get in a breakaway at the start of flat stages, knowing that it will be easy to get away but almost impossible to win. Stronger riders await the right stages knowing that it will be a hard-fought battle to get away (in recent years such battles can last for up to an hour), but once the difference is made, the breakaway will be almost sure of fighting for the win.

3.2 Mountain Stage Strategy: When Do You Attack to Win the Stage?

Successful breakaways on the flat are rare. They require optimal attack timing and, as we will show in Sect. 4, cooperation amongst the breakaway riders and noncooperation amongst the peloton. Furthermore, even those breakaways that succeed generally win the stage with small time gains. Attacking on the flat thus serves the purpose of winning stages more than gaining time. Mountain stages, by contrast, enable certain riders to gain considerable amounts of time over their competitors.

On a mountain stage, riders have to fight against the gravity of their mass more than against air resistance, which means breakaway riders do not face as strong a disadvantage relative to the peloton as on a flat stage. Therefore, strategies are not the same in mountain stages as in flat stages. The stronger a rider feels and the lower his risk of getting completely exhausted, the earlier he should attack to give himself more time to build a big gap on the peloton. In the 18th stage of the 2011 Tour, a hard mountain stage with three consecutive climbs and a hilltop finish, fourth-placed Andy Schleck broke away from his rivals at 62 kilometers from the finish. He won the stage and took enough time on his rivals to move up to second place overall. By contrast, while attacking late is less costly in terms of energy, it may not allow a rider to build big time gaps by the finish line. A common strategy for the general classification contenders therefore consists of attacking in the later part of each mountain stage, which enables them to gain some time on opponents while taking few risks with overall energy expenditure. In the eighth stage of the 2013 Tour, Christopher Froome attacked a few kilometers away from the finish of the last climb to test his opponents once they were tired while avoiding risks of blowing up from an extended sortie.

Deciding to join the right attack, or to join an attack at the right time in the mountains, may gain a rider the yellow jersey. For example, in the 14th stage of the 1976 Tour, second-placed Lucien van Impe was ordered by his team director Cyrille Guimard to attack early. Meanwhile, third-placed Joop Zoetemelk stayed in leader Raymond Delisle's slipstream, believing that in the unlikely event Van Impe gained time on both of them it is the leader who would have to chase him down. Indeed, when a breakaway threatens the leader, it usually is in his competitors' interest to draft him because it is the leader who has the most to lose if he does not do the work of chasing down the breakaway. However, Delisle turned out to be incapable of chasing down Van Impe and Zoetemelk started chasing Van Impe too late. As a result, Van Impe gained considerable time on both Delisle and Zoetemelk, became the general classification leader, and ultimately won the Tour.

In hard mountain stages, it has become a common practice that team leaders send some of their teammates in an early break, not so much to win the stage but so that they can be used to help the team leader later in the stage, e.g., by waiting for him. While at first this was mainly done by rivals of the race leader, it is now also part of the strategy of the race leader's team, not following the old "rule" that all teammates should stay with the team leader if he wears the yellow jersey. For instance, in the 17th stage of the 2020 Vuelta race leader Roglič knew he would be attacked by Carapaz in the final climb to the finish. Therefore, his team *Jumbo-Visma* sent young Dutch rider Lennard Hofstede in a breakaway so he could drop from the breakaway and help Roglič limit losses in that final climb, and eventually save his red jersey.

3.3 Stage Race Strategy: On Which Stage(s) Do You Attack to Win the Race?

Because no rider can afford to keep attacking, general classification riders save themselves on most stages and focus their effort on a few key stages where they can widen the gap the most. Riders may even win a *Grand Tour* without any stage victories at all, as did Firmin Lambot (1922), Roger Walkowiak (1956), Gastone Nencini (1960), Lucien Aimar (1966), Greg LeMond (1990), Oscar Pereiro (2006), Alberto Contador (2010, before being disqualified for doping), Christopher Froome (2017) and Egan Bernal (2019) in the Tour, Carlo Oriani (1913), Franco Balmamion (1962) and Alberto Contador (2008 and 2015) in the Giro, as well as Ángel Casero (2001) and Alejandro Valverde (2009) in the Vuelta.

On which stages can riders gain time and perhaps the race? The peloton's advantage against air resistance is the highest on the flat stages, so riders aiming at the general classification are better off not attacking on the flat. Similarly, there is no need to use too much energy or take too many risks on the prologue, which is too short to make significant time differences. After the prologue of the 1983 Vuelta, Bernard Hinault explained why he did not take too many risks: "With 3000 kilometer left to dispute, it was absurd to risk everything in the first six. I know when I'll put on the leader's jersey, and as long as I don't have an accident, no one will take it off me" (Fallon & Bell, 2013). In 1995, while the prologue of the Tour was raced on a rainy day and the road was wet, Miguel Indurain chose to not take risks and he did not win the prologue. Those who spend maximum energy or take risks in the prologue are riders who have no chance other than the prologue to get the leader's jersey, or riders who want to show they should become the team leader.

For any given energy expense, a rider can gain more time in mountain stages or time trials. A climber's strategy consists in limiting his losses in time trials and attacking in the mountains. Although, as explained earlier, there usually is no strategy in time trial stages (each rider faces the wind and goes as fast as he can), a time trialist's strategy on a stage race consists in gaining time in early time trials and then drafting his opponents as much as possible when they attack in the mountains. This was Jacques Anquetil's "economical" strategy, which was radicalized by Miguel Indurain, a five-time Tour de France winner who did not win a single stage of the Tours he won, except time trials. It should also be noted that since the 1970s, as technological advances improved time trial performances more than mountain performances, time trials may have become relatively more determinant of victory than before. One common point between climbers' and time trialists' strategies is their use of what game theorists call "backward induction" in sequential move games. If a rider knows he can gain at least x minutes on his opponent in a late mountain or time trial stage, he need not unnecessarily spend energy in early stages to catch up on a delay which is inferior to x.

When deciding on in what stages to attack, a rider has multiple reasons to believe that good things come to those who wait. Efforts in later stagers tend to be more profitable in terms of time gained. First, in a *Grand Tour* after 1 or 2 out of 3 weeks, some riders have abandoned the race due to crashes or mechanical misfortune. A rider can thus focus his attacks on those remaining opponents who compete for the win. Second, late in the race, teams get weaker and riders get tired, making it easier to drop leaders from competing teams. Third, attacking right before the end of the stage race allows a rider to make extremely intense efforts without having to worry about the risk of blowing up in the following days. This allows avoiding "Pyrrhic victories," i.e., stage wins that make you gain time but leave you so exhausted that the day after you lose everything. Fourth, because defending the leader's jersey is costly to the whole team since you have to fight against many teams at a time and catch up on the breakaways, the later you take hold of the jersey, the less costly it is to keep it until the end of the race. This is why certain teams aiming at the overall win may prefer not to lead too early, for fear of weakening the team and being unable to protect the leader's jersey until the very end. In 1999, after Lance Armstrong won the Tour prologue, *US Postal* team director Johan Bruyneel said: "We will not do everything in our power to keep it. There is no reason for Lance to take unnecessary risks in the coming days. Our first objective is the Metz time trial [i.e., the 8th stage]." This is how from the second to the seventh stage the *US Postal* team "gave" the leader's jersey to the French *Casino* team and subsequently let sprinter teams chase down breakaways and otherwise control the race. At the same time, Lance Armstrong was also saved for almost a week from the time-consuming ceremonial obligations that go along with wearing the yellow jersey. Such extra rest is very welcome at the beginning of a 3-week stage race. This is also how Tadej Pogačar won the 2020 Tour de France, by saving all his energy for the final time trial while letting *Team Jumbo-Visma* do all the work of protecting yellow jersey wearer Primož Roglič during most of the race. *Team Jumbo-Visma* learned from the experience and used the same tactics in the 2021 Vuelta.

These strategic considerations are all the more important since once a rider has taken the lead, his challengers may find it difficult to join forces and attack him. Although the leader's challengers would collectively be better off coordinating their attacks against him, each may prefer to wait and draft the first attackers and attack only once the leader has been exhausted by repeated attacks. This leads to the suboptimal situation where no one starts attacking the leader. However, could not the leader's challengers attack him simultaneously? While this is possible, the runner-up may be afraid to cooperate with the third-placed rider for fear of turning out to be weaker and losing his second place. Or the third-placed rider may fear exhausting himself and losing his third place on a following day. In other words, if followers cannot trust each other to attack the leader but not attack each other, each may prefer to secure an honorable placing. In 1961, Tour organizer Jacques Goddet called riders who did not challenge Jacques Anquetil's lead "dwarfs of the road." They may have been dwarfs of the road, but it is no surprise none was willing to take the risk of losing everything to have a slight chance of winning in the unlikely event all challengers took the risk to coordinate their attacks. When his challengers are playing against each other this way, the leader may profit from "social dilemmas," known in game theory as prisoner's dilemmas and assurance games (Kollock, 1998).

The fact that it usually is not worth the cost for overall contenders to attack on the flat often leads to relatively dull stages. Therefore, race organizers have long been trying to reduce the costs and increase the benefits of attacking on flat stages (Chany & Cazeneuve, 2003). For example, in 1936, Tour de France organizers cut many stages in two or three parts to multiply stage winners' time bonuses. In 1951, they shortened flat stages and they also modified the calculation of the team general classification. While each team's performance used to be measured by the team's best three riders on the final individual general classification, it was now calculated by the team's best three riders in each stage, thus giving more importance to early, flat stages.

In everyday life, agents have to decide not only what to do but also when to do it. Each of two countries may have to choose when to mobilize their troops or to declare war. Act too early and you will be seen by third parties as the attacker. Act too late and you will have lost the war without even fighting. However, when deciding when to attack, riders may not just have strategic considerations in mind, but normative expectations as well (Elster, 2009). In cycling, certain norms of etiquette or fairness prohibit riders from attacking when their opponents are having sanitary stops, going through the feed zone, or having mechanical problems. It should be noted that an unexpected consequence of the diffusion of two-way radios was that they increased riders' respect of such norms because now riders cannot attack ignoring or pretending to ignore their opponents' situation. Generally, norms and an associated demand for sanctions are easier observed in a close-knit network (Coleman, 1998). Professional riders, who ride with each other all year long, form such a type of network. In this context, it is no wonder these norms emerged and are to some extent respected. After the 15th stage of the 2011 Tour, when Alberto Contador took hold of Andy Schleck's leader's jersey by attacking him while his chain had come off, not only did Schleck reproach him for such behavior, Contador was also booed by the public and he finally apologized. In the early twentieth century, when both professional cyclists and occasional riders rode the Tour or Giro, only professionals respected these norms of etiquette, presumably because only professionals expected to repeatedly interact with each other for a sufficient period of time and could have been punished for infringing them.

4 Cooperation in a Breakaway and in the Peloton: When to "Free Ride"?

The discussion of attack timing strategy implicitly assumed that breakaways aim at winning stages, while the peloton aims at preventing them from doing so, as if each of these groups acted like an individual advancing his self-interest ("fallacy of composition"). Actually, riders face strategic interactions, collective action problems, and underprovision of public goods inside both a breakaway and the peloton (Albert, 1991). Once in a breakaway, a rider has to decide to what extent he should draft or shield other breakaway riders from the wind. This leads most breakaway riders to defect, unless they profit from certain favorable circumstances. And once a group of riders establishes a breakaway, each rider in the peloton must decide to what extent he should draft or ride against the wind to close the distance to the breakaway. Riders in the peloton thus find themselves in a situation which is partly similar to that of riders in a breakaway.

4.1 The Breakaway's Dilemma: Why Cooperate in a Breakaway?

Once two riders both aiming at the stage win find themselves in a breakaway a few kilometers away from the finish line, they face a highly nerve-racking strategic situation. Each has to choose between starting the sprint first or last, i.e., between attacking or drafting. They also realize that if both refuse to attack, the peloton will likely catch them and they will have wasted energy in breaking away for nothing. Despite this, each is still better off drafting the other until the final meters and beating him on the finish line, so neither is willing to launch the final sprint. This strategic interaction reaches its climax a few hundred meters away from the finish line. Riders observe each other and slow down considerably to make each other start the sprint.

When they are further away from the finish line, breakaway riders face a similar, if less acute problem. Each has to choose between riding in the wind and drafting the other rider or, in other words, choose between spending a lot or a little energy while riding in the breakaway. Once again, although both riders realize that if both spend too little energy, their breakaway will fail, each will still use any pretext to let the other spend more energy in order to be able to beat him. And given that each rider perfectly knows the other is also trying to spend less energy than he is, all riders tend to draft and their breakaway fails not long after it starts. If ever a rider tried to set an example by taking a long, hard pull at the front of the breakaway, he would sooner or later make it in others' interest to attack because he would now be tired and easy to drop.

The closer the breakaway gets to the finish, the more each rider's reasoning goes as follows: if others do not contribute to the success of the breakaway, there is no reason to unilaterally contribute. And if others contribute, there is still no reason to contribute because unilaterally defecting (called shirking or free riding) does not substantially reduce the probability that the peloton will catch the breakaway, while increasing substantially the likelihood of beating the other riders at the finish. This is because a cooperator bears the full marginal cost of riding in front, but shares the benefits of increased overall speed with all the other breakaway riders, i.e., riders' rewards are largely independent of their efforts. Thus, when deciding whether or not to cooperate, riders in the breakaway are effectively playing a prisoner's dilemma against each other (or its n-player, sequential version, the "investment game"). More precisely, taking into account the time dimension of a breakaway and modeling it as a sequential, multiperiod prisoner's dilemma, breakaway riders are playing a "centipede game" (Rosenthal, 1981) where each player has an incentive to be the first to defect (Fig. 10.1).

The "centipede game" is a sequential move game where two players alternately choose either to pocket a given amount of money (defect), which ends the game, or to hand over that decision to the other player (cooperate), who may in turn hand over the decision to the first player, etc., for 100 rounds. Only the first four rounds are shown in Fig. 10.1. The twist in this game is that payoffs are structured in a way that if the first player cooperates and the second pockets the money, the first player

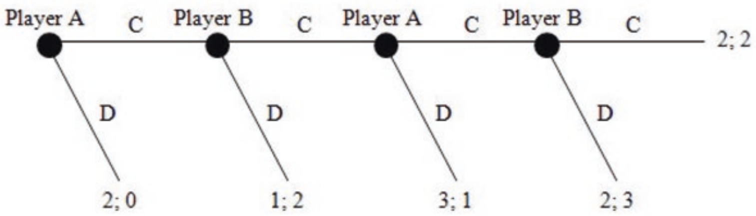

Fig. 10.1 Cooperation amongst breakaway riders as a centipede game. In this extensive form game each of two players A and B can alternatively choose either to cooperate (C) or defect (D). The two numbers at the end of each decision node represent first, player A's utility level, and second, player B's utility level. These cardinal payoffs go from 0 (least preferred outcome) to higher numbers (most preferred outcome). Only the first four rounds of the centipede game are shown here

always wins less than if he had pocketed the money first. As the sum of players' payoffs keeps increasing from each round to the next but does so to the detriment of the decision-maker, by backward induction the first player reasons: at the 100th round, the decision-maker will defect because on the last round the decision-maker has no conceivable reason to prefer cooperation. Knowing this at the 99th round, the other player will preempt defection because decision-makers always prefer that they decide to defect rather than let the other player defect on the next round. However, knowing this at the 98th round, the player will also defect, etc., until in the first round it is in the first player's interest to defect. Backward induction shows that this game has one perfect Nash equilibrium: on the first round, the first player defects, thus ending the game. In a two-rider breakaway, each rider wants to avoid being the last to defect, which means many breakaways stop soon after they start or may never even form in the first place.

In experimental setups, most people playing the centipede game do not defect on the first round. Possibly because the first player may doubt the second player's rationality, he cooperates, hoping and believing that the second player will not immediately defect. And because the first player apparently is irrational (he did not defect on the first round), it is in the second player's interest to make the first player believe that he too is irrational. In other terms, if at least one of the players is unsure about the other's rationality (or unsure about the other's belief about his own rationality), both may well cooperate and thus increase their joint gains. However, near the end of the game, as each player starts fearing that the other player will be first to defect, empirically players do defect, thus ending the game before the last possible play. As in experimental centipede games, riders in a breakaway start by cooperating, but, near the end of the stage, each starts preemptively defecting for fear of becoming the loser. In this sense, riders nicely replicate outside of the usual experimental setup certain end-of-game noncooperative behavior. However, it is unlikely that riders cooperate for the reason that they doubt each other's rationality. Riders are professionals and each of them knows riders are rational, each also knows riders know riders are rational, etc., which leads them to reason using a higher number of steps of iterated dominance than most people in the laboratory (around 1.5 or 2 steps, Camerer, 2003). Why, then, do certain breakaways succeed and certain groups of riders break away in the first place?

The Gruppetto's Dilemma
An interaction structure which is similar to the breakaway's dilemma is found in the "*gruppetto*" (formerly called the "autobus"), a group of riders in difficulty in hard mountain stages which forms behind the leading peloton to try and reach the stage finish within the time limits. In this group, it is in each rider's interest to draft other riders so as not to blow up. But if each rider drafts and none is willing to ride in front, the gruppetto will slow down and all its members will be eliminated. However, if failing to finish the stage within the time limits is sufficiently costly to one of the gruppetto's riders, typically the sprinter's jersey holder, he and his teammates will be willing to ride in front of the group and thereby let others draft. Alternatively, because the gruppetto's riders are most often the same and get to know each other well, they can easily identify and punish those riders who avoid riding in front even when they physically could. For instance, the gruppetto's cooperative riders may wait for a rider and give him food or energy drinks when he needs it only if he is usually being cooperative.

4.2 Possible Solutions to the Breakaway's Dilemma: How Can Certain Breakaways Succeed?

When breakaway riders form a "latent group" (Olson, 1965), i.e., a group with common interests but where everyone prefers to defect no matter what others do, they will not provide the public good (i.e., the breakaway) and the breakaway will sooner or later fail. However, collective action in a breakaway might still be possible in two types of cases.

The members of a "privileged group" (Olson, 1965) may include at least one person who values the public good enough to be willing to provide it. In a breakaway, a rider may be willing to ride in front of the group and forgo his chances of winning the stage as long as that makes him gain enough time or points on his competitors. In the eighth stage of the 1973 Tour, José Manuel Fuente was able to ascend the Col d'Izoard sitting on leader Luis Ocaña's wheel because the latter, although furious about working for Fuente (a fellow Spaniard he did not get along with very well), was willing to increase his advance on his general classification competitors. There exist additional private gains to cooperation in breakaways: a prize given to the most combative rider of the stage, (small) prizes along the route for the first riders to cross certain places, and TV time, which is good to a rider both to make a name for himself and to show his sponsor's logo and thus hopefully extend his employment contract. These "selective incentives" to cooperation might explain why a rider may be better off cooperating unilaterally, which in turn may explain why another rider may be better off cooperating, given that at least one other will be cooperating, provoking critical mass and bandwagon effects like those found in the development of strikes, riots, and revolutions (Granovetter, 1978). Social life too includes such privileged groups. During the Cold War, the USA was so eager to contain communism that it was willing to pay for the national security of all countries of the North Atlantic Treaty Organization.

The members of an "intermediate group" (Olson, 1965) may also perform collective action if the group fulfills two conditions. First, the group must be small enough to enable its members to identify free riders. Professional riders form a small world in which everyone knows who the free riders (drafters) are or the conditional cooperators. Second, the group must expect to be interacting indefinitely (i.e., infinitely or a finite but unknown number of times), so that its members may punish free riders but cannot reason by backward induction and thereby conclude that they had better defect. Riders may indeed expect that they will interact some unknown number of times with other riders, if not in the following stages of the same race at least in coming races or in some of the multiple competitions in which they will participate in their careers. Riders who have a bad reputation typically pay the price. When in the 1919 Tour de France Henri Pélissier had made himself unpopular amongst the peloton, as soon as he had mechanical problems the peloton attacked. A rider may thus be better off building a reputation of not being a "wheel sucker" or a "rat." Otherwise, no other rider will be willing to cooperate in the breakaways in which he finds himself. To build such a reputation, riders must earn it, i.e., they need to prove that they may contribute to collective work in breakaways. In other words, a major reason why some breakaways succeed is because riders cooperate to send all riders a signal that when they will find themselves in the same breakaway, they will not be cheated and may cooperate. In the long term, this strategy may well increase conditional cooperators' number of wins, relative to wins by free riders. That is to say, the prospect of indefinite interactions gives riders incentives to cooperate. However, in the most prestigious road races, riders with a strong reputation of being (conditional) cooperators might be especially tempted to use that reputation to free ride and win the most important stage of their career.

How may various factors affect a rider's temptation to free ride and a breakaway's risk of failure? First, when the number of breakaway riders increases, the marginal effect of each rider's effort on the overall speed of the breakaway decreases and each rider's likelihood of winning in case the peloton never catches up decreases, which makes it even more tempting or necessary to free ride. Smaller breakaways thus tend to favor cooperation more. However, it is also true that as the number of breakaway riders increases, the breakaway's physical disadvantage relative to the peloton decreases. And as the number of teams present in the breakaway increases, the number of the peloton's teams willing to chase down the breakaway decreases. This increases the likelihood of breakaway success. Hence, which of these opposite direction effects most impact a breakaway rider's chance to win the stage, or what is the optimal size of a breakaway, is an open empirical question.

Second, when in a breakaway a rider believes he is not the best sprinter, the cooperation problem worsens. Why would a rider cooperate if he believes he will not win the stage anyway? The best sprinter may promise the other breakaway riders compensation for their cooperation: if you cooperate and I win, we will share the stage win's cash prize. More generally, if one rider profits from the breakaway more than the others, perhaps because he may win the stage and at the same time take hold of one of the leadership jerseys, he may also compensate them for their efforts. In the 13th stage of the 1991 Tour, Miguel Indurain, who went on to win the general classification, gave Claudio Chiappucci the stage win to cooperate. However, such deals can be financially profitable only when there are few riders in the breakaway, i.e., when cooperation problems are least acute. In the absence of such side payments, when the chasing peloton closely follows the breakaway, it is the breakaway's best sprinter who has the most incentives to launch the sprint (Dilger & Geyer, 2009). Like in a Rubinstein bargaining game where two players alternately make (an unlimited amount of) offers and counteroffers to split some amount of surplus of which the size is diminishing over rounds of negotiation, a player's relative impatience disadvantages him in the bargaining process (Binmore et al., 1992). The most impatient rider, i.e., the rider whose likely ranking in the breakaway sprint is most threatened by the peloton's comeback, may be willing to provide the whole breakaway with the public good of launching the sprint, thus making the breakaway a "privileged group."

In other contexts, a rider who knows he is not the breakaway's best sprinter may still be willing to cooperate for some time if he can hope to drop the breakaway's better sprinter before the final sprint and win solo. This is a major reason why certain riders break away in the first place: they hope to first gain some time on the peloton and then attack again to drop other breakaway riders and avoid the stage finish interaction which is fatal to many breakaways. However, attacking early usually enables the better sprinter to draft the attacker and still win the stage (Dilger & Geyer, 2009), except if the attacker can somehow launch a surprise attack. In addition, the better the breakaway riders evaluate each other's probabilities of winning the stage in a sprint or solo, the harder the cooperation will be in the breakaway. Why would a rider cooperate if he knows that whatever his strategy he is unlikely to win? Only when each breakaway rider believes he is the better sprinter will they all start sprinting late, as in individual track sprint. Otherwise, the riders who know they are the worst sprinters will try to drop other breakaway riders before the final sprint. For a rider, this strategy is particularly attractive when the other riders left in the breakaway have cooperation problems, i.e., when none of them is still willing to lead the breakaway for fear of letting others draft and win.

Third, when a breakaway contains at least three riders and at least two (but not all) of them are from the same team, cooperation problems change. In such cases, teammates' strategy may consist of one of them in doing all the work and sacrificing his own chances of a win to increase the chances of his teammate to win. Teammates' strategy may also consist of one of them in attacking little before the finish and forcing the other riders to try and catch up on him, enabling his teammate to draft them and win. Anticipating this, riders who are not from their team will not cooperate in the first place. This became very clear in the 2015 edition of Omloop Het Nieuwsblad. British rider Ian Stannard from *Team Sky* found himself in a breakaway with three riders from the *Etixx-Quick-Step* team, amongst them their team leader Tom Boonen who desperately wanted to win the race for the first time. Stannard drafted the three other riders for about 40 kilometers, and when the teammates started attacking little before the finish, he turned out to be the fresher rider of the breakaway. He was able to counter every attack and finally outsprinted Niki Terpstra, the only *Etixx-Quick-Step* rider that was strong enough to hold the wheel of Stannard when he attacked himself with 3 kilometers to go.

4.3 The Peloton's Dilemma: Why Cooperate in the Peloton?

Once a group of riders has broken away, it is the peloton's rider who has the most to lose from the breakaway's time gain, usually the leader, who asks his *domestiques* to chase down the breakaway. When this happens, in the early part of a stage, the peloton's riders may free ride on the leader's team's efforts and the peloton forms a "privileged group." In the later part of the stage, when the breakaway's time gain has been controlled by the leader's team, but the breakaway may still win the stage, the riders who have the most to lose from the breakaway's success are the best sprinters. It is now up to them to ask their teammates to catch the breakaway before the final sprint. This involves two kinds of strategic considerations.

First, teams with sprinters are better off catching the breakaway at the optimal time: early enough so that no breakaway rider wins the stage, but late enough so that once the breakaway is caught, there is too little time left for other riders to counterattack. To determine at which speed it should go, for a long time sprinter teams used the earlier explained "Chapatte's law." However, strategic interactions inside the breakaway or between the breakaway and the peloton may make it difficult for teams to anticipate and adjust their speed to catch up to the breakaway at the optimal time. Indeed, more recently, breakaway riders have learned to save their energy early in the race. Instead of trying to widen the time gap as much as possible, as was common in the old days, nowadays once breakaway riders have created a sufficiently large time gap (e.g., 3 minutes), they adjust their pace to that of the peloton to keep their advance stable while saving as much energy as possible. Such a strategy makes it much harder for teams to catch a breakaway right before the stage finish.

Second, although teams with top sprinters are better off mutually cooperating to increase their joint chances of catching up on the breakaway, each team would prefer to let the others do the chasing work and still have their leader win. If the best sprinter's team can consistently catch breakaways and win sprints so that its payoff expectancy of chasing (which could, theoretically, be computed as the probability of catching up on the breakaway times the probability of winning the sprint times the stage prize less the chasing costs) is always positive, it may be willing to do all the chasing work on its own. In this case, other sprinters' teams will be able to free ride on these efforts and still win a certain amount of stages. However, when no team is strong enough to make the others a privileged group, it may be in sprinters' teams' collective long-term interest to strike deals. The stronger teams pay some weaker teams or let them win a certain number of stages to contribute to chasing. Empirical information on the results of bargaining amongst sprinters' teams is hard to find, though.

5 Three-Player Interactions: With Whom to Ally?

A coalition is a group of players who coordinate their actions for their mutual benefit, usually to the detriment of some other group of players. Coalitions may be hard to build, though, as in the three-player split-the-dollar game (Friedman, 1990). When a group of three players is given one dollar (or, for that matter, 99 cents) as long as at least two players agree on any division of this sum amongst them, all the three-player coalitions that may emerge (e.g., 33:33:33) are dominated by two-player coalitions (e.g., 50:50:0) and all two-player coalitions are dominated by other two-player coalitions (e.g., 51:0:49). Rational players may thus find it hard to build a coalition in the first place. Nevertheless, a duel amongst three opponents (sometimes also called truel) may take several forms (McCain, 2010).

The most common interaction is when two riders coalesce against a third rider who is left out of the coalition. Two riders R1 and R2 typically draft each other to drop, chase down, or otherwise gain time on an opponent O. One particularly tricky situation for O is when R1 breaks away. If O does not chase R1 or is unsuccessful, then R1 will win the stage. But if O successfully chases, he will unwillingly allow R2 to draft him, so R2 will beat him at the finish. Knowing this in advance can only demotivate O. In the 19th stage of the 1950 Tour, French teammates Louison Bobet and Raphaël Géminiani broke away together. After a few minutes, Bobet accelerated again, while Géminiani waited for Bobet's opponents, notably Ferdi Kübler, who now had the choice either not to chase and let Bobet take hold of the leader's jersey or to chase him, but in the process let Géminiani draft him and enable him to win the stage. Kübler was finally able to go back on Bobet, but predictably Géminiani counterattacked and won the stage. In the penultimate stage of the 1984 Vuelta, Eric Caritoux was the leader, Alberto Fernández was second, and Pedro Delgado was third. Delgado broke away. Momentarily, Caritoux's lead was in danger. Beside him was Alberto Fernández, second overall and just 37 seconds behind. Chase and risk being jumped by Fernández and don't chase and hand victory to Delgado—those were Caritoux's options. Then the Italians came to the rescue, in the form of Francesco Moser and Simone Masciarelli. Delgado was recaptured, Caritoux stayed in the maillot amarillo and José Recio won the stage into Segovia (McKay, 2012).

By contrast, in the 1985 Vuelta, the leader David Millar was in a group with second-placed Pacho Rodríguez and third-placed Pello Ruiz Cabestany (and several other riders). Pedro Delgado, who could take the first place, had attacked and was gaining time on them all. This put Millar into a terrible situation: do not chase and let Delgado win or chase, and enable Rodríguez to gain time in the final kilometers.

Finally, Millar lost his first place to Delgado with Rodríguez's consent, a sign of national unity amongst Spanish cyclists. Similarly, in the 1990 Tour, Greg LeMond profited from the fact that his teammate Ronan Pensec took hold of the leader's jersey on the tenth stage. If rival teams wanted to gain time on Pensec, they had to attack, which enabled LeMond to draft them.

Another tricky situation for O is if he breaks away with R1, who is allied to R2. If O does not lead the breakaway, he will not be able to gain time on R2. But if O does all the work in the breakaway, R1 will draft him and win the stage. In the 17th stage of the 1986 Tour, when runner-up Greg LeMond broke away with third-placed Urs Zimmermann, there was a risk that LeMond's teammate Bernard Hinault would lose not only his leader's jersey to LeMond, but also his virtual second place to Zimmermann. As this was not in LeMond's team's interest, when Zimmermann threatened Hinault's second place, LeMond was content with drafting him for the remainder of the stage.

Another interesting fight amongst three opponents is when two riders compete against each other for the favors of a "spoiler," a third rider who cannot win but can still decide who amongst the other two will. When two teams compete to get help from a third team and the helping team can choose the winner, the helping team might be able to reap almost all the benefits from its help. One way for the spoiler to help a team might be to backstab the other. In the 1906 Milano-Sanremo, Giovanni Gerbi, after 200 kilometers on his own, was caught in the closing kilometer by Gustave Garrigou. Knowing that Garrigou had the beating of him in a sprint, and knowing that his own *Bianchi* teammate, Lucien Petit-Breton, was closing on the pair of them, Gerbi slowed things down at the front and then, with Petit-Breton on board and the three racing for the line, pushed Garrigou off his bicycle and sealed the victory for Petit-Breton. Having worked out he couldn't beat Garrigou, Gerbi did some mental arithmetic. *Bianchi* were paying him two-and-half lire a kilometer if he won the race. But they were paying Petit-Breton six times as much if he won the race. Gerbi did a deal—fifty-fifty—and did the deed. He lost the race but pocketed more than he would have had he won (McKay, 2011).

6 Sprint Strategy: How to Sprint?

When at the end of a race all the peloton's riders or several breakaway riders arrive together at the finish line, the best sprinter will usually be able to win the stage. Although sprints imply a considerable amount of force, they also have to do with strategy, not only to decide when to start a sprint but also to decide how to behave while sprinting.

Let us imagine that a rider L leads out a sprint and following him are sprinters F1 and F2. While F1 is behind L to his left, F2 is behind L to his right and both are at the same distance from both L and the finish line. In this situation, both F1 and F2 can either draft L (which is what both prefer to do) or stay in line and forgo drafting

L. If only F1 drafts, he wins and F2 loses and vice versa. If both F1 and F2 stay in line, none drafts, so L wins. And if both F1 and F2 try to draft L, they collide and crash at a high speed and must quit the race. Although both riders prefer they both forgo drafting rather than both draft, each also prefers even more to be the only one drafting. This interaction between sprinters has the structure of a "game of chicken" (Table 10.2).

The game of chicken is an anti-coordination bargaining game with two Nash equilibria: unilateral defection and unilateral cooperation. In Table 10.2, this corresponds with the upper-right and lower-left cells, i.e., the two situations in which one of the sprinters drafts and the other one forgoes drafting. As Schelling (quoted in Dixit & Nalebuff, 2008) asked: "when two trucks carrying dynamite meet on a single-lane road, who backs up?" Like in the 1962 Cuban missile crisis, the outcome of the game may depend on players' capacity to use brinkmanship to impose their will. And to make the threat of mutually assured destruction credible even while each player is better off being accommodating if the other is inflexible, each player might try to appear as mad and unpredictable, as Nikita Khrushchev and later Richard Nixon did, during Cold War negotiations. Sprinters indeed try to build intimidating reputations for reckless people who will not give in whatever the costs to them or to others. For example, Dutch sprinter Dylan Groenewegen used "podium or iodine" as his fearless motto to intimidate his competitors. He stopped doing so after causing a horror crash in the 2020 Tour of Poland that almost killed his compatriot Fabio Jakobsen.

As in the flexible response doctrine of nuclear deterrence, a sprinter may gradually get closer to the sprint leader's slipstream or block another sprinter on the side of the road, fight for position, and spread his elbows to frighten and get the better of a rival. In the final sprint of the 1988 World Championship, Steve Bauer elbowed Claude Criquielion and made him fall. In the sprint of the sixth stage of the 1997 Tour, Tom Steels threw a bottle at another sprinter (Frédéric Moncassin), and in the sprint of the 11th stage of the 2010 Tour, Mark Renshaw headbutted another sprinter (Julian Dean). Both were eliminated for such behavior, but the long-term benefits of building a tough reputation of a sprinter one should not challenge might easily outweigh these short-term costs of elimination.

Table 10.2 Sprint as a "game of chicken"

		Sprinter F_2	
		Forgo draft	Draft
Sprinter F_1	Forgo draft	2; 2	1; 4
	Draft	4; 1	0; 0

In this payoff matrix, each row is one of the first sprinter's two choices (draft or forgo draft), and similarly, each column is one of the second sprinter's two choices. In each cell at the intersection of these choices (or strategies), one finds two numbers. The first represents the first sprinter's utility level; the second represents the second sprinter's utility level. These cardinal payoffs go from 0 (least preferred outcome) to 4 (most preferred outcome)

7 Conclusion

Strategic interactions of riders have the same logical structure as many social interactions. Amongst the multiple games within the larger game of bicycle races we distinguish: games between two individuals (riders) or organizations (teams), but also games amongst three or more players, which allow coalitions to develop; games that are constant-sum or variable-sum, thus involving partly conflicting interests but also potentially mutually beneficial cooperation; games that are simultaneous or sequential, thus allowing players to (mis)trust each other and be (dis)loyal; and games that involve complete or incomplete information, allowing players to screen others, signal their unobservable characteristics, or bluff. Part of the reason why cycling is fun to watch is precisely because it is cognitively and emotionally a lot like social life itself, including relations between spouses, friends, neighbors, club members, workmates, consumers, taxpayers, or organizations such as firms, trade unions, cartels, or states. From interpersonal to international relations, the strategic interactions between all these agents have much in common, and in this sense, studying professional road cycling helps to better understand social life.

The mentioned game theoretical models of bicycle races may be tested empirically to explain statistical regularities across time or races, not just punctual or anecdotal events. "Mechanism design" and "tournament theory" may also be used to establish "incentive-compatible" rules and otherwise help race organizers maximize competition between teams, outcome uncertainty, and the quality of the show.

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Chapter 11
Modeling Performances and Competitive Balance in Road Cycling Competitions

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1 Introduction

In the economics of professional team sports leagues, the concept of competitive balance is well documented (Fort & Maxcy, 2003; Groot, 2008; Humphreys, 2002; Késenne, 2000; Lee, 2010; Scelles, 2017; Scelles et al., 2022; Szymanski, 2001, 2003; Valenti et al., 2020; Zimbalist, 2002). It postulates the necessity of equilibrium between the teams in a league in order to guarantee uncertainty of outcome and thus generate public demand. The performance of each team is evaluated on the basis of the number of points gained, this in turn determining its ranking in a championship. This allows researchers to calculate indicators of competitive balance based on the number of points earned by teams. While it is more difficult to estimate the contribution of a single player to the team performance, this is seldom the main focus when studying competitive balance in professional team sports leagues. In the economics of individual professional sports competitions like tennis, it is a priori possible to apply the same indicators. As the number of contestants is much higher than in team leagues, it is perhaps not appropriate to incorporate all of them.

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Moreover, the "leagues" (WTA ranking for women and ATP ranking for men) are certainly not the main focus for public demand. Indeed, individual tournaments and especially the Grand Slams have their own interest independently of their impact on the players' ranking. Consequently, the performances of each player can be quite easily assessed and some indicators of competitive balance derived from these performances can be calculated (see, e.g., Du Bois & Heyndels, 2007).

By contrast, performances and competitive balance are not easy to define in road cycling. As has already been demonstrated in previous chapters, cycling can be seen as a team sport but the global team performance usually is of minor importance or even not taken into account at all. A large proportion of cyclists (referred to as "*domestiques*") are in support of other riders, meaning that they do not care about their personal result but instead try to help their team leader(s) or team captain(s) (Rebeggiani & Tondani, 2008). Moreover, a team leader generally has one specific objective among a range of possible ones, for example: winning a 1-day race, winning the overall classification in a stage race, winning a stage in a stage race, or winning another prize that is allocated at the end of the race (such as the green or polka-dot jersey in the Tour de France). As a consequence, modeling performances and competitive balance in road cycling is not straightforward. This becomes even more complex if we consider that performance is not only related to objectives and outcomes but also to means or efforts. The notion of efficiency refers to the relation between means/effort and outcome, in contrast with efficacy which refers to the relation between objective and outcome. An efficient team (rider) reaches a good outcome in minimizing its (his) effort, thanks to its (his) tactical and strategic skills and its (his) ability to take advantage of efforts produced by other teams (riders). The efficiency criterion seems particularly appropriate in cycling where "drafting" allows a rider to save between 27% and 39% of energy through the use of another rider's slipstream (Albert, 1991; Dilger & Geyer, 2009; Hagberg, 1990; Kyle, 1979; see also Chap. 10).

This chapter deals with the issue of modeling performances and competitive balance in professional road cycling. The text is structured as follows. The following section explains why it is so difficult to model performances and competitive balance in cycling (Sect. 2). Next, we briefly review the literature on modeling performances and competitive balance in cycling (Sect. 3). The fourth section introduces an innovative measure: competitive intensity in cycling. We also illustrate this measure with two stages of the 2020 Tour de France, and we discuss its implications. Conclusions then follow (Sect. 5).

2 The Difficulty of Modeling Performances and Competitive Balance in Road Cycling

Modeling performances—and thus competitive balance—is difficult in road cycling for at least five reasons:

- Road cycling can be seen as a team sport but wins; the allocation of world ranking points and the distribution of financial prizes are focused on individual performance and not on aggregated team performance (Sect. 2.1).

- Leaders from different teams do not have the same objectives and a leader's objectives may change from one year to another (Sect. 2.2).
- Performances by *domestiques* are difficult to assess because they crew for their leader but the latter's result is not automatically and only partially correlated to their efforts (Sect. 2.3).
- Strategic interactions between opponents can play an important role in the outcome of a race and the efforts produced by riders and teams (Sect. 2.4).
- The same outcome can be achieved with different levels of effort, this arising from the difference between efficacy and efficiency highlighted in the Introduction (Sect. 2.5).

2.1 Aggregated Team Performance Versus Individual Performance

Road cycling is clearly a team sport. "Drafting" consists not only in using opponents but also teammates' slipstream. Cabaud (2014) thus explains that during a race a team looks at protecting its leader (saving his energy) and ensuring that he will be in contention for winning at the end. These elements mean that what is prioritized is victory for the team leader rather than the best aggregated team performance. One reason is that the allocation of world ranking points and financial prizes is in respect of individual performances rather than aggregated team performances. The justification seems obvious: it is easier to promote the best rider based on his simple and individual performance rather than the best team based on an aggregation of its members' performances. This second approach would be more difficult to understand for everybody and could have a negative impact for communicating and marketing the product, leading to a lower interest from the different stakeholders (Morrow & Idle, 2008). This largely explains why the team classification is considered as a relatively minor prize in the Tour de France and other stage races.

2.2 Leader's Objectives

In the past, some legends like Eddy Merckx or Bernard Hinault had the reputation of wanting to win every race. More recently, riders with such all-encompassing objectives profile seem to have largely disappeared. Instead team leaders now usually tend to have objectives related to specific races (e.g., winning the Tour de France) or specific types of races (*Grand Tours*, cobblestones classic races, etc.). Some riders even have very concrete objectives that do not correspond to winning the race. Thus, in the Tour de France, some riders will focus on winning the king of the mountains or the points classification, or on winning one (specific) stage of a tour. For riders in smaller teams, just being in the breakaway and getting TV exposure can already be a major goal.

The diversity of objectives makes unified performance evaluation challenging: does it make sense to observe performance in the general classification for riders focusing only on secondary prizes? Is it useful to evaluate the general classification performance in the Tour de France for a sprinter like Mark Cavendish? How does one take into account performances in rankings other than the general classification by riders in contention for the overall win in the Tour de France? Such riders usually do not care about the other classifications as was the case with Egan Bernal, winner of the 2019 Tour de France. Bernal was the runner-up in the mountains classification (behind Romain Bardet), an award in which he was seemingly disinterested: he did not care about taking points on certain mountain passes even when he was in a leading group. It is, in fact, a common practice in cycling to "give" away prizes to other teams for strategic reasons, e.g., to secure the support of another team in later stages. A well-known strategy by the team of Lance Armstrong in the Tour de France was to render the yellow jersey to another (preferably French) team for as long as possible during the first 2 weeks of the race. By doing so, the pressure to defend the yellow jersey was off their shoulders to another team. The energy the team thus saved was very welcome in the deciding stages of the third week of the Tour de France. More recently, the case of *Jumbo-Visma* with Primož Roglič also illustrates the point very well, although with an opposite strategy and outcome. In the 2020 Tour they defended the yellow jersey for almost 2 weeks and lost it in the final time trial on the penultimate day of racing, perhaps because Primož Roglič was too tired. In the 2021 Vuelta, they took a totally different approach with the team giving the leader's jersey away on several occasions. Primož Roglič eventually won the 2021 Vuelta. We refer readers who are interested in race strategies to Chap. 10 and Scelles et al. (2018) for a detailed discussion of this topic.

It is also difficult to compare leader's performances from one year to the next as his objectives may change over time. A leader adapts his objectives not only to his strengths and weaknesses but also to his past performances, as well as to the race route which changes yearly. Take the example of Joaquim Rodriguez. He finished 7th and 3rd, respectively, in the 2010 Tour de France and the 2010 Vuelta a España and can thus be considered a credible leader for the general classification in *Grand Tours*. However, he decided not to take part in the Tour de France 2011 and 2012 although the Tour de France is the most prestigious *Grand Tour*. The reasons were twofold. First, he had more chance to perform well in the Giro and Vuelta those years because of lesser competition in these *Grand Tours*. Second, the 2012 Tour de France route did not really suit his riding style and strengths. Indeed, as a climber he knew that the over 100 kilometer of cumulated distance for individual flat time trials in the 2012 Tour de France would make a top ranking highly unlikely. Sometimes, a leader will choose not to compete in a race he already won before to save energy and to focus on other races that he has never won.

2.3 Performances by Support Riders

We already mentioned that it seems unfair to evaluate performances by support riders on the basis of their leader's performance. It would make more sense to look at a priori objective factors like time spent sheltering the leader from the wind, the intensity of the effort, the road profile when the effort was made (flat or mountain), and so on. The weighting of such factors in global performances by *domestique* riders is not easy to determine. Besides, as for leaders, it seems complicated to build a unified indicator. Indeed, one helper can have a very specific role (e.g., bottle carrier), whereas another can have a fully different mission (e.g., being the lead-out men in the sprint). Even when succeeding in evaluating performances by support riders, such performances are not directly useful in terms of measuring competitive balance for a specific prize. They may have an indirect impact on it (in determining partially the leader's performance) but the public and the media are not very interested in the comparative performance of such *domestiques*. We could assume, however, that team managers are highly interested in the assessment of performances by support riders. In fact, they may have very particular objectives for such helpers or may be looking for a specific type of *domestique*. In such cases, the assessment of the individual performances should be based on very specific personal objectives, making it much more difficult to model these performances.

2.4 Strategic Interactions Between Opponents

In Chap. 10 it was discussed in detail how strategic interactions between opponents can affect both the outcome of a race and the efficiency. They can allow a rider/team to reach an outcome that would have not been possible without the help from (an) other rider(s)/team(s). For example, a rider can win after having been part of a breakaway, whereas he would not have been able to win as part of a peloton. In this case, his win is not only due to his own efforts but also to his opponents' contributions which allow the breakaway to become successful. Another example is the case of a sprinter who wins after the peloton catches a breakaway thanks to the collaborative effort of several teams, whereas his team would not have been able to realize this on their own. Strategic interactions between opponents can affect efficiency as a rider (team) can reach the same objective with two different efforts according to his (its) cooperation with opponents, implying two different levels of efficiency. For example, a rider can win a race after having been alone for a long time (meaning a large effort) or having taken advantage of his opponents' efforts (meaning a more limited effort). In both situations, the outcome is the same (a win), but the effort input by the winner is markedly different.

2.5 Efficacy Versus Efficiency

Finally, there is also the difference between efficacy and efficiency. As already explained in the Introduction the notion of efficacy refers to the relation between objective and outcome, while efficiency refers to the relation between means/effort and outcome. The latter is particularly important in a stage race. Indeed, the surplus of effort input during one stage could result in a poorer later (or overall) outcome (and thus efficacy). It highlights that efficiency is crucial in achieving success in a stage race. But this is also the case for a 1-day race. A rider who is alone in a breakaway during a large part of a race will tend to find it more difficult to win. Indeed, he will usually have spent so much energy that he will be unable to follow the "fresher" riders at the end of the race. Consequently, efficacy and efficiency are different but efficacy needs efficiency. The difference between efficacy and efficiency further highlights the difficulty in modeling performances. It means that the latter does not refer only to efficacy but also to efficiency. This suggests the necessity to measure the effort input by riders in order to have an overview of their performance. If competitive balance is analyzed later in this chapter, it might be affected by strategic interactions and efficiency as they could increase or decrease the difference between riders and teams. Besides, the huge importance of strategic interactions and well-balanced efforts in explaining performances in professional road cycling reveals the utility of using sociological and physiological theories in addition to economic theory in modeling performance.

3 Literature on Modeling Performances and Competitive Balance in Road Cycling

The economics literature on modeling performances and competitive balance in road cycling remains limited. The scarcity of publications on these issues, especially in comparison to team sports, is explained by the difficulties that professionals and researchers encounter when they try to define what "performance" means. This is largely related to the unique situation in cycling where only one rider is successful after the finish line yet his success is often due to the work of his teammates and even his competitors. The first subsection focuses on several studies which model performances in road cycling. It stresses informal rather than formal structures which prevail in cycling as an important factor in justifying the difficulties of measuring performance. The second subsection presents competitive balance which is based on the comparison between riders or teams' performances. It provides a literature review about this concept in professional road cycling.

3.1 Modeling Performances in Cycling

In cycling, as in sport in general, performance is a concept that is complex to define with different meanings both at the micro level (rider, breakaway, or peloton) and at the macro level (organizational success). At the macro level, this complexity is even greater if we consider that all stakeholders do not have the same expectations (Morrow & Idle, 2008). At the micro level, these difficulties are reinforced by the fact that the ideology of "personal best" does not fit on every occasion with road cycling. Indeed, success in cycling often requires a rider to restrain his maximum effort, for instance when cooperating in a breakaway (Albert, 1991). Many racing situations thus yield a set of complex and ambiguous cooperative social structures. The elements developed in this subsection are not intended to be exhaustive. For a recent systematic review of research specifically investigating the performance of elite cyclists in competition (not restricted to road cycling), the reader is directed to Phillips and Hopkins (2020).

The first contributions focusing on performance in cycling, just like in team sports, have been published by physiologists. Olds (1998) proposes a model of breaking away and chasing. Drawing on a mathematical model validated previously (Olds et al., 1993, 1995), this research aims at determining the optimum length a breakaway should be to ensure it can hold off a chasing pack of cyclists. Among his determinants, Olds (1998) notes the importance of the distance remaining in the race, the speed of the breakaway group, the number of riders in the chasing and breakaway groups, how closely the riders in each group draft one another, and other external factors like the grade, the surface roughness, as well as the fact that riders are facing headwinds or crosswinds. One of the most insightful results is the curvilinear nature of the relationship between the number of riders in a chasing group and the lead required for the breakaway to be successful, with diminishing returns arising from larger chasing groups. In other words, if the chasing group becomes too large, then it is not possible to guarantee optimal cooperation in such chasing group, which in turn increases the likelihood of the breakaway staying clear. It must be noted that this insightful result comes from Olds' physiological/mathematical perspective; however, a broader range of factors (e.g., competitive, social, and psychological) should be considered before deducting that a large chasing group automatically leads to a greater likelihood for the breakaway to be successful. Yet, Olds' result is consistent with some other conclusions drawn in sociology showing the complexity of the cooperation in a cycling group (see, e.g., Albert, 1991; Rees et al., 2014; Williams, 1989).

In his research based on interviews with American riders, Albert (1991) describes several of these rules which characterize road cycling. The results focus on specific informal structures of collaboration among riders. All the efforts of this researcher have concentrated on showing the difficult balance between cooperation and competition which occurs in cycling, especially when the race is twofold divided (peloton vs. breakaway). This scheme induces some associations between competitors like "drafting" (also called "slipstreaming") or "wheel sucking." The first refers to the ability for a rider to ride in the slipstream of the cyclist in front of him and could lead to the second one, a negative situation where one rider could obtain the maximum benefit of drafting, while expending the minimum of energy (see also Chap. 10). These conclusions—whether they are physiological, kinetic, sociological, or ethnographical—illustrate the complexity inherent in defining a "performing" rider, where performance relies in part on sometimes ambiguous tactics of cooperation.

Professional road cycling has not yet been analyzed intensively in sports economics. Still, a few authors have attempted to explain performances by individual cyclists, drawing on a labor-based approach (e.g., Torgler, 2007) as well as sporting and economic determinants (e.g., Sterken, 2005). In almost all such studies, Tour de France data are used. To deal with the complexity of the different sporting prizes present in stage races (i.e., different jerseys, stage victories, etc.), some authors develop models that take "multidimensional performances" into account. Cherchye and Vermeulen (2006), for instance, create a completely new metric that makes it possible to weigh the number of yellow jerseys won by a cyclist with a number of other prizes to determine the best Tour de France cyclist ever (see below). Rogge et al. (2013) use data envelopment analysis to calculate cycling team efficiency. They discern two main categories of variable inputs: team quality (team budget, number of ranking points of the team) and team experience (past performances of the team's riders). Based on teams participating in the Tour de France during the 2007–2011 period, the integration of the multiple prize nature of professional cycling results in the identification of several performance levels. In a study that does not focus exclusively on the Tour de France, Rodríguez-Gutiérrez (2014) relies on the CQ ranking (CQ for cycling quotient; see www.cqranking.com) which includes almost all the races contested by professional cyclists. In order to take into account the fact that all riders do not cover the same number of kilometers and days of competition, two indexes of rider efficiency are proposed by the creators of the CQ ranking: one defined as the ratio of the number of CQ points to the number of kilometers (efficiency per km), the other defined as the ratio of the number of CQ points to the number of days (efficiency per day). Rodríguez-Gutiérrez (2014) uses both indicators, along with the total number of CQ points. Raya (2015) also uses the latter.

Sports economics has also been used to analyze performance at the macro level, for instance with respect to the success of a cycling race in its entirety (e.g., 3 weeks for the Tour de France). The main dependent variable studied in these situations has been TV demand (Van Reeth, 2013) which is at the core of sports economics. The majority of the studies on the consumer demand for sport events, especially in team sports, have been carried out on the basis of spectators' attendance. Professional road cycling cannot be analyzed this way, however, as ordinarily the events take place on public roads. Hence, race organizers have no mechanism through which to measure public attendance for their event. As a result, TV demand has always been seen as the most relevant criterion though which to evaluate demand for cycling (see also Chap. 6) but it has become increasingly relevant too in team sports and for international events like the Olympic Games or the FIFA World Cup.

In his study on TV demand for the Tour de France in Flanders, Van Reeth (2013) finds that stage characteristics are strong determinants of TV viewership. He suggests that some types of stage are more successful from a spectator point of view than others. For example, mountain stages—notably the ones in the Alps and the Pyrenees—significantly raise TV audiences. By contrast, individual and team time trial stages have a negative impact on Tour de France viewership. Van Reeth (2013) also mentions the need for race organizers to ensure a certain amount of uncertainty in their competitions. In the same vein, Andreff (2014) draws several conclusions explaining the (commercial) success of the Tour de France, in spite of doping cases which have blighted previous editions. Among those conclusions, the multitude of sporting prizes (yellow jersey, polka-dot jersey, green jersey, etc.) is considered as a successful element. This seems true for the other big cycling races as well.

3.2 Modeling Competitive Balance

As mentioned above, one reason why cycling performances are so difficult to model is that they can refer both to individual and to team output. As a consequence, measures of competitive balance can relate to individual or team results. Tables 11.1 and 11.2 sum up the indicators of competitive balance used in the literature on professional road cycling, respectively, for riders and for teams. The tables indicate that competitive balance in cycling has been looked at mainly for the Tour de France and from six different points of view: ex ante, intra-race, end of the race, over one season, over several seasons, and over several decades. End of the race refers both to the end of a stage race or to the end of a specific stage. It could also refer to the end of a 1-day race.

3.2.1 Modeling Competitive Balance Between Riders

If we focus on competitive balance between riders in the Tour de France, almost all authors are exclusively interested in the general classification. The only exceptions are Larson and Maxcy (2014) who consider the likelihood of breakaway success at the end of a stage, and Cherchye and Vermeulen (2006) who include six single performance indicators. Based on a consultation of sports journalists working with the Flemish public broadcasting service, the authors obtain the following ordinal ranking among their six single performance indicators: (a) number of yellow jersey wins, (b) number of second places in the final general classification, (c) number of third places in the final general classification, (d) number of stage victories, (e) number of green jersey wins, and (f) number of red polka-dot jersey wins. This ranking confirms the importance of the general classification but also of the prize of stage victory, consistent with Larson and Maxcy (2014) and their focus. The latter use the likelihood of breakaway success to examine potential changes in outcomes associated with the use of two-way radio technology by competitors and team

Table 11.1 Competitive balance between riders in the literature on cycling

Author(s)	Race(s)	Level of competitive balance	Indicator(s)
Sterken (2005)	Tour de France	End of the race	Time difference between the first and the second
			Number of days in yellow jersey/ number of stages
			Number of stage victories/number of stages
Cherchye and Vermeulen (2006)	Tour de France	Several decades (1953–2004)	Dominance matrix[a]
Mignot (2013)	Tour de France	End of the race	Number of changes in the leader
			Time difference between the first and the second
			Time differences among the first classified riders
Van Reeth (2013)	Tour de France	Intra-race	At most 90 seconds of time difference between the top 2 riders in the general classification
			Number of stage wins already obtained by the Tour de France winner of the previous year
		Several seasons	Post-Armstrong effect
Andreff (2014)	Tour de France	End of the race	Time difference between the first and the second
		Several seasons	Same rider winning several Tours de France in a row
Larson and Maxcy (2014)	1436 races (non-time trial stages of the Tour de France, Giro, and Vuelta)	End of the race (stage)	Likelihood of breakaway success
Rodríguez et al. (2015)	278 races (both stages and single-day races)	Ex ante	Standard deviation of the number of UCI ranking points got by the riders in the first 10 positions in the general classification
		Intra-race	Number of leader changes
Rodríguez-Gutiérrez and Fernández-Blanco (2017)	Vuelta	Ex ante	Standard deviation of the CQ rank numbers obtained during the previous 12 months by the riders in the first three positions in the overall standings at the end of the previous stage
		Intra-race	Average distance in seconds between the top two riders at the beginning of each stage

(continued)

Table 11.1 (continued)

Author(s)	Race(s)	Level of competitive balance	Indicator(s)
Van Reeth (2019)	Tour de France	Intra-race	Number of stage wins already obtained by the previous year Tour de France winner At most 90 seconds of time difference between the top 2 riders in the general classification
Bačik et al. (2021)	Tour de France	End of the race	Percentage of riders who finished the race Best five riders' mean time gap Coefficient of variation of best five riders' time gaps Team leaders' mean time gap Coefficient of variation of team leaders' time gaps
		Several seasons	Percentage of finishers in year n who had already finished the race in year n-1 Correlation between the best five riders' time gaps in years n and n-1 Correlation between team leaders' time gaps in years n and n-1

[a]Dominance matrix is not an indicator of competitive balance per se but could be used as a basis to calculate an indicator of long-term competitive balance

directors. The data suggests that the period in which radios were used (1992–2010 in the study) is associated with a significant increase in the breakaway success compared to the 1985–1991 period. Nevertheless, when controlling for stage types, the authors find a significant negative impact of radio technology for hilly and flat terrain compared to mountain terrain.

Among authors interested in the general classification, Sterken (2005), Mignot (2013), and Andreff (2014) all concentrate on the time difference between the first and the second rider at the end of the race, a measure considered to be of particular cycling public interest. Nevertheless, a comparison relying on only two riders is not sufficiently robust to capture overall competitive balance. More generally, Andreff and Mignot (see Chap. 7) write that a common limitation to indices is that they usually assess competitive balance on the basis of one or two riders, or at most a small number of riders in contention for the yellow jersey. This is indeed the case with most indices in Table 11.1 since the maximum number of riders taken into account was ten (Rodríguez et al., 2015), until the study by Bačik et al. (2021). These authors include the percentage of riders who finished the race (i.e., all riders are considered, although the competitive balance between them—e.g., the time gap for rider ranked r compared to the rider ranked r-1—is not captured) and the team leaders' mean time gap in percentage of the winner's time (up to 21 team leaders other than the winner considered, but not all riders). Although compared to previous literature the number of riders included in the analysis was extended, these indicators can still not

Table 11.2 Competitive balance between teams in the literature on cycling

Author(s)	Race(s)/ ranking	Level of competitive balance	Indicator(s)
Rebeggiani and Tondani (2008)	UCI Pro Tour	One season	Relative entropy
			Points got by first five teams/points got by last five teams
			Herfindahl index[a]
			Gini index of the concentration of the points collected by the teams grouped by nations
Andreff (2014)	Tour de France	End of the race	Average time differences
		Ex ante	Differences in the number of UCI ranking points
			Budget differences
Rodríguez et al. (2015)	278 races	One season	Standard deviation of the number of UCI ranking points got by all teams that compete in the race
Bačik et al. (2021)	Tour de France	End of the race	Coefficient of variation of the percentage of riders having finished the race per team[b]
		Several seasons	Correlation between the percentage of riders having finished the race per team in years n and n-1

[a]Not calculated by the authors but they provide the share of total points for each team
[b]The percentage of riders having finished the race per team corresponds to the number of riders having finished the race as a percentage of the number of riders having started it for each team

be used to capture the overall competitive balance. Of importance at this juncture is the distinction established by Fort and Maxcy (2003) between the analysis of competitive balance (ACB) and the uncertainty of outcome hypothesis (UOH). While the ACB literature focuses on competitive balance over time, the UOH literature analyzes its effect on fans. For the latter, it is not necessary to rely on a measure of the overall competitive balance.

Van Reeth (2013, 2019), Rodríguez et al. (2015), and Rodríguez-Gutiérrez and Fernández-Blanco (2017) look at explaining TV audiences by including variables related to competitive balance in their models. In Flanders, Van Reeth (2013) finds a significant positive impact of the situation where there is at most 90 seconds of time difference between the top two riders in the general classification and of the post-Armstrong effect (all post-2005 Tour de France stages—the study deals with the 1997–2012 period) but no significant impact of the number of stage wins already obtained by the Tour de France winner of the previous year. In Spain, Rodríguez et al. (2015) find a significant negative impact for the standard deviation of the number of UCI ranking points obtained by the riders in the first ten positions in the general classification (which means a positive impact of competitive balance) and a significant positive impact of the number of changes in the leader, but no significant impact for the time differences among the first classified riders (excluded in their model). Also in Spain, for the 2015 Vuelta, Rodríguez-Gutiérrez and Fernández-Blanco (2017) find a significant negative impact of the standard deviation of the CQ rank numbers obtained during the previous 12 months by the riders in the first three positions in the overall standings at the end of the previous stage, and the average distance in seconds between the top two riders at the beginning of each stage (which means in both cases a significant positive impact of competitive balance). Van Reeth (2019) tested the impact of the number of stage wins already obtained by the previous year Tour de France winner (dominance) and the situation where there is at most 90 seconds of time difference between the top two riders in the general classification (suspense) in Flanders, Wallonia (2000–2017 for both), Denmark (2002–2017), France (2012–2017), the Netherlands (2007, 2010–2017), and Spain (2008–2017). Dominance has a significant positive impact in Denmark but no significant impact in other markets, while suspense has a significant positive impact in all markets (except France where it could not be tested over the period studied).

3.2.2 Modeling Competitive Balance Between Teams

Measures of cycling competitive balance between teams are representative or at least more representative of the overall competitive balance than rider-based measures. They are also closer to those used for professional team sports. The first attempt was made by Rebeggiani and Tondani (2008). Among their indicators, they include an index of relative entropy that can vary in a range between 0 (perfect equilibrium among the teams and thus high competitive balance) and 1 (maximum heterogeneity between the teams and thus low competitive balance). Based on the UCI ProTour, the authors find values of 0.9585 in 2005 and 0.9592 in 2006, indicating a lack of competitive balance between teams at the start of the ProTour. Rebeggiani and Tondani (2008) also calculate the Gini index of the concentration of points collected by teams, grouped by nations. The objective is to observe whether a team collects its points everywhere and in the same proportion all around the world or only in a few countries, and perhaps mainly in one nation. Based on this methodology, the authors find a balanced worldwide distribution of points for *Team CSC* in 2006, whereas *Bouygues Telecom* had a very (French) concentrated distribution of points in 2005. Andreff (2014) also introduces a couple of team-based indicators. Competitive balance at the end of the race is measured through the average time differences between teams. Competitive balance is also measured ex ante through two indicators: the differences in the number of UCI ranking points and the budget differences. In addition to their rider-based measures of competitive balance, Rodríguez et al. (2015) also incorporate a team-based variable in their model explaining TV audiences. This variable is the standard deviation of the number of UCI ranking points obtained by all teams that compete in the race. The authors find no significant impact except when focusing on regional channels (national channels excluded) and stage races (1-day races excluded). Bačik et al. (2021) use two indicators: the coefficient of variation of the percentage of riders having finished the race per team, the idea being that competitive balance is high if teams have more or less the same percentage of riders finishing the race; and the correlation between the percentage of riders having finished the race per team in years n and n-1, the idea being that a strong positive correlation indicates that the same teams have more riders finishing the race over time (low competitive balance). In the Tour de France over 1947–2017, the authors find that the percentages of riders having finished the race per team have become more similar to each other (improvement in competitive balance), while the correlation between the percentage of riders having finished the race per team in years n and n-1 has tended to be positive (the same teams tend to have more riders finishing the race over time) but decreased over time (i.e., the difference between the strongest and other teams became lower, indicating an improvement in competitive balance).

4 An Innovative Measure: Competitive Intensity in Road Cycling

In the economics of professional team sports, a competitive intensity concept which differs from competitive balance has been introduced, designed to take into account any moment of a game or a championship. This has been developed by Scelles (2009, 2010) on the basis of a proposition by Kringstad and Gerrard (2004). His research defines competitive intensity as a notion incorporating three main elements: stakes, outcome uncertainty, and fluctuations. Prior to providing more details about this concept and applying it to cycling, it must be noted that competitive intensity has influenced competition formats already for a long time. Organizers have always had the objective of maximizing public interest in producing an intense spectacle, even without having conceptualized the concept of competitive intensity. For example, the FIFA World Cup has had four main formats: (1) group stages with less than half of teams qualified for the next knockout rounds (1930 and 1950), (2) a single-elimination tournament with knockout games only (1934 and 1938), (3) group stages with half of teams qualified for the next knockout rounds (1954–1982 with 16 teams and 1998–2014 with 32 teams), and (4) group stages with more than half of teams qualified for the next knockout rounds (1986–1994). Scelles and Durand (2010) show that the current format (3) is only the third in terms of competitive intensity, behind formats (2) and (4), but close to them, whereas format (1) clearly generates less competitive intensity. However, they find that it is most appropriate to optimize competitive intensity when also taking into account a couple of constraints.

- A minimum number of matches for each team. Half of teams played only one game in a single-elimination tournament (format 2).
- A format both fair from a sporting point of view and clear for public. This was not the case with format (4) since some teams that were not in the top half of their group (consisting of four teams) were qualified all the same for the next round. Besides, the qualification or not of a third-ranked team in a given group was

dependent on its number of points compared to third-ranked teams in the other groups, what created a lack of clarity for public.
- A number of participants sufficiently large to avoid that many countries with potentially high TV audiences do not qualify for the event, explaining why the current format is better with 32 rather than with 16 teams.

In professional cycling, organizers also seek to make races more attractive for the media and public by focusing on their intensity. Therefore, the route design of any cycling race is central to event organizers seeking to achieve their objectives. For instance, the Ronde van Vlaanderen changed its finish in 2012 from the rather desolated Meerbeke to Oudenaarde. This city, in the heart of the Flemish Ardennes, made possible a much more intense finale with a higher concentration of hills towards the end of the race. In stage races, not only the design of an individual stage is important, but also the global buildup of stages, i.e., the succession or variety in types of stages. A model based on the calculation of competitive intensity within each stage and across all stages of a cycling stage race is interesting as an organizer has the opportunity to directly influence competitive intensity by using different designs for each stage. A useful measure of competitive intensity will identify elements that are positive or negative for the interest of the race, and will thus allow the organizer to take into account this information for its next editions.

4.1 Competitive Intensity in Professional Team Sports

In professional team sports, competitive intensity can be applied both to a match and to a championship. In the discussion here we focus on intra-match competitive intensity. Scelles (2009, 2010) explains that it is based on the number of points that the two teams will receive for the championship (the stake of the match), on the goal difference as an indicator of outcome uncertainty (does it allow a quick change?), and on the number of fluctuations in the number of points that are potentially received by teams for the championship. The intra-match competitive intensity (IMCI) concept is visualized in Fig. 11.1. Two variables are required for the calculation of intra-match competitive intensity (IMCI): the percentage of game time with a possibility of a reversal of the score (intra-match uncertainty, IMU) and the average fluctuations of the state of score (intra-match fluctuations, IMF).

The concept of intra-championship competitive intensity is similar but encompasses both intra-championship uncertainty and fluctuations (Scelles et al., 2011a). The different calculations built to measure competitive intensity are in the same vein as those used to calculate competitive balance. The purpose of such a model is to estimate if each match can interest attendees and TV viewers, to draw conclusions on what makes a championship interesting, and then possibly to change some rules to optimize competitive intensity.

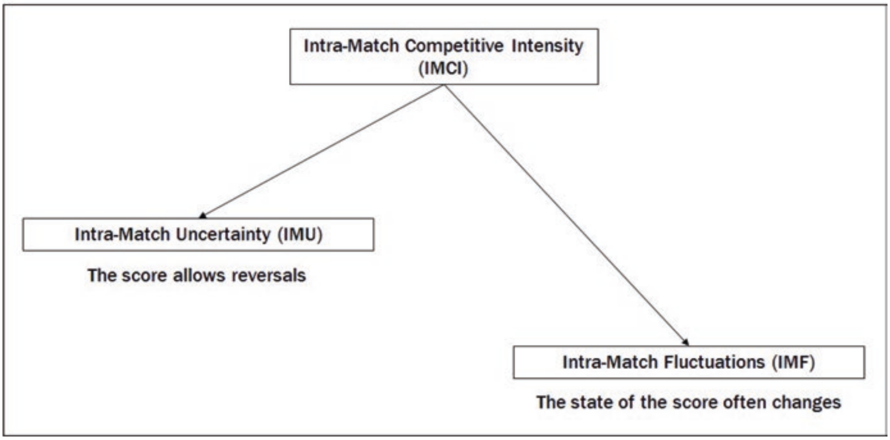

Fig. 11.1 Intra-match competitive intensity model in professional team sports. (*Source* Scelles et al. (2011b))

4.2 Competitive Intensity in Road Cycling

Based on the previous elements applied to team sports, we propose a measure of competitive intensity in road cycling and, more specifically, in stage races (Cabaud, 2014; Cabaud et al., 2017). Such competitive intensity can focus on two levels: intra-race (what is the situation at the end of a stage?) and intra-stage (what is the situation during the stage?). For this first attempt at measuring cycling competitive intensity, we only deal with the latter. Two main reasons motivate our choice. First, the intra-stage level will already incorporate information related to the general classification which is of prime importance for the intra-race level. Second, intra-race uncertainty in cycling is more difficult to define than intra-championship uncertainty in team sports. For example, consider a professional team sports league, in which three points are awarded for a victory. Where a team is first in the league with a gap of seven points with two matches remaining, we know that it will remain first whatever happens. By contrast, in professional road cycling even with an a priori large time gap some uncertainty remains. A rider can lose a large amount of time through a fall, a mechanical failure, or a sudden loss of energy. That said, the intra-race level remains important as it could inform organizers on the impact of the design of the succession and variation in stages.

4.2.1 Competitive Intensity in Regular Stages

In the model we suggest, three criteria are used to measure competitive intensity in regular stages (i.e., non-time trial stages). The first two correspond to the intensity created by the different elements that are at stake during a given stage: the position in the general classification and the stage win. A third criterion corresponds to the riders present in any attacks. All the data necessary for these calculations are publicly available (classifications) or were coded by watching pre-recorded stages. Calculations are made during the entire race, in the early part of the race every 15 minutes, and then every 3 minutes during the last hour of the race. The choice of a value of every 15 minutes before the last hour of the race is explained by the fact that usually we observe stability in the middle of race. As soon as the breakaway is created, the only factor which varies before the last hour of race is the gap between the breakaway and the peloton. In the last hour of a race, changes are multiple. That is why the gap between each measure is set at 3 minutes in order to have the maximum information available for calculations while benefiting from underlying data. Each of the three criteria leads to a value between 0 and 1, and their sum corresponds to the competitive intensity of the entire stage (Fig. 11.2).

As indicated in Fig. 11.2, several calculations based on three criteria are carried out independently prior to deriving the final value of immediate competitive intensity. The calculations for the three criteria are as follows.

Criterion 1: Interest of the Breakaway in Relation to the General Classification
For the calculation of criterion 1, we distinguish between a fixed part and a variable part. The criterion focuses on the interest of each rider in a breakaway according to his general ranking. It will be strong if well-ranked riders are part of the breakaway, and stronger still if the position of the leader is threatened by the breakaway.

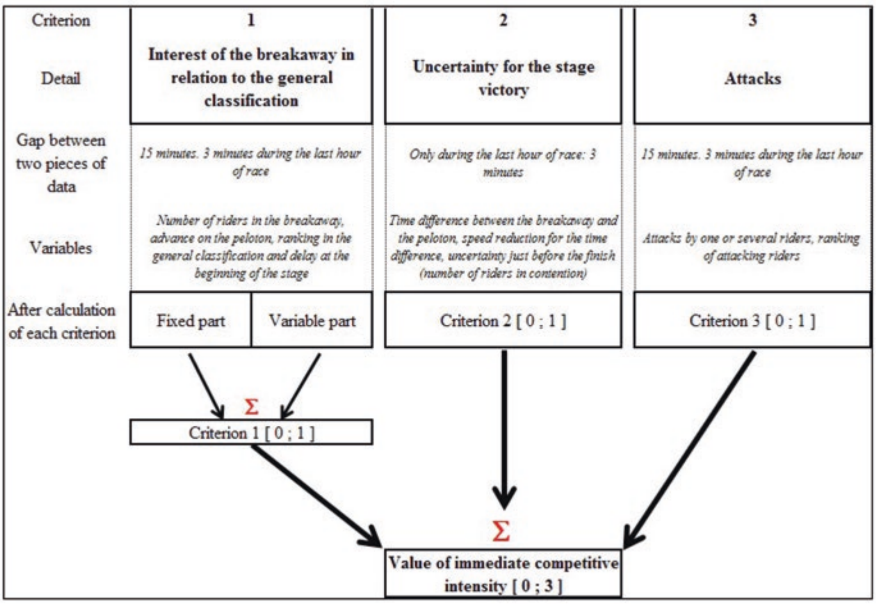

Fig. 11.2 Intra-stage competitive intensity model in cycling

(a) Fixed part:

For each rider in an offensive group (breakaway or counterattack), a fixed value (F) is allocated, this being a function of his general ranking at the beginning of the stage (R):

$$F = 1 / R$$

As criterion 1 is based on threatening the leader, the maximum value of the fixed part will be 0.5. This happens when the 2nd of the general classification is part of the breakaway.

(b) Variable part:

The first part of this calculation focused on determining whether there is uncertainty around a possible change in the leader during the stage. This is the case if a rider in a breakaway has a sufficient lead to threaten the first position of the leader in the general classification, thus making uncertain who will be the leader at the end of the stage. This uncertainty represents the threat of the breakaway rider to the leader in the general classification. To determine this uncertainty (called U_1), it is necessary to calculate the difference (called x_1, in seconds) between the deficit of the rider in the general classification at the beginning of the stage and the time difference between the breakaway group he belongs to and the leader group. The formula applied is as follows:

$$U_1 = 1 - |x_1| / 100, \text{if} |x_1| \leq 100,$$
$$U_1 = 0 \text{if} |x_1| \geq 100.$$

Thus, if $x_1 = 0$, uncertainty is maximal and equal to 1. The formula applied ensures a decreasing value when the difference is further away from $x_1 = 0$, both for a positive and negative value of x_1. If x_1 is over 100 seconds, there is no danger for the leader. If x_1 is below -100 seconds, the rider who is the temporary leader in the breakaway is certain to keep this temporary position in the next minutes of the stage and there is no immediate uncertainty anymore.

In the first stages of a stage race, time differences between riders in the general classification are low. Consequently, even a lowly ranked rider in the overall general classification is a potential leader. Now, it is often unlikely that he will take the lead at the end of the stage. Indeed, the usual situation is as follows: the peloton lets the breakaway get ahead and controls the time difference, and the temporary leader is not really a factor of uncertainty for the peloton, or for the media and general public. Hence, to correct this problem, we weigh his danger (U) by his ranking in the general classification (R) for the calculation of the variable part (V):

$$V = U / \left(R / 5 + 0.6\right)$$

Thus, even with an uncertainty for the leadership with a value of 1, a lowly ranked rider will give a limited interest in the breakaway. The formula is built so as to have a maximal value of 1 when the 2nd in the general classification is in the breakaway and the threat for the leader is maximal. Then the value is decreasing in relation to the rider's ranking.

(c) Sum of the fixed part and the variable part:

At any time in the race, a rider in a breakaway has a fixed value and a variable value. The sum of these two scores leads to a total value for the rider at a certain moment of the race. Each rider contributes more or less to the interest of the breakaway, independently of the other riders. Since each rider thus is a potential threat to the leader, albeit to a different degree, it is necessary to sum the value of all riders in the breakaway. In the rare cases when the total value is more than 1, we put an upper limit on 1 so as to remain on three criteria, these having the same weight in the calculation of intensity.

Criterion 2: Uncertainty for the Stage Victory

The second criterion is related to uncertainty about the stage victory between the different groups during the last hour of race, with a measure every 3 minutes. The question asked is the following: "If the time difference continues to vary in the same way till the finish, is there uncertainty of stage victory between the breakaway and the peloton?"

First, we calculate the seconds that the peloton will make up for if the pace remains unchanged until the finish (S_u). For this, we divide the seconds made up by the peloton over the last 3 minutes (S_m) by 180 seconds to find the average per second, and then we multiply by the seconds remaining until the finish (S_r):

$$S_u = \left(S_m / 180\right) * S_r$$

The time remaining until the finish is known only at the end and not intra-stage, which is a limitation in our calculation. It would be better to use the average speed or the distance covered by the peloton and the breakaway over the last 3 minutes so as to calculate the theoretical time remaining until the finish for the two groups. But as such data is unavailable, we decided to rely on the actual time remaining until the finish by considering it as an acceptable proxy.

Second, we calculate the difference between the current time gap in favor of the breakaway (S_c) and the time theoretically made up by the peloton until the finish (S_u). This enables us to determine the theoretical time difference we can expect at the finish line if the two groups continue at the same pace (x_2):

$$x_2 = S_c - S_u$$

If the difference is positive, the breakaway keeps its advantage. If the difference is negative, theoretically the peloton will have made up for the breakaway before the finish. In the two cases, if the calculated difference is strongly positive or negative, there is a limited uncertainty: one of the two groups has a strong advantage on the other. The closer it is to 0, the more uncertainty there is over the stage victory. By applying the same formula as for the first criterion, it will be possible to get a value of intensity for the second criterion between 0 and 1 in function of the calculated difference:

$$U_2 = 1 - |x_2| / 100, \text{if} |x_2| \le 100,$$
$$U_2 = 0 \text{if} |x_2| \ge 100.$$

In the case when there are more than two groups in the last hour of race, the calculation is made between the first and the second group, then the first and the third group, and so on.

A limitation of our formula is that it does not take into account a factor which seems important for the measurement of the uncertainty for the stage victory: the number of riders who will compete for the stage victory at the end. For example, a mass sprint implies many riders, suggesting a maximized uncertainty. Now, if there is no breakaway 3 minutes before the end, the last value of immediate competitive intensity is 0 for criterion 2. In order to make up for this weakness, we decided to calculate an additional competitive intensity value at the end. Our calculation is based on two assumptions:

- In case of a mass sprint, we consider that no more than 25 riders will compete for the stage victory, based on a mean of one sprinter for each of the 20 to 22 teams and a second sprinter for 3 to 5 teams.
- In case of a breakaway, we consider it very unlikely that more than 25 riders will compete for the stage victory.

It is worth noting that Larson and Maxcy (2014) also choose the threshold of 25 riders in their definition of a breakaway. We apply the following formula for the uncertainty for criterion 2 at the end of the stage (U_{2e}):

$$U_{2e} = (n-1) / 24$$

with n the number of riders in contention, limited to 25.

The formula is built to be equal to 0 when a single rider is ahead (explaining $n - 1$ rather than n and $25–1 = 24$ rather than 25) and 1 when at least 25 riders are in contention.

The sum of calculated intensity values will lead to the value of criterion 2 at the time when the calculation is made, still limiting this sum to 1. We have to recognize that criterion 2 is not without limitation in its current form. In particular, we do not take the stage route into account. The formula assumes the time gap will be reduced in a linear way, which is a reasonable assumption if the stage route remains similar, but in mountain stages this is of course not the case. If there is a mountain top finish, the time difference is much more likely to be reduced at a higher pace at the end of the race. If the finish is located after a descent of a mountain pass, it becomes much more difficult to reduce time gaps at the same rate as during the climb of the mountain pass. In the future, we will look at improving criterion 2 according to the stage route.

Criterion 3: Attacks
This is not a calculation, but a value which is arbitrarily allocated in respect of the attacks in the race. If there is at least one attack during the time gap between two measures (15 minutes or 3 minutes during the last hour of race), a value is allocated to this criterion according to the ranking of the best rider who is among the attackers:

- 0.2 if the attacker is ranked beyond the 20th position in the general classification at the beginning of the stage
- 0.4 if he is in the top 20
- 0.6 if he is in the top 10
- 0.7 if he is 5th
- 0.8 if he is 4th
- 0.9 if he is 3rd
- 1 if he is 2nd or 1st with a time gap of no more than 100 seconds

The value 0 corresponds to a time interval without attack.

Calculation Overview
The three criteria are based on actual data available at a certain moment during the race. Their sum gives an indication of the competitive intensity of the race at the moment the calculation is made. Using the data over the whole stage, it is possible to draw a curve reflecting the evolution of competitive intensity during the stage or to calculate the average intensity for the stage or for the last hour of race. This method allows to create a dataset that can be used, for instance, for a statistical study between different (types of) stages or for comparing the competitive intensity difference between stage races.

4.2.2 Competitive Intensity in Time Trials

The previous criteria cannot be applied to time trials. In these stages, riders do not start at the same time (except for teammates in team time trials). As a result, there is no breakaway and attack and thus no possibility to calculate the three previous criteria. While we could rely on intermediate time checks to evaluate uncertainty both for the general classification and the stage victory, we identify several weaknesses with such a method. First, the number of intermediate time checks is limited to usually two or three. Second, we could calculate uncertainty for the general classification only when the leader's intermediate times are available, but that is at the end of the stage only since usually the leader is the last one to start. Third, it is not relevant to evaluate uncertainty of the stage victory as long as two riders able to win have yet to register an intermediate time. For these reasons, we instead choose two criteria based on the comparison of riders' times at the end of the stage.

(a) Uncertainty for the general classification (criterion 1):

We use the time difference between the leader and the second-placed rider after the time trial took place and we take into account whether or not a change in the leadership of the stage race took place. The following arbitrary values were allocated:

- A difference below 15 seconds: 0.8
- A difference between 15 and 30 seconds: 0.6
- A difference between 30 and 45 seconds: 0.4
- A difference between 45 and 60 seconds: 0.2
- A change in the leadership: 0.2

As a consequence, if the stage ends with a change in the leadership and a difference of less than 15 seconds in the new general classification, the value of the indicator is maximized and equal to one (0.2 + 0.8).

(b) Uncertainty for the stage victory (criterion 2):

It is not relevant to rely on a threshold of 100 seconds as for our previous criteria 1 and 2. Since time trials differ in distance, time differences between the first and the second riders are not comparable across time trials. Therefore, our idea is to relativize such time differences according to the times realized by the winner and the second-placed rider. For this purpose, we calculate the difference between the time spent by the second (t_2) and the time spent by the first (t_1) then we divide the latter by this difference. It corresponds to the time (in seconds) necessary for the first to make up 1 second over the second rider (t):

$$t = t_1 / \left(t_2 - t_1\right)$$

The smaller the time difference, the larger the time necessary to make up 1 second, meaning more uncertainty. If the winner needed 1000 seconds (more than 16 minutes) to make up for 1 second over the second rider, it means that the stage victory was uncertain. In contrast, if the winner needed 60 seconds to make up for 1 second over the second rider, it means that the stage victory was not uncertain. Based on t, we allocate the following arbitrary values:

- 1 if $t \geq 350$
- 0.9 if $300 \leq t < 350$
- 0.8 if $250 \leq t < 300$
- 0.7 if $200 \leq t < 250$
- 0.6 if $160 \leq t < 200$
- 0.5 if $130 \leq t < 160$
- 0.4 if $100 \leq t < 130$
- 0.3 if $80 \leq t < 100$
- 0.2 if $60 \leq t < 80$
- 0.1 if $40 \leq t < 60$
- 0 if $t < 40$

(c) Sum of the two criteria:

In summing the two indicators, we get a value between 0 and 2 for each time trial. In regular stages, theoretically this value can be between 0 and 3 but its mean will never be over 2 because one of the three criteria is applied only during the last hour of stage. Nevertheless, it is not appropriate to make comparisons between the values for regular stages and time trials because while in regular stages we have multiple observations during the stage, in time trial stages we only have a single value at the end of the race.

4.3 Illustrations

4.3.1 Illustration in a Regular Stage

To illustrate our intra-stage competitive intensity model for regular stages, we chose the ninth stage of the 2020 Tour de France. In this exciting mountain stage, Adam Yates lost the yellow jersey to the advantage of Primož Roglič. The stage profile is represented in Fig. 11.3.

During the first 50 kilometers of this stage, there was a succession of attacks from riders who were not dangerous in the general classification but the different groups were not able to gain more than 10 seconds over the peloton. Between 160 and 120 minutes before the finish, on the Col de la Hourcère, attacks continued and two groups broke away: Marc Hirschi (78th in the general classification, at more than 1 hour from the yellow jersey) alone in the lead, followed by a group of eight riders, of whom the best ranked was Warren Barguil (23th at 7’55”). Similar to the start of the stage, criterion 3 generated a level of competitive intensity around 0.2 (see Fig. 11.4), due to the repeated attacks of riders ranked beyond the 20th rank.

Fig. 11.3 Profile of the ninth stage of the 2020 Tour de France. (*Source* Official Tour de France website (letour.fr))

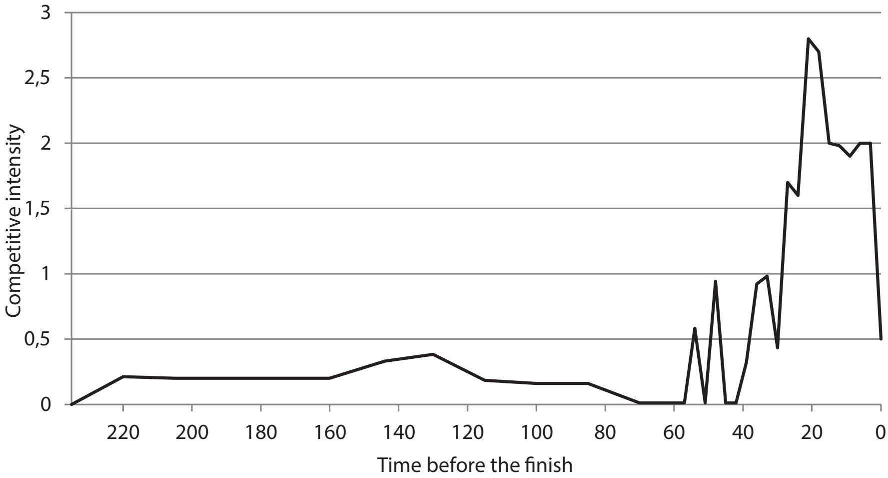

Fig. 11.4 Competitive intensity during the ninth stage of the 2020 Tour de France

The two breakaways had a limited lead and did not threaten the yellow jersey, meaning that the fixed part of criteria 1 generated a low competitive intensity (around 0.18). While Marc Hirschi increased his lead over the peloton up to 4’30”, the second group was never ahead of the peloton by more than 1 minute and was again caught 70 minutes before the finish. Marc Hirschi was still alone in the lead but did not influence the general classification—criterion 1 is almost 0. Between 60 and 30 minutes, his lead decreased in an irregular way. There was uncertainty regarding the stage win—criterion 2 generated a high competitive intensity.

Between 30 and 15 minutes before the finish, the three criteria were almost at their maximum for several reasons. There were numerous attacks by favorites in the general classification on the Col de Marie Blanque—criterion 3 was very high. While Marc Hirschi was still alone in the lead, yellow jersey wearer Adam Yates was unable to follow attacks and two additional groups broke away with a small lead: Roglič, Bernal, Pogačar, and Landa in the first group (respectively 2nd, 5th, 9th, and 12th in the general classification) and Martin, Bardet, Quintana, Uran, Porte, and Mollema in the second group (respectively 3rd, 4th, 6th, 8th, 13th, and 14th in the general classification). The differences in the general classification between all these riders were low, and the uncertainty for the yellow jersey at the end of the stage (criterion 2) was very high. Last, the suspense for the stage win was also very high since the differences were low and tended to decrease: 15 minutes before the finish, Hirschi led, 14 seconds ahead of the Roglič group, itself 19 seconds ahead of the Martin group, followed by the yellow jersey group 31 seconds later. Criterion 1 was very high.

In the last 15 minutes, there were no attacks, but criteria 1 and 2 remained very high since there was a great uncertainty both for the stage win and the yellow jersey. The Roglič group joined Marc Hirschi 2 minutes before the finish, five riders fought for the stage win, Tadej Pogačar won, and Primož Roglič took the yellow jersey.

4.3.2 Illustration in a Time Trial

To illustrate competitive intensity in a time trial, we chose the 20th stage of the 2020 Tour de France. This time trial of 36.2 km included a steep final climb up La Planche des Belles Filles. The stage profile is represented in Fig. 11.5.

Before this time trial, Primož Roglič wore the yellow jersey with a lead of 57” on Tadej Pogačar, 1’27” on Miguel Angel Lopez, and more than 3 minutes on other riders. Miguel Angel Lopez and the lower placed riders were never in contention for the yellow jersey during the time trial. As we consider that there is uncertainty for the general classification if after the time trial there is no more than 1 minute between the first- and the second-placed rider, it was necessary that Primož Roglič was between 3” ahead and 1’57” behind Tadej Pogačar to generate such uncertainty. Actually, Tadej Pogačar won the time trial and claimed the yellow jersey as he ended 1’56” ahead of Primož Roglič in the time trial so 59” ahead of him in the general classification. The uncertainty for the general classification was 0.4, with 0.2 coming from the time difference between 45 and 60 seconds and 0.2 from the change in leadership.

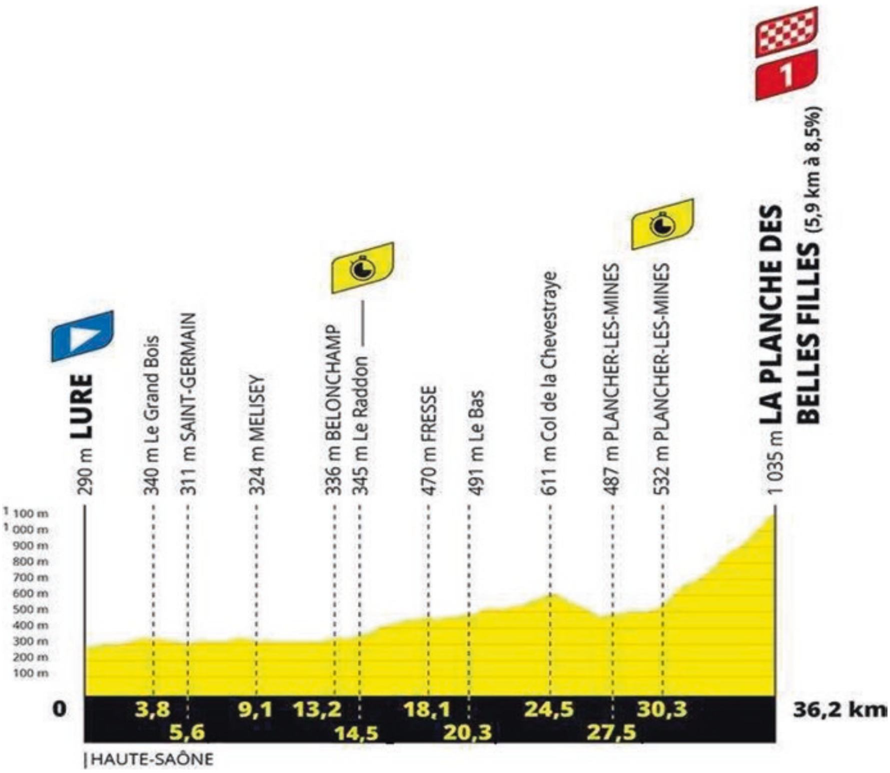

Fig. 11.5 Profile of the 20th stage of the 2020 Tour de France. (*Source* Official Tour de France website (letour.fr))

Tadej Pogačar won the time trial with an advance of 1’21” on Tom Dumoulin and Richie Porte with a time of 55’55” (3355”) vs. 57’16” (3436”), meaning a value of 55 was computed for t (3355 / (3436–3355)). We remind that this is the time (in seconds) necessary for the winner to make up 1 second over the second rider. As this value is between 40 and 60, we allocate a competitive intensity equal to 0.1 for the stage victory, meaning a very low uncertainty. Consequently, the overall competitive intensity for this stage was 0.5.

4.4 Implications

Organizers of mega team sport events can influence competitive intensity by modifying the competition format. Especially in professional road cycling, the opportunities to change the competition design are large because organizers choose the entire race route and are faced with few regulatory constraints for the course. In the early 2010s, the Tour de France organizer made some interesting choices, for instance, reducing the overall length of the time trials or giving more importance to secondary mountain ranges like the Vosges or the Massif Central. Our method of calculation of intensity not only offers the opportunity to verify the impact of these modifications, but also points out to organizers the elements in the race which increase intensity. Other modifications could be tested so as to optimize intensity, and this method of calculation could be used to confirm or refute the expected impact. After a test phase, it would be possible, for example, to verify whether or not the use of two-way radio communication is harmful for competitive intensity or whether or not the decrease in the number of riders per team is favorable for competitive intensity.

Another possible use of this measure is to test if a stage with a specific design early on in a 3-week stage race (e.g., a cobbled stage or a mountain stage in the first week of the Tour de France) stimulates or reduces competitive intensity during the following stages. For example, the fifth stage of the 2014 Tour de France (a cobbled stage) was not intense according to our measure, but it may have influenced competitive intensity in the next stages because of Chris Froome’s abandonment and the time loss of Alberto Contador. The fact that the fifth stage was not intense according to our measure but nevertheless had important consequences for the general classification means that our measure can certainly be improved as it focuses on the time difference between the breakaway and the leader, and on the general ranking of the riders in the breakaway, whereas a lagging behind for a favorite or challenger in the general classification is also a factor which seems to generate competitive intensity.

5 Conclusion

In this chapter, the aim was to discuss the issue of modeling performances and competitive balance in professional road cycling. The second section provided six factors explaining why it is very difficult to model performances and thus competitive balance. In spite of these difficulties, our third section revealed that several authors have tried to model performances and competitive balance in road cycling using theories from different sciences like physiology, sociology, and economics. In the latter, competitive balance in road cycling has emerged as a recent topic since our literature review highlighted that the first research papers on this specific issue only became available in 2005. Beyond the different levels and indicators used for measuring competitive balance in road cycling, we can wonder if this concept is the most appropriate to understand the attractiveness of races for audiences. Indeed, competitive balance postulates the necessity of equilibrium between competitors but does not incorporate the fact that professional cyclists might aim for different sporting prizes. This means that a rider can focus on a specific prize (e.g., a stage win) and not be competing at his best for the others (e.g., the overall win of a stage race).

The newly developed concept of competitive intensity fills the gap. In our fourth section, we suggested a specific method to measure intra-stage competitive intensity. Our approach is based on three criteria: uncertainty for the general classification, uncertainty for the stage victory, and attacks. It allowed us to calculate a global indicator of competitive intensity at different moments during a stage. This indicator reports how intense the stage is at any time, and the average of the different calculations made during the stage informs us about the overall intensity of the stage. Then, we can compare different stages according to their specific design (mountain stages, flat stages, long stages or short stages, etc.). Such comparisons are useful for organizers since they can help them to optimize the design of their race, not just the design of a particular stage but also the design of the succession and variation in stages. Thus, the conceptualization of intra-race competitive intensity would be interesting in order to analyze competitive intensity over stages. At the end, it should be noted that competitive intensity in professional road cycling is still a very novel concept. More research is needed to further develop and improve the idea.

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Chapter 12
Doping in Cycling

Hans Vandeweghe

1 Introduction

It may surprise you, but doping was not invented in Austin, Texas. Nor did it start with Lance Armstrong. Unfortunately, it will not end with Lance Armstrong either. So, how did it start? Easy: as soon as sports were organized, competitors started looking for ways to improve their performances. Organized sports competitions were born in the mid-nineteenth century, and pretty soon, it was said that there were "means" that could be used for special performances. Cycling was on the wrong track right from the start: too long, too hard, and too much. In Paris in 1868, it all started out neatly with a 1200 m race, but 10 years later, the Englishman David Stantin claimed he would be able to bike for 1000 miles in 6 consecutive days, being on his bike for 18 h a day. He won his bet and it took him 73 h. The concept of 6 days of sports—first in walking races and later in cycling races—was based on the working week back then: 6 days of work and rest on the 7th. And that is how medication overuse and wonder drugs originated. It should be noted that medication overuse is more than just taking doping products. It is about the misconception that the slightest inconvenience can be cured with a pill. In his excellent biography *Racing Through the Dark*, former cyclist David Millar describes this firm belief as follows: "I had to face reality: I got addicted to sleeping pills and it started during the final week of the Tour. I had also become an expert at injecting what we called recuperation products. I kept telling myself it was not doping. No, I just needed a *Rohypnol* once in a while in order to be able to sleep" (Millar, 2011).

No other sport would turn out to be more outstanding in impossibly hard races than cycling. The first real 6-day races started in the USA approximately at the same time as the classic road races in Europe. Six-day races were very destructive at the

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time. The rider who slept the least—at the beginning he was all alone—was most likely to win. The better riders had assistants, called "soigneurs," to keep them on their bikes, to keep them awake, and indeed, to give them their "products." At the end of the nineteenth century, both strychnine and nitroglycerine had a bad reputation in running and cycling races. But also the race itself was controversial. In 1896, the *New York Times* saw that Teddy Hale won $5000 but a reporter noted: "Teddy Hale won like a ghost, his face as white as a corpse, his eyes no longer visible because they'd retreated into his skull" (www.en.wikipedia.org/wiki/Madison_(cycling)). Most people showed up the last few days in order to see the riders fall off their bikes. After 1903, the French also came into the streets in large numbers to be able to see living corpses on two wheels pass by in the Tour de France.

The rest of the chapter proceeds as follows. Section 2 presents an overview of the most important doping products that were used throughout the twentieth century: amphetamines, anabolic steroids, corticosteroids, and growth hormones. By the end of the century, a new wonder product came on the market. The introduction of EPO completely reshaped doping use in cycling. We discuss EPO and blood doping in Sect. 3. Next, Sect. 4 illustrates the progress made and the difficulties encountered in testing of doping. In Sect. 5, we analyze what causes the use of doping and look at the role of cyclists, doctors, and the UCI. We finally conclude with an evaluation on where cycling stands today in its fight against doping use.

2 From Amphetamines to Clenbuterol

Apart from the very active caffeine, most products up to World War II could be catalogued as drugs with beneficial side effects. They were supposed to suppress fatigue and especially relieve the pain. Many of these drugs are, in fact, still being used today. That is one thing that is so astonishing about doping. All the products that were at some point said to enhance performance never really disappeared from cycling, often a consequence of former cyclists becoming team staff. The reduced popularity of certain products was usually due to the easy detection and the better replacement products that came and disappeared again.

2.1 Amphetamines

Amphetamine was the first real medicine to be used as doping on a large scale in organized sports. It was discovered in 1887 as a product related to ephedrine, but it was only produced chemically from 1927 on. The first well-known effect was in the treatment of asthma and bronchitis, but very soon its stimulating effect was discovered as well. Amphetamines caused people to become tired more slowly, a false feeling by the way. The first user mentioned in the standard work *Dictionnaire du dopage* by Doctor Jean-Pierre de Mondenard (2004) is the German athlete Rudolf

Harbig at the 1936 Olympics in Berlin. In doping books, the cycling brothers Pélissier are often said to be the first users of amphetamines, but that is one of the many misconceptions about doping, as the medicine did not even exist at the moment the brothers were successful. After their career, in an interview in 1924, the brothers Pélissier complained that the Tour de France was so hard that they started using a mixture of strychnine, alcohol, ether, trimethyl, nitroglycerine, heroin, cocaine, and doubtful products mainly trying to break through their pain barrier. Up until today, pain relief might very well be the most important trigger for cyclists to use medication that is not on the prohibited list.

Before World War II, cyclists were experimenting with amphetamines to a limited extent in the Tour de France, but after 1945, cyclists became extensive users. As with many products later on, the Italians were the pioneers. During World War II, Fausto Coppi improved the world hour record using seven pills of amphetamine (nicknamed "*la bomba*"). After his career, Coppi talked about his drug use in public:

Question: *Do cyclists use la bomba?*
Answer: *Yes, and anyone claiming he doesn't should not be talking about cycling.*
Question: *What about you, did you take la bomba?*
Answer: *Yes, every time it was necessary.*
Question: *And when was it necessary?*
Answer: *Almost always.* (laughter)
(translated interview from video "Intervista a Fausto Coppi (La Bomba—1952)," YouTube, 2015))

In the 1960s, amphetamines were the first products that were being detected by doping controls. One of the last amphetamines used amongst athletes was pemoline, known by its brand name *Stimul*. In the spring of 1977, no less than 24 Belgian cyclists were caught during a single doping control, including some great riders such as Merckx, Godefroot, and Maertens. It was extremely striking that the brother of Eddy Merckx graduated as a pharmacist presenting a paper on pemoline. All known amphetamine-like products are on the doping list, but only for use in competition. That is also the case for another well-known product, cocaine, related to amphetamines due to its stimulating effects on the central nerve system. Today, amphetamines are still used, albeit rarely, in training, but the side effects (such as addiction) are now well known making it less popular.

2.2 Anabolic Steroids

In 1935, an Austrian, a Swiss, and a German biochemist were able to synthesize the male hormone testosterone and were granted the Nobel Prize in chemistry in 1939. As of 1937, testosterone would be commercialized by, amongst others, the German pharmaceutical company *Schering*, which sponsored the infamous experiments by Doctor Mengele in Auschwitz. Testosterone is part of the group of anabolic steroids, the hormones to grow muscles. Like all other anabolics with names ending in "ol," a product like *Dianabol* is a slightly different chemical version of the body's own testosterone.

Testosterone was first connected to sports in the magazine *Strength and Health* in 1938, and it was meant to make bodybuilders believe that it was the product of the future. The first clear proof of the use of anabolic steroids in competitive sports appeared in 1959. During the Davis Cup final in Barcelona, Doctor Vidal Saval injected the Spanish tennis player Andres Gimeno in between his two matches with testosterone "to give him more strength." Later on, it would be revealed that the Russian weight lifters were taking testosterone at the Olympic Games in 1952. At the very first doping congress near Grenoble (France) in 1964, a list of prohibited doping products was created for the Tour de France. Hormones were still allowed back then. It would only be in 1976 that anabolic steroids appeared on the doping list of the International Olympic Committee. Testosterone itself, however, would only be added to the prohibited list in 1982.

While EPO may have changed the face of cycling later on, the effect of anabolic steroids on sports in general was much more impressive, especially in athletics. Some great Belgian athletes are undeniably linked to the use of anabolics. Their careers are remarkably parallel to the detection of anabolics in the urine by the doping laboratories in the second half of the 1970s. In contrast to what was the case with amphetamines, cycling was less keen to embrace anabolics. This time, even Italy was lagging behind. Mainly the short working testosterone, which was only active for a small amount of time and thus hard to detect, was used in cycling.

2.3 (Gluco)Corticosteroids

We know glucocorticosteroids as cortisones, and according to many doctors in cycling, it is the most dangerous doping product available. Their massive use in cycling, especially in France and Belgium, is a result from winter training in cold and wet conditions, which caused exercise-induced asthma or other diseases. The first and for a long time only products reducing those effects were (gluco)corticosteroids. Along with improved breathing, cyclists noticed a euphonizing effect comparable to that caused by amphetamines and less dangerous, so they thought. They were wrong. Glucocorticosteroids are also hormones, but instead of being anabolic or muscle building, they are catabolic or muscle reducing. These products get their energy from "eating" the proteins in the body, mainly in the muscles.

The precursor hormone ACTH (adrenocorticotropic hormone) is derived from the corticosteroids, and it stimulates the production of corticosteroids. Its brand name was *Synacthen*, and it was undoubtedly the most popular doping product in cycling in the 1970s, 1980s, and 1990s until the introduction of EPO. It took until 2006 for the doping laboratory in Cologne (Germany) to develop a test that could detect ACTH. For a long time, glucocorticosteroids could not be detected either. The doping laboratory of Ghent (Belgium) was a pioneer. However, ever since 2004, the rules regarding corticosteroids have gotten more permissive, mainly because the World Anti-Doping Agency (WADA) is an Anglo-Saxon organization and the problem of corticosteroids in big sports countries such as the USA and Great Britain is negligible compared to the problems caused by the use of other doping products.

The Grey Zone in Doping (Van Thuyne, 2006) is the title of the PhD study of Doctor Wim Van Thuyne of the doping laboratory in Ghent. For 4 years, he recorded the medication mentioned by the athlete on every doping form that entered the laboratory in Ghent. In particular, the UCI samples of professional cyclists showed some astonishing results. During the period that the hunt for EPO became effective, the use of corticosteroids increased strongly. In 2002, one out of every four UCI cyclists spontaneously reported the use of corticosteroids. The number increased every year, and in 2005, it peaked at 36%. The real use was probably even much higher.

Many cyclists use corticosteroids because of its euphonizing effect and tradition. The fact that even today there is still a problem is proven by the internal rules of the Mouvement pour un Cyclisme Crédible (MPCC), an interest group of mainly French teams promoting clean cycling. They go beyond the WADA code and commit themselves to prevent a cyclist having been treated with corticosteroids from racing for a period of 14 days. Since February 2013, the UCI also imposes a race ban of 8 days to any cyclist having been treated with corticosteroids.

2.4 Growth Hormones

In 1985, biosynthetic human growth hormone (HGH) came on the market, which was a year too late. In 1984, during the Olympic Games in Los Angeles, there was an enormous shortage of human growth hormone on the American West Coast, which was until then derived from the cerebellum of dead people. The big culprit was bodybuilder Dan Duchaine, who had published his *Underground Steroid Handbook* (1982) in which he promoted human growth hormone. Although the effect of the use of growth hormone is doubtful, sports quickly embraced the product, mainly because it could not be detected.

Nevertheless, cyclists only surrendered in the 1990s, but not in all teams. While one cycling doctor renounced the product, another would cautiously allow the use of the product, as proved by the testimony of *Festina* doctor Eric Rijckaert. In 1999, French rider Erwann Menthéour was the first to confess that he had tried growth hormone back in 1996. Also, the *Festina* team had started using growth hormone in 1996. There are no usage traces before 1996, let alone traces going back to the 1980s, like in athletics. In 1998, Willy Voet, a *Festina* soigneur, was arrested at the French-Belgian border near Lille. In his car, a sufficient amount of EPO for at least 2 cycling teams was found, along with 80 bottles of growth hormone. Since then, HGH is more popular than ever, even though its effect has never been proved. Jef D'hont, soigneur of the famous Tour winning team *Deutsche Telekom* and author of the controversial book *Memoires van een Wielerverzorger*, saw how HGH, or its precursor IGF 1, was introduced in the peloton. He tells from his own experience:

"It did not make cyclists, but in my opinion in the long term it stimulated fat burning." A cyclist explains the attractiveness of growth hormone: "Imagine an undetectable product and everyone says that it works, it is really expensive and you can afford it. Will you try it? Yes" (D'Hont, 2007).

2.5 Beta-2-Agonists

EPO will be discussed in Sect. 3, but were there many other new products after growth hormone? New medicines are always in the pipeline, but it takes some time before they actually are used as doping. A lot of products which are thought of to be performance enhancing but which in reality are not still turn up on the prohibited list. Also worth mentioning are the precursor hormones: DHEA for testosterone and IGF1 for growth hormone. These precursors are not always easy to detect, but their effects are highly doubtful as well.

The beta-2-agonists, better known as the modern asthma products, deserve a separate entry. Athletes often suffer from exercise-induced asthma requiring some kind of treatment. All beta-2-agonists are prohibited, except salbutamol (maximum 1000 nanograms per milliliter (ng/ml)), formoterol (maximum 30 ng/ml), and salmeterol when they are administered per inhalation in accordance with the therapeutic recommendations of the manufacturer. A Dutch study showed that only 800 ng of salbutamol is performance enhancing, also for those not suffering from asthma. It should be noted too that it is not true that "all athletes are asthmatic and therefore use an inhaler." At the Olympic Games in Sydney, 7% of the athletes requested a TUE and that is the highest percentage. At the Olympic Winter Games, this number increases to 8%, although heavy training in cold and/or polluted air almost guarantees exercise-induced asthma.

Some products do a bit of everything. Clenbuterol is such a product. As a beta-2-agonist it improves the breathing, it is muscle building and fat burning, but it is not as strong as a steroid. Track-and-field top athlete Katrin Krabbe was caught using this product in 1992, and Tour winner Alberto Contador was punished for using it in 2010 (see below). It is the product that is used the most for fattening cows (albeit often illegally), and since 2014, it is accepted that in doping analyses small doses of clenbuterol can be found due to contaminated food (supplements).

3 The Wonder Drug EPO

3.1 The Origin of Blood Doping

When the International Olympic Committee decided to assign the 1968 Olympic Games to Mexico, it caused sports science, and consequently doping, to make a quantum leap. Sports scientists had never been very interested in studying oxygen transport in the blood, but the necessity to perform at 2200 m altitude enhanced the awareness of that specific aspect of sports performance. For the German Democratic Republic (communist East Germany) Mexico 1968 were also the first Games as a separate Olympic team. In the new institute for sports medicine of the Deutsche Hochschule für Sport und Körperkultur in Leipzig, their sports scientists studied performing at altitude. Thirty kilometers east of Berlin, in the Kienbaum-Grünheide woods, a high-level sports center with low-pressure cellars was built, so that the athletes could simulate training at Mexican altitude.

Mexico 1968 brought the study of physiology into high-level sports. Ever since, the focus has been on the oxygen transport from the lungs to the mitochondria in the muscles where oxygen is used to supply energy. When exercising, the body consumes up to 20 times more oxygen than when resting. Too little oxygen produces lactate and causes acidification. Plenty of oxygen means going on forever at a high tempo. The blood obsession had begun. Blood doping by means of transfusions with one's own blood is assumed to be used in athletics since 1972. The first traces in cycling were found during the 1984 Los Angeles Olympics. It was a common legal practice in the American Olympic cycling team. At the advice of their coach, Eddie Borysewicz, eight members of the track team manipulated their blood. They did not do it in the Olympic village but in a motel nearby, where they got the blood. The team won nine medals, the first American podium places in cycling since the 1912 Olympics.

The scientific explanation of blood doping is very easy. The increase of hemoglobin in the body improves the oxygen transport, which is probably the quickest way to better performance. Hemoglobin is a part of the red blood cells, and a healthy person produces about 2.3 million red blood cells per second. Therefore, increasing the percentage of red blood cells in the blood—the well-known hematocrit—is the main objective of blood doping. It can be achieved in different ways. The classic technique by making use of blood transfusions was as follows: draw 500 ml of blood and separate the plasma from the red blood cells, whether with a centrifuge or not. The 350 cc of red blood cells left from the 500 ml of blood is the so-called packed cells. Those packed cells are reinjected during a blood transfusion. The body can cope with that extra volume so that the blood can transport 10% more oxygen. But blood transfusions are complicated and dangerous. Blood is perishable outside the body. The maximum shelf life was 6 weeks only if it was kept between 2 and 6 °C. In Los Angeles in 1984, some riders of the US squad got sick, as testified by track cyclist Pat McDonough in 1991. In the points race, the American local heroes Whitehead and Van Haute could not perform to the best of their abilities due to a sudden fever caused by a blood transfusion, a phenomenon that other athletes also sometimes suffered from.

As of 1985, blood doping would be prohibited, but the first steps towards a test would only be taken in 1994 and it took until 2004 for the first athlete to be caught. Both at the Olympics in Athens and in the Tour of Spain a month later, Tyler Hamilton was caught for homologous blood transfusion, having used the blood of another person (see below).

3.2 How EPO Found Its Way into Cycling

In the 1990s, transfusions were completely pushed aside for about 10 years by a chemical and more efficient kind of blood doping: rHuEpo (recombinant human erythropoietin, a body's own hormone that was produced chemically). That exogenous type of EPO stimulated the production of red blood cells in the bone marrow in the same way as the endogenous EPO. EPO was, of course, not invented for athletes. It was developed as a medicine for patients with chronic kidney disease and anemia. Later on, it was also used in the fight against cancer in order to give organs a boost against the destructive effects of chemo. As in sport, EPO replaced risky blood transfusions. The first rHuEpo (or alpha epo) in 1989 was available as *Eprex* and *Epogen*. Only 1 year later, EPO beta was introduced under the brand names (*Neo*) *Recormon* and *Marogen*, and in 1990, EPO omega under the names of *Epomax* and *Hemax*. Erythropoietin appeared on the IOC doping list in 1990 after an experiment by the Swedish professor Ekblom was mentioned at a congress in New York. He tested seven endurance athletes with and without EPO. There was a progress of up to 30 seconds after a 20-minute run, or a maximum progression of 2.5%. In high-level sports, 1% is often enough to make a significant difference. In long stage races, EPO has a cumulative effect, so that those 2% can result in a better recuperation of maybe 20% at the end.

Sports welcomed the introduction of artificial erythropoietin slowly, however. And as was the case with most types of doping, cycling was not the first sport to use it. In many doping books, the Dutch and Belgian athletes who died from heart attacks at the end of the 1980s are said to have died from incorrect use of EPO. That is pure nonsense, which became self-perpetuating. The production and selling of EPO only started in 1989, while it was mainly nonprofessional cyclists who died from heart attacks in the late 1980s. It is impossible that amateurs had access to EPO in phase three of the clinical research. In fact, the first manifest signs of the use of EPO in high-level sports date back to 1992, at the Barcelona Olympics. In athletics, there were a number of very strange results. The doctor of the Spanish athletics team at the Olympics in Barcelona was a former athlete, a certain Eufemiano Fuentes. His wife, Cristina Perez, had also been selected. Perez was already suspicious at the Olympics in Seoul. In 2008, she gave an interview to the Spanish paper *La Provincia* in order to defend her husband. "If I tell you everything that happened in Barcelona, Pandora's box will be opened. My husband has a substantial share in the thirteen gold medals of Spain; let's keep it at that. He is certainly not a criminal but a doctor who cares about his athletes' health" (Steroid Nation, 2008).

In cycling, Miguel Indurain, who won the Tour five times, is said to be the first big EPO adherent. There is no direct evidence for that theory, nor circumstantial evidence like was the case with Lance Armstrong. His sudden supremacy in the mountains made the Spaniard suspicious and the power he developed uphill (7 Watts per kilo body weight during long climbs) is physiologically impossible. In his book *Stages of Dark and Light*, Riis (2012) former cyclist and now team manager Bjarne Riis situates his acquaintance with EPO at the end of 1992 with the Italian team *Ariostea*. In his book, *Festina* doctor Eric Rijckaert (2000) talks about 1993. All sources mention Italian riders as the early adopters of EPO in cycling, and all traces lead to the University of Ferrara, where former athlete Francesco Conconi, who would become world famous with his Conconi test, was looking for an EPO test commissioned by the International Olympic Committee. So he needed to test urine and test persons. By coincidence, the test persons were the athletes he was training, most but not all of them cyclists. In some cases, he could raise their percentage of red blood cells with more than 50%. Of course, he never came close to an EPO test. The magician Conconi had a student magician who would become an opponent later on: Michele Ferrari. They were both part of the medical team that trained Francesco Moser for the world hour record in Mexico City. In 1994, Ferrari was a doctor for the *Gewiss-Ballan* team that took all three podium spots in La Flèche Wallonne with Argentin, Furlan, and Berzin. Bjarne Riis, also known in Ferrara, was part of the *Gewiss* team too. Given the revelations during the Conconi and Ferrari trials, there is no doubt they were the predecessors of the efficient use of EPO in the peloton. Just this once, the Spaniards were defeated.

The most original way to stimulate the body's own EPO to produce more red blood cells is living in an environment poor in oxygen. Training at an altitude or in low-pressure rooms and sleeping in altitude tents are all well-known aids, but none of them are as effective as exogenous EPO injections. Oppositely are the artificial oxygen carriers HBOC (hemoglobin-based oxygen carrier) and PFC (perfluorocarbon) which bind oxygen and immediately transport it to the tissue. They are developed to be used in wars for soldiers who suddenly lose a lot of blood. The HBOC is in a development phase, but the PFC is already in circulation. The brand names are *Oxygent* and *LiquiVent*, available since 2002. This is a booming domain introducing new brands every year. They are also used in sports, but their efficiency as a doping product can be doubted as they also cause vasoconstriction, which can never be the purpose of blood doping. Mauro Gianetti, once second behind Johan Museeuw at the World Championships in the EPO year 1996, almost died after using PFC during the Tour of Romandie. At least, that is what the doctor who treated him assumed at the hospital in Lausanne after an unconscious Gianetti was brought in from Montigny with symptoms nobody could explain (New York Times, 1998). Gianetti never admitted to having used PFC, but he said there was an investigation into "something he was given by someone." Whether it really was PFC could be doubted. Some sources say *HemAssist* was very popular at that time, but the development of the product was stopped after a number of deaths during the clinical tests. Another product that was once tried is *Fluosol*, but it is no longer available. The eternal question is how a second-class cyclist would be able to have access to such a new product. Probably in many cases were the accidents caused by poor practice in blood transfusions.

3.3 Second-, Third-, and Fourth-Generation EPO

The use of EPO as a medicine implied cool preservation and multiple injections per week. The injections were at first subcutaneous and comparable to insulin injections for diabetics. Later on, the injections were intravenous, into the vein, because this would make it more difficult to detect the EPO in testing. In 2001, *Amgen* introduced darbepoetin alpha, branded as *Aranesp* (second-generation EPO). For some patients and thus for some athletes, it reduced the number of injections to one per week. At the Olympic Winter Games in Salt Lake City, three gold medalists were caught and five gold medals had to be handed in. The doping users and doping hunters were even, with a slight advantage for the users who had become cautious. But already in 2003, the hunters were challenged again by the introduction of *Dynepo* (third-generation EPO), a version produced by using human cells instead of cells of a Chinese hamster. At first, there was panic and the doping hunters had to make up arrears, but they succeeded.

The fourth generation of EPO is called continuous erythropoiesis receptor activator, better known as CERA. The European brand name is *Mircera* and the producer is the Swiss firm *Hoffmann-La Roche*. The C in CERA stands for continuous. This effect is caused by a kind of motor added to the EPO, a so-called PEG or polyethylene glycol. Thanks to the PEG, the EPO remains in the blood for a longer period of time, so injections are only required every 3 or 4 weeks. It was introduced in January 2008, and already in that summer, the infamous cyclist Riccardo Riccò was the first one to be caught for using CERA.

Amgen's EPO patent expired in 2012. This meant that biosimilar generic products could be developed. In Europe, *Hospira* introduced *Retacrit*, the so-called zeta EPO. The laboratories are duty-bound to try out every new version of EPO. The list becomes endless, as are the countries producing the products. That way, the battle between doping hunters and doping users stays exciting after all.

4 Testing of Doping

Testing of doping started in the second half of the 1960s. In 1966, both the UCI and the international football federation (FIFA) had urine samples tested during their respective World Championships. Also during the Tour that year, there were doping hunters, but the cyclists went on strike against what they called the "disrespectful treatment." In 1967, the International Olympic Committee published a prohibited list, the first realization of the new Medical Commission under the leadership of the Belgian prince Alexandre de Merode. The first doping tests at the Olympic Games were carried out in Grenoble and Mexico City in 1968. Neither the entire procedure nor the laboratories at the time can be compared to the meticulous procedures and the high-tech research centers in use today. Nevertheless, there is always room for improvement.

4.1 Testing of EPO

During Lance's confession to Oprah, she asked him why he was never caught. There is an easy explanation: in the first decade of his career—he started in 1992 as a professional cyclist and ended his career in 2011, so almost 20 seasons—the fight against doping fell behind, due to an insufficient doping policy by the organization until 1999 responsible for testing of doping, the International Olympic Committee. EPO was introduced in 1989, and it was widely used in the peloton from 1993 on. However, only 8 years later, there was a test. In 1998, the *Festina* scandal accelerated everything. The UCI was the first sport federation to use the EPO test as published in *Nature* in 2000 by Françoise Lasne and Jacques de Ceaurriz of the French Laboratoire National de Dépistage du Dopage (LNDD). Tracing EPO and its derivatives is the most complicated test a doping laboratory can do. Before the urine can be tested, it has to be treated for 24 h. In the beginning, the EPO test was not very refined. After a few days, the product could no longer be traced.

In April 2001, the Danish cyclist Bo Hamburger had the questionable honor to be the first rider to test positive on EPO. He would eventually not be punished because the result of his B sample did not match his A sample, but he was still fired by his team manager Bjarne Riis. Later on, Hamburger would confess the use of EPO, of course in a book, like many other cyclists. Many more cyclists would follow, as would many athletes. In December 2012, it was announced that five Eastern European medalists of the Olympics in Athens had to turn in their medal. Eight years after the Olympics, their urine samples were retested and found positive. They were not the first athletes to be found positive after a retest. It already happened to Lance Armstrong in 2005 when his 1999 samples were looked at again, but there were no consequences because there was no legal framework to sanction a positive retest at the time. Today's urine or blood samples can have consequences in 1, 2, 3, or 8 years from now. The "postponed" doping test may very well be the most powerful tool in the fight against doping.

4.2 Contador's 0.000000000005

Nowadays, high-tech laboratories are able to detect the equivalent of one sugar cube in 30 Olympic swimming pools. So although laboratories do still not detect everything, a poignant question is: don't the laboratories of today trace too much? Alberto Contador is the most obvious example of a cyclist being punished for a mere futility. The clenbuterol found in his urine was a product that was easy to trace. It is popular amongst bodybuilders, and cyclists sometimes use it for three effects: fat burning, muscle growth, and improved respiration. On July 21, 2010 (a rest day in the Tour de France), 50 picogram (pg) of clenbuterol was found in Contador's urine. One day later, 16 pg was found, and in the samples of July 23rd and 24th, traces of 7 and 17 pg were found. Before and after that, nothing was found. Fifty picograms was 40 times less than the minimum value of 2 ng/ml of urine that a doping laboratory had to be able to detect at the time if it wanted to trace clenbuterol, that is, like a speed camera that has to be able to catch drivers speeding 120 km/h that can also catch drivers at 120.0125 km/h.

Unfortunately, even a very small amount of clenbuterol is not allowed. The WADA doping code says that clenbuterol is an exogenous product and that every trace has to be reported and consequently the athlete be punished, unless the athlete has a very good explanation. Soon, Contador came up with a very good explanation. It was obvious: unintentional food contamination. Shortly after Contador's defense was announced, it was said that the Spanish Tour winner had had a blood transfusion causing the clenbuterol traces in his urine. The underlying argument was that Contador had received a blood transfusion and that this blood (probably dating from his training period) contained traces of clenbuterol. The blood transfusion theory was explained by plasticizers in his blood by means of a test that was and still is under development. During the trial, the blood transfusion theory was soon forgotten because it raised many questions, mainly in support of Contador's defense. The preliminary phase of a doping case being pled at the Court of Arbitration for Sport (CAS) had never been longer than in the Contador case. A couple of years before, the same offense would never have been taken to court. But WADA saw things differently in the case of Contador. Ever since 2009, there is the strict liability principle for nonspecific products, which means that every athlete is responsible for any product in his body and WADA does not care how it got there. Whenever it is in the body, the sentence is 2 years. After 23 experts were heard in the Contador case, which is unique in the history of doping, and after the use by the defense of a lie detector that, in fact, cleared Contador, it all came down to two theses. The defense said that food contamination was the cause and came up with proof there was food contamination all over the world. WADA tried to prove the opposite, which seemed a lot harder as in the meantime WADA, and its laboratories had sent warnings concerning contaminated meat from Mexico and China. A number of athletes had already been cleared for traces of clenbuterol too because they had been to China and Mexico: table tennis player Ovtcharov, mountain biker Van Houts, and cyclist Nielsen. Furthermore, over 100 U-17 football players caught in the FIFA U-17 World Cup in Mexico were not sanctioned either.

Nevertheless, on February 6, 2012, the CAS convicted Contador. The judges ruled in favor of Contador that the positive test on clenbuterol was probably rather caused by contaminated food supplements than by a blood transfusion or contaminated meat (Inner Ring Cycling Blog, 2012). However, the strict liability principle was applied and Contador was suspended for 2 years. His suspension was applied retroactively from January 25, 2011, to August 6, 2012. In practice, he was only suspended for 6 months, and he missed the 2012 Tour de France, but was back on his bike in the Eneco Tour and won the Vuelta a month later. He was, however, stripped from his victories in the 2010 Tour de France and the 2011 Tour of Italy. If Contador had been caught for clenbuterol in 2014, though, he would never have been convicted. That year, the punishment policy changed. The riders Jonathan Breyne and Michael Rogers also had minimal quantities of clenbuterol in their urine after a trip to China, but they were not prosecuted by the UCI and WADA did not appeal.

4.3 Monitoring the Blood

Apart from the would-be undetectable new EPO products, there are a number of techniques to cheat. Adding a few grains of washing powder to the urine is said to make EPO undetectable, it is still impossible to trace transfusions with one's own blood, and micro-doses of EPO are often not detected. There is only one solution to this: check the blood parameters. In 1997, a blood parameter was used for the first time in the fight against doping. Officially, though, it was not about doping but about the athlete's health. In 1996, Bjarne Riis had won the Tour de France, and after, amongst others, his own team manager Walter Godefroot had said that new EPO was far too risky, the International Cycling Union (UCI) decided to introduce a new rule. As of 1997, the UCI decided that a rider would be suspended for 14 days if his red blood cell percentage or hematocrit level (HCT) would be more than 50%. This was pure nonsense since an athlete's health could never be a reason to suspend him. By depriving someone of exercise his hematocrit would in fact rise even more. However, the UCI had no alternative: There was too much EPO in the peloton and there was no test. On March 22, 1997, during Milano-Sanremo, the riders' blood was checked for the first time. The peloton was quite nervous. Right from the start, the limits set for the blood parameters were highly criticized. A number of athletes always had a hematocrit above 50%, and some others were just below the limit. Raising the limit to 50 for all cyclists meant that everyone could use EPO up to 50% HCT and that is exactly what happened. Athletes with a hematocrit of 40 would benefit more from the new "health control" than athletes with a natural high hematocrit.

Without a real test, EPO caused the playing field to be unlevelled and riders could win races they would normally not be able to win. It became a lot more difficult after 2001 with the Lasne and De Ceaurriz EPO test that was developed in (2000) (see Sect. 4.1) and was being used in all doping laboratories soon afterwards. But Lance Armstrong and some other athletes proved that it was not impossible to cheat. They went back to blood transfusions with their own blood, which could not be traced. As a result, at the beginning of the twenty-first century, there was a transfusion revival. This probably became clear to the broader public for the first time in July 2003 when during a Tour de France stage, Jesús Manzano fell while he was riding in front of the peloton with Richard Virenque on the Col de Portes. Apparently, he lost consciousness, and in 2004 he explained that his fall was the result of a poorly executed blood transfusion involving the use of oxyglobin (Cyclingnews, 2004), a product that was rather unknown up to that moment. In fact, oxyglobin is an oxygen carrier for veterinary use and is only approved for human use in South Africa.

Using the blood of another person is an even bigger risk and could cause a positive test until one month after the transfusion. That is what happened to Tyler Hamilton in the summer of 2004. But he did not just test positive due to a new test on homologous transfusions. The Hamilton case also illustrates how the UCI had started to work on better detection methods. Data mining (putting data into computer models) and targeting (focusing on suspicious athletes) are the key concepts in the story that began on April 25, 2004, in Liège-Bastogne-Liège, with Hamilton as the defending champion of 2003. That year, the UCI had launched a new algorithm to filter suspicious athletes: the stimulation index. The index consisted of a simple formula: the hemoglobin in grams per liter minus 60 times the square root of the reticulocytes in percent. Reticulocytes are young red blood cells. Too many reticulocytes indicate a recent EPO treatment. Levels between 85 and 95 were considered to be normal and 133 was considered to be alarming. One day before the race in which he would finish ninth, Hamilton's stimulation index was at a suspicious 123.8. A couple of days later during the Tour de Romandie, where he would win, his stimulation index was 132.9 and his hematocrit had increased to 49.7%.

During the period, Hamilton was being monitored, and the stimulation index did not yet exist officially. It was first announced during the Giro that year. Ever since 2004, the reticulocyte level is the most important parameter of all the blood parameters, precisely because it is so hard to manipulate. If the reticulocyte level drops below 0.4% or rises above 2%, it could indicate the use of blood transfusions (low) or EPO (high) in a recent or distant past (see Sect. 6). During the Tour de Romandie, Hamilton, who became a client of Doctor Fuentes in 2003, did not only have unusually high levels of hemoglobin and hematocrit, he also had a very low level of reticulocytes. He was subsequently invited by the UCI to give an explanation, but he resorted to "medical reasons." At the Olympic Games, Hamilton won the gold medal in the time trial. He tested positive for a homologous blood transfusion. At least that was the result of a new test that had been developed in Australia. Later on, Hamilton confessed to blood doping that day, but up until today, he claims that it was a transfusion with his own blood. It is very plausible that Hamilton is truly convinced that he received his own blood and that accidentally, blood bags were switched without his (or anyone else's) knowledge. Hamilton's blood had been manipulated by Fuentes since 2003, and later on, it turned out that his colleague and hematologist José Luis Merino often made mistakes when identifying blood bags. In fact, because Merino did not always remember whom the code on the blood bags corresponded to, he wrote the names and codes on a piece of paper in his wallet. It was partly because of that paper that the police could, for instance, discover that "hijo de Rudicio," son of Rudy (Pevenage), was Jan Ullrich.

4.4 Operación Puerto and Operación Galgo

Because it was known that blood deteriorated after 26 days and with blood transfusions becoming popular again, the search for a better conservation of blood bags intensified. Since 2004, Eufemiano Fuentes and his colleague José Luis Merino had been specializing in the glycerolization of the blood. Glycerol was added to the red blood cells, after which they were frozen. The technique originated from the research of the American army in search for techniques useful on their many battlefields. The code name they use for their new technique was "Siberia." The freezing of blood allowed cycling teams to much better manage the blood bags necessary for a big Tour.

But the Spanish Justice Department knew what gynecologist and sports doctor Eufemiano Fuentes was doing. With a hidden camera, they gathered evidence. On May 23, 2006, they had everything they needed to put charges against him: there was proof on tape. On video, there was a cool box with blood and doping and next to the box stood team manager Manolo Saiz, negotiating about doping. Furthermore, during house searches, the investigators found large doses of growth hormone and EPO, over 200 bags of frozen blood and plasma of athletes, and transfusion material. In particular, the frozen blood, with the rarely used modern technique of cryopreservation, astonished the experts. The case was called Operación Puerto, but a week later, Eufemiano Fuentes was already free to go. After his arrest and liberation, he said that he had only "taken care of" people. In a radio interview, he also explained that he had not only treated cyclists, but also tennis players, athletes, and football players as well and that he had not done anything illegal according to the Spanish law.

Spain would be the last European country to adopt a doping law, albeit under slight pressure, as Madrid was a candidate for the 2016 Olympic Games. However, the controversial Spanish doping legislation did not apply to the Spanish athletes. As a result, during Operación Puerto foreign countries mainly sanctioned foreign riders. It was the Italian Olympic Committee (CONI) that punished Alejandro Valverde, the owner of the blood bag "Valv. Piti" that was found during house searches. Based on DNA samples, it was proven that "Valv." referred to Valverde and Pitio was the name of Valverde's dog. Many athletes had code names referring to a pet. Some other codes that were used were: Fuentes was "Asterix," Merino was "Obelix," and the courier Alberto Leon was "Ali Baba."

Although at first Fuentes seemed to be untouchable because there was no Spanish doping legislation in 2006, on December 9, 2010, he was arrested again in what was called *Operación Galgo* ("Operation Greyhound"). During a raid at a number of addresses, large amounts of anabolic steroids, hormones, and EPO were found, as well as a new transfusion laboratory. Eufemiano Fuentes and his sister Yolanda were the initiators. The Spanish athletics legend Marta Domínguez and the vice president of the Spanish athletics federation were arrested as well. Sadly, there was one loss of life too. Courier Alberto Léon was arrested a second time because he kept blood bags in his refrigerator and he committed suicide at the beginning of 2011.

The whole Fuentes case nevertheless showed one encouraging sign. His blood bag business may well have been a desperate answer to the detection methods of EPO that became more and more accurate. The fact that so many cyclists from different teams and from all over the world came to see that one doctor in Madrid to enrich their blood may be the best proof that the fight against doping was much more efficient than it was generally thought to be at the time. Afterwards, it became clear that apart from Madrid, there was one other center using the technique of blood glycerolization: *Humanplasma* in Vienna. It was frequented by the riders of the *Rabobank* team like Michael Boogerd, Denis Menchov, Levi Leipheimer, and Michael Rasmussen. Both Madrid and Vienna used the ACP, the automated cell processor, an all-in-one device that freezes blood by adding glycerol, thaws it again, and washes it to remove the glycerol in order to reuse it.

4.5 Athlete's Biological Passport

The information given by UCI chief doctor Zorzoli at the beginning of March 2005 at the doping workshop in Cologne was only intended for the attentive listeners of the doping laboratories. But his slides were disclosed, and they were not joyful at all. After the introduction of the EPO test in 2001, the average hematocrit of the peloton had dropped to an all-time low of 43.7, but since 2003, it had increased to 44.4 again. Since 2004, the reticulocytes also dropped with a quarter all of a sudden. As of 2001, the amount of young red blood cells was integrated in the criteria to determine whether a cyclist manipulated his blood. Too many young red blood cells indicated the use of EPO. Oddly enough, too little of those cells also indicates blood manipulation because in that case, the body has stopped producing red blood cells itself, usually due to a transfusion.

The fear of experienced Tour doctors who had witnessed the 1980s became real. The increased control on the use of EPO had caused the revival of the blood transfusion technique. Riders such as Tyler Hamilton and Santi Perez were caught for homologous transfusions, using the blood of someone else who has the same blood group. Bengt Saltin, the Swedish doctor and doping fighter of the Fédération Internationale de Ski, had already warned earlier on that athletes were recruited in teams on the basis of their blood group in order to supply their teammates with blood. Extremely odd blood parameters were used by doping fighters as an additional confirmation for a positive EPO test or to pressure an athlete and his team. Iban Mayo was under intense scrutiny during the 2004 Tour de France when his sponsor *Euskaltel* was informed about the odd blood parameters of the Basque climber during the Dauphiné, which he won. Blood profiles were also used to test an athlete at the right moment. In this way, based on fluctuating blood parameters, the Lithuanian rider Rumsas was targeted as of 2000. Finally, after three negative urine tests, he was caught for the use of EPO in 2003. Over the years, the system was so refined that a positive sample was no longer needed in order to convict an athlete.

In 2007, evidence of what everyone suspected became public: the doping problem was also a country-specific problem. During the meeting for professional cycling teams on Tuesday June 19, 2007, in Geneva, it was suggested to publish the blood parameters per team, but the International Cycling Union did not agree. Instead, the blood parameters by nationality were unveiled and some participants in the meeting were astonished. It was clear that not all cycling countries had the same approach. Due to a stricter approach in Italy and the actions taken by the police, Spain had taken the lead in manipulating EPO and blood. The UCI figures are related to the reticulocytes, the young red blood cells. Almost a third of the Spaniards, 32.7%, were below the lower limit of 0.4% reticulocytes, while only 14% of the Italians were below this lower limit, and in all the other countries, the percentage varied between 5% and 7%. One out of 14 Spanish professional cyclists (7%) was even doped heavily. Their parameters were below 0.2%, the pathological limit to scientists. With less than 0.2% of young red blood cells, one would have to be near to dead. No other countries had cyclists with a value below 0.2.

The introduction of the athlete's biological passport around 2008 started a new era in the fight against doping. The so-called blood passport does not look for the product anymore, it looks for the effects of products in the blood. No less than nine different parameters are used for the blood passport. While it is possible to manipulate one blood parameter and maybe two, it is impossible to manipulate all parameters. Together with preserving urine samples, first 8 and later 10 years, it is a very effective threat. The UCI started collecting data in 2008. As of 2021, the UCI has the blood profiles of about 1500 cyclists in its independent Athlete Passport Management Unit linked to the WADA laboratory in Lausanne. In 2012, Portuguese marathon runner Helder Ornelas became the first athlete to be suspended because of suspicious blood parameters in his blood passport.

Lance Armstrong also showed an abnormal biological passport. When he made his second comeback in 2009, he wanted to win the Tour for the eighth time, but he finished second behind his teammate Contador. Later, it became known that during the Tour, two of his blood parameters were abnormal. During the third week of the Tour, his hemoglobin did not drop with 10%, which would have been normal, but it had slightly increased compared to the beginning of the Tour. His young red blood cells dropped as well and were below his average level. According to Michael Ashenden, at the time one of the experts of the panel that were supposed to analyze the blood profiles, those values indicated the use of blood transfusions. A transfusion by definition inserts older blood, thus older red blood cells, consequently reducing the number of young red blood cells. Ashenden added that he found it strange that Armstrong's blood values had not been presented to the panel members. However, the expert panel only got to see those values indicating manipulation of the blood with 99.9% certainty. Armstrong's profile never got to 99.9 and not even to 90%.

4.6 Data Gathering

The war on drugs is going on. Similar to the biological passport, research has been done and samples have been collected to implement a hormonal passport. Although specialists argue whether strange hormonal parameters could lead to sanctioning, the research goes on. Never in the history of performance-enhancing drugs have the governing bodies and their controlling bodies been so efficient in chasing down the abusers. When previously it took the doping researchers decades to find methods to prove substance abuse, they now have analytical procedures in place together with the introduction of new products. That was the case for the SARMs, the selective androgen receptor modulators. These fairly new products are said to work like anabolics, but without the side effects. In the Giro of 2020 an Italian rider from a procontinental team was caught for SARM. The buzz about the catch went through the peloton very quickly.

Speeding up the research, better control of the national doping agencies (after the Sochi/Russia scandal), and the biological and hormonal passports combined with data gathering amongst the riders have led to a cycling that has never been cleaner and less doping driven than ever before.

4.7 Operation Aderlass

The most recent "high profile" doping case in road cycling dates from 2019. Operation Aderlass was an investigation into doping practices carried out by Mark Schmidt, formerly a team doctor at both the German *Gerolsteiner* and *Milram* cycling teams. Already in October 2009, Bernhard Kohl, who had been caught in a doping control while riding for *Gerolsteiner* in 2008, accused Schmidt of having overseen the doping practices.

Operation Aderlass started when Austrian police arrested five athletes at the FIS Nordic World Ski Championships 2019 in Tirol, following admissions by cross-country skier Johannes Dürr. Although mainly winter sport athletes were customers of Schmidt, some professional cyclists were involved as well. Already a few days after the police raid, Austrian riders Stefan Denifl and Georg Preidler both confessed to having used blood doping under the assistance of Schmidt. They were later handed a 4-year ban by the Austrian anti-doping organization. Additionally, in one of the few cases where a rider has been criminally prosecuted for doping use, Preidler was found guilty of fraud and received a 12-month suspended prison sentence by the Innsbruck Court. In the aftermath of Operation Aderlass, many more (often retired) professional cyclists were discredited. Alessandro Petacchi was given a 2-year period of ineligibility from the UCI, while Danilo Hondo (coach for the Swiss cycling federation) and Borut Božič (team director for the *Bahrain-Merida* team) both lost their jobs.

5 Determinants of Doping Use

5.1 The Difficult Choice to a Rider

Why does a cyclist decide to use doping? David Millar changed his mind when he signed a big contract with *Cofidis*. Apparently, at the time it was a team putting so much pressure on its riders to perform well that without being told directly, the riders knew what they had to do. In his book, David Millar explains: "The team did not have an active part in doping, but they facilitated it because they never asked questions and they never condemned doping. It was a demoralizing environment for those who wanted to keep clean. Older teammates told us that we were responsible to be in excellent shape for the big goal" (Millar, 2011).

Cycling has a number of triggers causing a cyclist to resort to doping. Take superstition. In a sport that is old-fashioned in terms of training and guidance but that at the same time is so dangerous, superstition seems to be fatal. The argument "if I don't take anything, it won't work" is often followed by an equally incorrect assumption "if I take something, it will work and it doesn't hurt to try." Up to the beginning of this century, old myths were passed on by the soigneurs, sometimes from father to son, sometimes from colleague to colleague. Only cycling has used so many failed C-riders to become soigneurs. And there is no other sport that immediately recycled more former athletes to team manager. But almost none of the current generation of managers knows the meaning of clean cycling and most of them are guilty as well. Either they turned a blind eye at crucial moments and did not ask the questions they should have asked at the time, or they used doping themselves. They are another reason why it is so difficult to ban doping from cycling. The rigorous hierarchy in cycling is another important factor. A cyclist uses doping because he thinks he is screwed by the micro-system of team hierarchy but also by the macro-system in which better teams have more means: "the other one uses doping, so I use doping too." It is indeed true that better cyclists who earn big money can afford better and more effective products. The regular use of EPO, for instance, was too expensive for many cyclists.

Cycling also has a historical deficit that is difficult to wipe out. For too long, doping was a compromise accepted at a time when people asked too much of cyclists. Let's not forget that the first professional races consisted of riding a bike 6 days in a row. The one that kept awake the longest—using any means—won the race. On top of that, as of 1903, there was the Tour de France. The first Tour lasted 35 days and had six endless stages that often took place partly at night. Ten years later, there were already 15 stages in 28 days covering 5388 km. In 1910, the Pyrenees were climbed for the first time. The tenth stage from Bagnères-de-Luchon to Bayonne over multiple mountain passes covered 326 km. In 1926, the Tour lasted less than a month and 5745 km was covered in 17 stages. Declarations by cyclists after World War I already showed that the Tour de France incited doping. Today, the Tour organizers and the French cycling world strongly deny that the Tour contributes to the doping problem in cycling. It is hypocritical, though, to cherish the hardest sport competition in the world as a national heritage, taking cyclists over the highest mountain passes and sending them over dangerous roads, while at the same time being the most rigorous with regard to doping.

Doping can also be the highway to fame and money. That is, of course, the case for almost any sport, but in cycling, one excellent result can lead to a contract being multiplied by ten. The one who is not caught wins. The one who is caught does hardly lose anything. Above all doping is the easy way out. Of course, doping is also an excuse for not having to pursue progress in other domains. Most of the cyclists that used doping could not suspect that the effect they were looking for by using pills and needles could be achieved by improved training (methods) as well.

Insufficient knowledge about training science also explains the popularity of medicine in cycling. But doping used as an extension to or as a tool in resourceful scientific training is, of course, the ultimate doping. Lance Armstrong is the clearest example: extreme resourceful training and needles and pills to perfect the physiological system. His attitude shows that he does not agree with the allegation that he really benefited from the products he used and that he does not want to be reduced to a mediocre cyclist who all of a sudden won the Tour seven times only because of the use of EPO and other products. Lance Armstrong is willing to admit that he used doping, but only because everybody did it and because he felt that it was better to his body. It would be interesting to present that thesis to his competitors at the time. No doubt more than 95% still admires him as the winner of seven Tours.

Economic Theories of Doping Use

Two types of reasoning are generally used in economic theory to explain doping use in sport. The first theory is derived from the economics of crime (Becker, 1968). It basically assumes that whether athletes use doping or not is the result of a well-thought assessment in which costs and benefits are rationally weighted. As long as the expected benefits (e.g., glory, higher prize money, etc.) sufficiently outweigh the potential costs (e.g., punishment if caught, health costs, etc.), athletes will continue to use doping. The testimony of Bobby Julich, 3rd in the 1998 Tour de France, illustrates this theory:

> During the 1998 Tour, my fiancé found out what was going on from another rider's wife. She confronted me on it and it was one of the most dreadful experiences of my life. She told me right then and there that if it ever happened again, our relationship would be over. That was motivation enough and I knew I had to stop. (Cyclingnews, 2012)

When his wife found out, the costs of using doping became so high it was no longer a rational choice for Bobby Julich to continue using EPO. Note also that a mere net benefit is not good enough since the benefit has to be sufficiently high to compensate the athlete for the ethical standard he breaches. Consequently, all else being equal, the higher the ethic standard of an athlete, the more difficult an athlete will find it to use doping and vice versa. A well-known example of a cyclist whose ethical standards were so high that he preferred to end his career as a professional cyclist rather than to start to use EPO is two times Tour of Flanders winner Edwig Van Hooydonck.

The second theory is based on game theory. In this analysis, doping use is the result of the "prisoner's dilemma" situation athletes are facing. All athletes would be better off if nobody used doping because in that case athletes incur neither health costs nor any other doping costs. However, in this ideal situation where nobody uses doping, the advantage of being the sole user is enormous. If all athletes reason like this, they all take doping and incur the associated costs, while the sporting result is likely to be very similar. As a

(continued)

result, the net benefit is clearly lower than in a no-doping situation since in spite of using doping, the benefits are the same while the costs are now higher. This is, of course, under the assumption that doping leads to better results and that it increases performance for all athletes to the same degree. Game theory predicts that in such situations, the only stable outcome will be that all athletes use doping. In this reasoning, athletes do not really have a choice if they want to be successful and they just have to follow the actions by the others to maintain a level-playing field. As a result, they do not feel like being cheaters either, as is very obvious from the statement by 1997 Tour de France winner Jan Ullrich:

> Almost everyone at the time was taking performance-enhancing substances. I didn't take anything that was not taken by the others. It would only have been cheating for me if I had gotten an advantage which was not the case. I just wanted to ensure I had an equal opportunity. (Cyclingnews, 2013)

In his book on doping, former cyclist Tyler Hamilton explains the sentiment amongst cyclists in the second half of the 1990s, when it was still impossible to detect EPO use. During those years, trying to ride "clean" was considered by many to be an unprofessional attitude for a cyclist. In fact, it signaled a lack of motivation (Hamilton & Coyle, 2012).

(Based on Van Reeth & Lagae, 2014).

The more physiological a sport, the more effective doping becomes. Without a doubt, from a physiological point of view, cycling is the most demanding and inexorable sport, a sport reducing the body to an incinerator without too many technical tricks. If you fan the fire, the fire will burn. Some wood will burn longer and be hotter than some other, and fire accelerators are very welcomed. That is why cycling is much more susceptible to doping than football or golf for that matter, a skill that was promoted to a sport. But doping has an addictive effect also. Or to use the words of a user who was caught and said voluntarily: "Have you ever driven a car with and without air-conditioning in the desert? That is like racing with or without EPO." Doping is all about fine-tuning the body and comfort during performance.

5.2 *The Omnipresence of Doctors*

No other sport has more doctors per athlete than professional road cycling, and it really is the only sport, except maybe horse-riding, with more doctors than coaches. The better teams have three doctors, taking turns, however, for only 30 athletes. The 1990s were the heydays of the cycling doctor. As sports science grew in importance and the unknown EPO was introduced, blood controls were appropriate and the doctor became more important than the soigneur. But "the" cycling doctor does not exist. The clean cycling doctor does exist, but he is a recent phenomenon. There is also the credulous cycling doctor: cyclists recorded abnormal blood levels for 20 years, but he never noticed anything. Since the 2011 Giro d'Italia, a cycling doctor or a cyclist cannot use a syringe at a race anymore without asking explicit permission, the so-called no-needle policy. In the 1990s, the cyclists injected themselves intravenously at the breakfast table. There is no way that a cycling doctor would have survived if he had not participated in some kind of doping program back then. During the 1990s, doctors had to compete with the cyclist's confidant: the masseur or soigneur. It resulted in a clash between theoretical knowledge and practical experience. The cyclist shopped around amongst the team doctor, a doctor outside the team, the team soigneur, and sometimes even a fixer outside the team.

To what extent are doctors guilty of the problem of overmedicalization and its derivative doping? None of the doctors gets off completely scot-free. At some point, every one of them has turned a blind eye to an abnormal blood value or a suspicious attitude. The doctors introduced the vascular widening products such as fonzalyne and interleukine, or Alzheimer medicines such as *Praxilene*. They allowed antidepressants such as *Prozac* or *Cipramil* to be used. Up until today, antidepressants are still used, and there has been the revival of a relic from the past: the "final bottle," to drink during the last hour in a race. It can contain up to five different products, amongst which at least the stimulant caffeine and the anesthetic paracetamol. "During the final a cyclist is in pain and paracetamol eases that pain" is the explanation, which is far too easy. Of course, paracetamol is just the beginning. In 2012, Taylor Phinney explained how painkillers such as *tramadol* could be responsible for many of the multiple collisions in the finals of cycling races: "There is widespread use of finish bottles, which are just bottles of crushed up caffeine pills and painkillers. That stuff can make you pretty loopy, and that is why I have never tried it. I don't even want to try it as I feel it dangerous" (www.inthegc.com, 2012). *Tramadol* affects the central nervous system and is one of the most powerful painkillers.

The trinity of the medical support of professional cyclists has Italian passports. The chief wizard of the so-called preparatore is Doctor Francesco Conconi. His student wizards are doctors Michele Ferrari and Luigi Cecchini. Between 1991 and 2006, they were invincible in the Tour de France. Indurain and Armstrong were accompanied by Michele Ferrari, Riis and Ullrich by Luigi Cecchini, and Pantani by Francesco Conconi. The three doctors were discredited for doping too often for the accusations not to be true, but narrowing down their part in cycling to inciting to injections and pills is not true either. Those men were obsessed with sports and especially with cycling. With their scientific approach, Conconi, Ferrari, and Cecchini drastically changed cycle training. The Schoberer Rad Messtechnik, better known as SRM, measuring everything from wattage and heartbeat to the number of revolutions per minute, made the underdeveloped cycling science enter a new era. In particular, Michele Ferrari was a genius, and according to Armstrong he was the baby that was thrown out with the bathwater. Michele Ferrari was one of the first doctors whose name was connected with EPO and another effective prohibited product, testosterone. As explained earlier, he was the doctor of the 1994 *Gewiss* team. At the time, it was said that *Gewiss* was EPO. Later that year, Ferrari would be interviewed by the French newspaper *L'Équipe* and he would make an unwise comment that haunts him up until today: “EPO is not dangerous, it's the abuse that is. It's also dangerous to drink 10 liters of orange juice” (Cyclingnews, 2003).

Lance Armstrong never doubted Ferrari. After his outing shortly after his first Tour victory, he kept working with Michele Ferrari, whom he first visited in 1995 at the advice of Axel and Eddy Merckx. They already knew Ferrari. Armstrong's team started using EPO at the end of 1995, urged by the leader, as testified by his teammate Frankie Andreu later on. The year 1996 was by far the best year for their teammate Axel Merckx. In support of Johan Museeuw, who would become World Champion, he took fourth at the World Championships in Lugano beating notable EPO users such as Richard Virenque, Davide Rebellin, Laurent Jalabert, and Bjarne Riis. Afterwards, little Merckx would be third in the tough Tour of Lombardy as well. In 1996, Armstrong was victorious in La Flèche Wallonne, the only classic he ever won. When Armstrong miraculously returned after cancer in 1998, he visited Ferrari again, convinced that he wanted to win the Tour de France. Michele Ferrari played an important role in the success of the *US Postal* team and more particularly the success of its leader but received a lifetime ban from professional sport in July 2012 by American anti-doping agency USADA.

5.3 A Note on the Role of the UCI

The UCI is often blamed for being responsible for the widespread use of doping in professional road cycling. Historically, however, one cannot but conclude that the UCI has taken multiple initiatives in the battle against doping. When it came down to introducing new doping measures, the UCI lead the way numerous times. For instance, in 1960, the UCI was the first federation to incorporate an article about doping in its regulations. Previously, doping did not exist as a prohibited practice and the first national laws against doping date from 1961. A couple of years later, in 1966, the UCI was the first international federation to devote an entire chapter on doping in the regulations and the first to have urine samples analyzed. The UCI also funded studies on the detection of EPO in the 1990s, and in 1996, it was the first major sport association to make its athletes take blood tests for scientific research.

The UCI has always been an early adaptor of new ways of testing too. In the spring of 2001, the UCI was the first federation to apply the new French EPO test and also the first federation to suspend an athlete based on this test. In fact, WADA did not approve the test until 2003. In 2005, the UCI was the first federation to announce a blood passport and the first federation to apply this as of the end of 2007, and in 2011, the UCI was the first federation to establish a no-needle policy before, during, and after races.

It is not up to us to defend the UCI nor does its pioneering role free the UCI from any responsibility for the persistent way in which cycling is associated with doping. But it is not true either to picture the UCI as a lame duck. However, one thing that could be said is that the UCI has not always been the best communicator in the interest of the sport and its athletes. While in other sports, e.g., tennis or football, federations often prefer to remain silent on doping cases, certainly when a positive A sample has not yet been confirmed by a positive B sample, the UCI has usually been very open in its communication. Although in principle, such a policy could be applauded, it does not always serve well the image of the sport with the general public.

A major credibility problem arose when it became known that Armstrong had made two donations to the UCI in support of its anti-doping policy. In 2002, Armstrong signed a personal check of $25,000, and in 2005, his management company made a second payment of $100,000. According to Pat McQuaid, the president of the UCI at that time, the money was used to buy a *Sysmex* blood testing machine (Cyclingnews, 2010). Media publications suggested these donations were a compensation for the way the UCI had protected Lance Armstrong. It was said that with the help of the UCI, Armstrong had been able to avoid a sanction (at least) twice, in spite of positive doping tests. In July 1999, the French anti-doping authorities controlled Lance Armstrong at the Tour de France. Traces of triamcinolone acetonide, a glucocorticosteroid, were found in his urine. During the Tour of Switzerland in June 2001, Lance Armstrong was thought to have tested positive on EPO. Lance Armstrong himself communicated this to his team members and said he had the positive test erased after consultation with the UCI.

However, in both cases, there never really was a positive test. In July 1999, a month after a test was developed, traces of triamcinolone were indeed found. As a result, Armstrong was informed that he needed a prescription by a doctor, which he got. In June 2001, the Tour of Switzerland is one of the first Tours in which athletes were tested on EPO. Lance Armstrong's urine test results were not positive. In those days, the laboratory in Lausanne considered an EPO test to be positive if 80% of the EPO markers were in the error zone. Although according to the investigators, 70% was already highly suspicious and a cause for further testing and targeting, in order to consider a sample to be positive, a cautious margin of 10% was added, hence the 80%. The laboratory in Paris only considered a sample to be positive as of 85%. Lance Armstrong's tests of June 19 and 26 resulted in 75% and 70%. His two urine samples were qualified as negative, but as "highly suspicious as to the use of EPO." As there was no positive test, there is no way that a positive test could have been made to disappear. In those days, the UCI warned the athlete that he or she was targeted and would be tested more regularly. The UCI was always praised for that proactive approach to prevent the use of doping, but was later branded as showing irresponsible behavior. Nevertheless, warning the athlete was a recommendation in the Hamburger arrest at the CAS in 2001. In that arrest, the judge clearly stated that the rider has a right not to be in a black box as to the new EPO test, meaning that the rider has to be able to inspect how the test works. Johan Bruyneel, Armstrong's team leader, recently confirmed that there never was a positive sample. So Lance Armstrong lied when he told his teammates that he had tested positive in 2001 and that he had made a deal with the UCI. Such lies were, in fact, used by Armstrong to stimulate his teammates to use doping as well.

6 Where Does Cycling Stand in 2022?

Even if doping has not disappeared from cycling, it is a minority of riders that still cheat. Of course, the fight against doping must be pursued, but while the media want us to believe that doping is still out of control, it is not. In a way, the USADA Armstrong files in 2012 were a happy reading for those aware of the finesses of anti-doping. There was no sophisticated doping involved. There were no sophisticated methods, and there was indeed a conservative approach, albeit very organized to the point that anybody who came close and who could be a threat was neutralized in a verbal or legal way. But Armstrong was right in his defense: he applied techniques of the 1980s in a moderate way.

There are multiple encouraging signs that in 2022 professional road cycling is in a much better place. All professional cyclists suspected for doping use in the past few years have been riders from lower-tier teams. In fact, 2021 marked the first cycling season since the WorldTour was created in 2005 without a confirmed doping case (Velonews, 2021), while in 2020 the only WorldTour rider convicted for doping use was the little known Patrick Schelling from the *Israel-Start-Up Nation* team. Furthermore, not only are the climbing times in the mountains definitely slower than 20 or 30 years ago, the 7 Watts power per kilo body weight uphill is behind us as well. In March 2022, by winning with a lead of over 1 minute Tadej Pogačar almost humiliated his opponents during the Tirreno-Adriatico stage finishing on the Monte Carpegna. the favorite training climb of Marco Pantani, who lived nearby. Pantani's record on that climb is 16 minutes and 22 seconds (8,05 Watts per kilo body weight). In 2022 it took Pogačar, probably the world's best climber at that moment, over three minutes longer to reach the top: 19 minutes and 29 seconds (6,5 Watts) (Vandeweghe, 2022). Even when taking different weather and race conditions into account, the difference remains huge. Some other world-class riders like Jonas Vingegaard Rasmussen and Mikel Landa were even over 4 minutes down on Pantani's time.

This makes us believe that the testing for performance-enhancing drugs in road cycling is in a better shape than ever before. In the past 20 years, doping testing has made a quantum leap. There are improved testing, improved detecting, improved data mining, and the preservation of samples for 8 years and of course the blood profiling. All this taken into consideration, we can safely conclude that doping in cycling is currently practiced by less than 10% of the riders.

The conviction in March 2021 of the former team doctor for *Team Sky* (now *Ineos Grenadiers*), Richard Freeman, nevertheless proves that the war on drugs in cycling is here to stay. In a medical tribunal in Manchester, Freeman was accused of aiding cyclists with doping and related misconduct. He admitted to 18 of 22 charges against him. In March 2021, the tribunal additionally found Freeman guilty of ordering testosterone, a performance-enhancing drug restricted by WADA and UK anti-doping rules, for a *Team Sky* cyclist in 2011, "knowing or believing" it was to help dope a cyclist (Cyclingnews, 2021).

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Part IV
Developing Trends in Professional Road Cycling

Chapter 13
Professional Women's Road Cycling

Suzanne Ryder

1 Introduction

Professional women's road cycling has seen many moments where the sport is said to be "booming," similar to many women's sport (McLachlan, 2019). Recently, events like the introduction of the Women's WorldTour (WWT) in 2016, the implementation of a minimum wage in 2020, and the materialisation of a Tour de France Femmes avec Zwift in 2022 imply the sport is progressing and parity with men's cycling is in sight. Considering how a 100-plus-year-old sport that gives people who fervently follow it many joys (Vaughters, 2016) mostly excluded women from leading, organizing, and participating in races, it probably has come a long way. Women are no longer reduced to the sidelines as *spectatrices*, the female fans under awe of the brave, strong, muscular, "young men who took on a prodigious challenge from which fragile women were naturally excluded" (Thompson, 2006). Women race bikes, and, when given the opportunity, they produce the same joys as men's cycling.

Road cycling is a sport that is substantially growing since the advent of reliable live television broadcasting. It is steadily becoming a worldwide sport, with the Tour de France as a "crown jewel" that attracts tens of millions of cycling fans worldwide for each stage. Then why does it have so much trouble to create an equal business for women and men? Jonathan Vaughters wondered in the first edition of this book back in 2016 if it would be possible for cycling's business model to be reconstructed for the modern era without losing its popularity, quirkiness, and attachment to history. This chapter questions what needs to be considered in the discussions on the economics of women's road cycling to reconstruct a business model for a modern era where gender equity is reality.

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The chapter considers relevant literature and an original sociological study on gender and labor relations in professional women's road cycling. The data from that research was collected via participation by the author in the local Melbourne, Australia, cycling scene, semi-structured interviews with mostly Australian elite and professional women cyclists, and ethnographic observations of the Women's WorldTour in 2019. The data presented in this chapter are predominantly from interviews and observation fieldnotes. All names are pseudonyms. The aim of this chapter is to provide a historical, structural, and cultural analysis of professional women's road cycling which is imperative in the discussions on the sport's economics. First, this chapter presents a historical background on women's cycling and women's racing specifically (Sect. 2). Next, the chapter focuses on the current organizational structure of elite women's road cycling (Sect. 3). Finally, the media coverage and television broadcasting of women's racing are considered (Sect. 4). A gender perspective is adopted to better understand the social power relations that shape the challenges in professional women's road cycling.

2 History of Professional Women's Bike Racing

Women have raced bikes since the invention of the bicycle in the 1860s, but their racing history is mostly forgotten. Where detailed accounts of men's cycling records were kept, women's achievements effectively disappeared (Bootcov, 2019; Gilles, 2018). Before further exploring the history of women racing bikes, it is important to understand more about the social context of this time frame and the relationship between gender and bicycling.

2.1 The Social Context of Riding Bikes

The Victorian societal constructions of gender and the lack of women's racing record keeping coincide. The social space of bike racing was considered a male preserve during a time where society deemed a clear demarcation of social roles attributed to sex that manifested in separate codes of normative behavior, speech, dress, and moral profile (Dauncey, 2012; Kiersnowska, 2019; Simpson, 2007). In other words, because cycling was for men, it was not for women.

From the outset, learning how to ride the "freedom machine" was different for women and for men (McLachlan, 2016). The early types of bicycles, the velocipede and the high wheeler, were risky and dangerous vehicles to ride. The associated risks and the required agility and courage positioned these machines as macho "danger-machines," attracting athletic and daring young men to show off their bravery and virility (Oosterhuis, 2016). Even though the high wheeler was almost exclusively for men, women are known to have raced them as well (Gilles, 2018; McLachlan, 2016). Among cycle historians, there is a consensus that the first documented account of racing women was in November 1868 (Simpson, 2007). French women had taken part in the cycle races staged in Parc Bordelais in Bordeaux (Dauncey, 2012). Although the details are blurred on how many women participated, Simpson (2007) points out that the significance of this account is the expressed interest by women in bike racing from the early days onward.

When manufacturers brought the safety model onto the market in the 1890s, the bicycle gained more popularity among groups such as women and older men, using the bicycle mainly recreationally. However, different models were produced: diamond-shaped frame bicycles designed for men and drop frames for riding in a skirt designed for women (McLachlan, 2016). The diamond frame was structurally stronger than the drop frame, so manufacturers made the drop frame ten pounds heavier, slowing women down. The technology of the bicycle itself shaped the ways in which it was possible to ride it along the lines of gender (McLachlan, 2016). Although cyclists in general faced challenges for their existence (neglected roads, conflicts with pedestrians and coaches, the dislike of arrogant, intruding cyclists by rural folk), women's possibilities were further limited by their gender.

A similarity across cycling cultures in different nations was the controversy of women's right to cycle, what kind of cycling they should attempt, and the behavior and apparel that they should adopt (Dauncey, 2012). The discourse concerning women and riding bikes was influenced by "scientific" theories, medical opinions, and moral arguments (Kiersnowska, 2019). The "science" included the idea that humans were born with a finite amount of energy and due to the female reproductive system, women had lost their physical energy. This idea infiltrated the opinions of medical practitioners who further created the myth of women as the weaker sex, claiming that women were mentally and physically impaired by the demands of their reproductive apparatus and menstruation cycles. Morally, maternity became a woman's sole purpose, and therefore, she should not engage in energy-consuming activities, such as cycling (Garrard et al., 2012; Kiersnowska, 2019). Despite this dominant ideology, women, along the lines of class, found ways to cycle within the limits of this larger social structure. It helped that with time, the medical discourse became more nuanced and medical experts authorized female cycling provided that the activity was undertaken in moderation (Dauncey, 2012). Ladies cycling schools opened for middle- and upper-class women to learn how to cycle properly, respectably with elegance and decency. For men, cycling in public was hardly an issue, but women needed to make sure to be respectable and understand that their cycling practice involved seeing and being seen, and therefore continuously submitted to the male gaze (Oosterhuis, 2016; Simpson, 2007). Eventually, cycling became an essential social accomplishment among high-society ladies (Kiersnowska, 2019).

Other women used the bicycle as a machine for their liberation of constraining social norms and carried a liberated attitude and daring outfits. These women were labeled as the "New Woman" and they were vocal about their desire to enjoy educational, employment, and political rights equal to those of men (Kiersnowska, 2019). These types of logics were considered a threat to the social fabric of Victorian society by both the male bourgeois establishment and higher-class women who continued to adapt to prevailing gender role patterns (Kiersnowska, 2019; Oosterhuis, 2016). The New Woman's quest to gender equality was portrayed as negative and associated by media and opponents of women on bicycles with militant feminism and manliness (Oosterhuis, 2016).

2.2 *Women's Racing in the Late 1890s: A Sum of the Right Ingredients*

The controversy linked to women racing was perhaps more significant than the concerns with riding properly for social status or the use of the bicycle to promote women's liberation. "Women who participated in sporting rivalry were accused of transgressing standards of acceptable female behavior, encroaching into male territory, aping mannish ways and thus denying their own sexual identity" (Kiersnowska, 2019). Nonetheless, women were involved in both professional and amateur record settings and various championship titles, although some of which were not necessarily recognized internationally at this point (Simpson, 2007). These women racers, their coaches and managers, and a minority of genuinely interested followers took their cycling very seriously, as they subscribed to the latest ideas about physical conditioning, training, and diet. However, they could not escape the dominant gender discourse that constructed women's racing as lesser.

Women's bicycle races were initially crowd pleasers, constructed as a novel and exciting spectacle for mostly male audiences (Gilles, 2018). Rather than staged in their own right, women's racing events were often on the program of freak shows or staged between the races of prominent (male) cyclists (Dauncey, 2012; Simpson, 2007). Race organizers were primarily interested to capitalize on the aura of outrageousness of women racing bikes and exploit the female racers, instead of organizing competitive women's racing as a serious sport (Kiersnowska, 2019).

Women's racing was not simply a product of women wishing to race and officials arranging competitions. In fact, women were mostly banned by clubs and associations, which also refused to license or organize races for women (Kiersnowska, 2019; Simpson, 2007). The development of women's racing was vulnerable to the patronage of entrepreneurs, to audience demand, and to the whims of public opinion (Simpson, 2007). For a short while, these factors came together at the end of the nineteenth century in the favor of women. The public had become more accepting of women cycling in general and men's bicycle races lost its novelty. Female racing ignited public interest so race organizers started to organize ladies' races as events in their own right (Kiersnowska, 2019; Simpson, 2007). Simpson (2007) explains how three ingredients were necessary for this development to occur: public interest, riders supply, and willing investors. By this time, men's cycling had developed into one of the greatest spectator sports, drawing tens of thousands at large events. There were several reasons why women racing on bicycles sparked the interest of the public. First, the unusual sight of women competing in sport fascinated the spectators. Normally, women mostly kept to the private sphere and were not out in public like this. Second, the audience was unused to seeing women undertaking such a risky venture. Third, the predominantly male audience enjoyed the opportunity to view the female body in scant clothing. Fourth, many supporters of women's racing were those committed to the philosophy of women's social equality or those who were passionately interested in any kind of racing (Simpson, 2007).

The second ingredient for the development of women's racing was a steady supply of women willing to take the physical and social risks to race and thus satisfy audience demand for novelty and excitement. Women who were able to explore their interest in bike racing did so under the support of a male figure: their husbands, fathers, or brothers who were somehow involved in the cycling industry (manufactures, retail, professional racers, journalists, race promoters). Some women were involved in racing through their own background in theater or circus, while others raced for political reasons. For many of these women, who had no financial backing of their family, the prize money was a big motivation to compete in races. Women's earnings ranged from £6 to £60 for the winner, or up to £100 per week, while also wining the additional prizes such as jewelry or other valuable objects (Dauncey, 2012; Kiersnowska, 2019; Simpson, 2007). The third ingredient for women's racing opportunities was the interest of investors such as entrepreneurs and bicycle manufacturers. They saw the interest of the audience, and with their access to velodromes, they capitalized on that intrigue.

From these three ingredients, the dynamics between the stakeholders (riders, manufacturers, entrepreneurs) shaped professional women's cycling in this era. Racers needed equipment (bicycle, clothing, shoes) and events to race in. These women raced professionally and required a steady income to provide them the necessary time to train, because their fathers and husband could not completely fund them (Simpson, 2007). Manufacturers needed a market to sell their bicycles in. Entrepreneurs were in the need of a steady supply of riders, entertainment to sell, and admission sales and widespread advertisement. These various needs came together, and as a result, the women racers, alike men racers, became employees of companies solely to enter and win as many races as possible on the bike the company made. The racers were supplied with bicycling equipment and a regular income, allowing these women to train and compete full-time (Simpson, 2007). In return, the manufacturers linked the races and athletes to the marketing of their products. They hoped that women in the audience might become excited enough about riding bicycles to purchase one.

These dynamics and ingredients of the 1890s resulted in a rare time in history "where sportswomen earned more money than sportsmen in the same sporting code" (Simpson, 2007). Although the bicycle brought speed, freedom, novelty, and challenge to both men and women, women's racing was not without social risk and therefore not necessarily "freeing" women in any significant social manner. Being out in the public space of the velodrome or a road race brought along ridicule, threats, and public criticism. The most prominent criticism was safety and the need to protect women. Despite the appeal of the risk for the audience, women's cycling future was negatively impacted by accidents and the intense criticism that arose consequently. In 1902 in the United States, the death of rider Dottie Farnsworth led to suspending women's racing altogether (Simpson, 2007).

2.3 The Continuous Barriers into the Twentieth Century

The popularity of cycling and racing was also influenced by the motorized vehicle craze (Gilles, 2018). In the United States, Britain, Canada, and Australia, the bicycle was mostly pushed out by the car, more so than in European countries (Oosterhuis, 2016). In Australia, the bicycle had lost its symbol of modernity as it was superseded by the automobile (Bootcov, 2019). Bicycle sales had plummeted, prices had fallen, and manufacturing firms were either disappearing or taken over by bigger companies. This dip in the cycling industry affected racing because consumer's enthusiasm to watch professional cyclists had dampened (Gilles, 2018). One would think that men's racing was also affected by the changing status of the bicycle, but in the early 1900s, many big races (now considered classics or *Grand Tours*) were created: the Tour de France in 1903, Il Lombardia in 1905, Milano-Sanremo in 1907, the Giro d'Italia in 1909, the Ronde van Vlaanderen in 1913, and the Vuelta a España in 1935 (Mignot, 2016). While these races were principally for men only, Alfonsina Strada was able to compete in Il Lombardia in 1917 and 1918. Despite the Giro d'Italia not allowing women's participation, she managed to enter, start, and was allowed to (unofficially) continue the race because her participation attracted a lot of attention from the press (Mallon & Heijmans, 2011).

The promoters of women's racing persisted to keep the popularity of their sport high, and they considered they had two advantages over men's cycling: sex appeal and dramatic, tightly contested finishes (Gilles, 2018). Nevertheless, women's bicycle races disappeared out of the big cities, attracted fewer and fewer crowds, and was considered nonexistent by the early 1900s (Gilles, 2018).

Despite the loss of status, the bicycle's popularity returned, and historians identify a second boom in the 1920s to mid-1950s (Oosterhuis, 2016; Bootcov, 2019). Oosterhuis (2016) explains how bicycle cultures developed differently in different nations. The Dutch and Danes linked the utilitarian use of the bicycle to their national identity, the Swedes toured and cycled recreationally, and countries like Spain, Italy, Belgium, and France started hosting long-distance, staged road races that fueled European cycling fandom (Bootcov, 2019). In Australia, the bicycle made its comeback when job losses and financial squeeze related to drought and economic depression created a context to look for alternative means of transport (Bootcov, 2019). In a time of economic hardship and weak political leadership, the Australians took delight in sporting contests and celebrated hero-athletes which included female distance cyclists like Joyce Barry and Valda Unthank (Bootcov, 2019). This inclusion of female cyclists was shaped by several factors: the reinvigoration of men's competitive cycling, a growing interest in racing by women, the diminishing of lingering notions of inferior female biology, and the strong connection with Australian national identity (Bootcov, 2019). It is worthy to quote the conclusions of Bootcov (2019) in full about the role of women in professional road cycling in the 1930s:

> [These women athletes] made a contribution to economic growth in a difficult decade, and though they were amateurs, they embodied a new era of professionalization in women's

> sport. They broke the boundaries of expectation and helped to define a new femininity of active physicality, extending the national identity of the sporting Australian to include women too. Although they were exploited in a sense by the bicycle industry for economic gain, they exploited the opportunities on offer and forged their own paths to attain their own goals.

Despite the success of women cyclists in this time, it did not lead to a sustainable, respected realm of bicycle races for women. Grassroots competitive women's cycling in Australia does not carry the admiration and appreciation Barry and Unthank enjoyed. While there are successful Australian women professional cyclists in the international scene, the national structure and culture remain minimal and male-dominated (Ryder, 2021).

The male dominance of (professional) road cycling was problematic because it hindered equality for women in the sport. It was not until 1958 that the UCI officially sanctioned a women's world championship, and it was 1984 when a women's road race was first included in the Olympic Games, more than a hundred years after that first race in 1868 (Simpson, 2007). While these events are regarded as progressive as they signal inclusion, women faced difficulties associated with the enduring Victorian ideal of femininity and the associated ideas which sports are acceptable or unacceptable for women to participate in, before, during, and after these times (Dauncey, 2012). Since road racing was deemed unacceptable for women, they needed to emphasize their femininity to make up for the associated aggression of racing. For example, in the 1999 Tour de France feminine, riders were actively encouraged to show their femininity as well as their athleticism by wearing makeup, nail polish, and coiffured hair (Dauncey, 2012). While the market for women's cycling was established seriously and profitably, it was difficult for women to access the realm of competitive cycling equally to men, even when a Tour de France for women was founded in 1984 (Dauncey, 2012). The male-dominated establishment had trouble accepting women sporting stars and prevented women from gaining the same popularity (Dauncey, 2012). This male dominance was also visible in the denial of women assuming responsibilities and positions within cycling federations. If women were able to break through the glass ceiling, they resigned out of frustration of the thinking of the federations which indicates the lack of inclusivity in practice (Dauncey, 2012).

The male dominance was not excluded to the organizational level and can be recognized at the competition and symbolic level as well. Where the origin of women's racing at the end of the nineteenth century was as a side show, this was still the case in the 1980s, a hundred years later. At this time, few races could claim to organize a women's only race as most race organizers organized either solely men's races or separate races for women, junior, and other categories (Lucas, 2012). The "men were the main attraction to an event, and women were relegated to the warm-up act as second-class competitors" (Lucas, 2012). For example, even though the Coors Classic race was promoted as the premiere women's stage race in the world, the 1984 edition saw the men compete in a serious 114-mile road race, while the women raced a 60-minute criterium and fewer miles (Lucas, 2012).

The male dominance expanded in the symbolism of racing, which is exemplified in the analysis of the efforts to commemorate a monument for the Coors Classic race by Shelly Lucas (2019). She reiterates that despite Coors Classic being the biggest organized race for women at the time, women were not recognized in the mythologizing and commemorating of this race. Through emphasizing the inclusion narrative of this event, the inequality of the race, such as fewer racing opportunities, less physically challenging in terms of endurance, tactics, and skill, and less media coverage and money, was and remains overlooked (Lucas, 2019).

This brief historical note on women's bike racing shows how women's participation has not developed linearly and women have faced many barriers along the way (McLachlan, 2016). The many structural and cultural barriers to participate and progress, such as denied access and membership to clubs, as well as the social, cultural, medical, sexual, and political advisability of women's adoption of cycling as either recreation, transport, or sport, make the current structure and achievements even more admirable. In the following section, the current organization of women's road racing is discussed. This discussion includes how the legacy of its history continues to shape the reality of professional women's road racing today.

3 Organizational Structure of Women's Road Racing

The organization of professional women's road cycling concerns many of the same stakeholders as men's cycling. In Fig. 13.1, borrowed from Morrow and Idle (2008) and altered to women's cycling, the main organizational agents in the field of women's cycling are indicated.

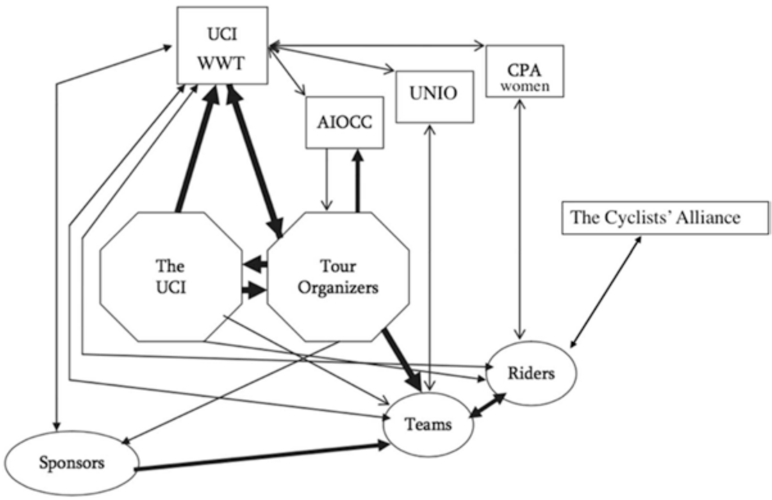

Fig. 13.1 Organizational structure of professional women's road cycling

3.1 The Organizations

According to Van Reeth and Larson (2016), the main actors in cycling are the riders, the teams, and the race organizers. The Union Cycliste Internationale (UCI) is the international regulatory body that provides a larger structure around those main actors and creates general rules, supervises the competitions, and provides the licensing of the race events, teams, and riders. In other words, they sell licenses to organizers to be allowed to host an event, for teams to compete in races, and for riders to be allowed to be part of a team and compete. The UCI is located in Aigle, Switzerland, and is recognized by the International Olympic Committee (IOC). The UCI is an important stakeholder for professional women's cycling because the organization is the owner of the highest competition for women's road cycling, i.e., the Women's WorldTour (WWT), which is stated in their regulations: "item 2.13.002 the UCI Women's WorldTour shall be the exclusive property of the UCI" (UCI, 2021c). The management committee of the UCI consists of 18 positions, 6 of which are held by women in 2022 (UCI, 2021d). It appears that the UCI has appointed more women lately since as recently as in 2020 there were still only two women in the management committee. The UCI has never had a woman as president.

To better coordinate the interests of riders and teams in the web of stakeholders, two important actors were established. The Cyclists' Alliance (TCA) was founded in 2017 by former professional cyclists Iris Slappendel, Carmen Small, and Gracie Elvin. TCA has a strong representation of women in their main organizational positions. The alliance advocates for women cyclists to have a safe and stable working environment and support them during and after their career. Three months after TCA was launched, the CPA (Cyclistes Professionnels Associés) announced their own women's union led by Alessandra Cappellotto and Marion Clignet. CPA Women works with the UCI to improve the working conditions of female cyclists and to ensure their safety, "following in the footsteps of the men's chapter of CPA" (CPA Women, 2021). Both the CPA and CPA Women's website emphasize they are the only association recognized by the UCI, positioning themselves as the only legitimate organization to represent professional cyclists despite the founding of TCA and the new men's union called The Riders Union (see, e.g., Hood, 2020). Moreover, on their website, the CPA opens with "we are the riders" where the CPA Women opens with "the women riders." This gender marking suggests that men are the norm for the CPA and the women are an add-on.

TCA's independent launch could have been seen as a threat to the CPA's power position as the sole rider representative body. The CPA might have acted towards their increasing loss of power by quickly responding and launching a women's branch. This power position was validated on April 4, 2021, when the UCI announced they endorse the CPA women's section during their management committee meeting from February 2–3 and consequently made financial contributions (Frattini, 2021). The UCI did not mention TCA, which leaves them independent but also without a direct seat at the table. Despite the politics behind all this, TCA and CPA Women seem to be working together on wider issues such as sexual abuse and rider safety (Jones, 2021).

Besides the riders' organizations, UNIO was launched in February 2020 and formally recognized during the UCI committee meeting of February 2021. As a women's team association, they aim to safeguard and promote the interests of all professional women cycling teams worldwide while working together with all stakeholders in order to guarantee a sustainable future for all teams and women's cycling in general (UNIO, 2021). UNIO was founded by Esra Tromp (currently vice-president), Ronny Lauke (currently president), Thomas Campana, and Danny Stam. The existence of UNIO, TCA, and CPA Women could lead to the opportunity of riders and teams making agreements about the working conditions outside the UCI.

3.2 The Teams

Teams have become a necessary part of the organizational structure in professional women's cycling. The teams need sponsors to exist, and the name of the team usually carries the main sponsor's name, for example: *Liv Racing*, *Canyon//Sram Racing*, *Trek-Segafredo*, and *Team BikeExchange*. Many of the sponsors are cycling specific brands, although non-cycling companies continue to sponsor as well, e.g., *Movistar Team Women*, *Team DSM*, and *Team SD Worx*. The names of cycling teams change often because sponsors usually agree to short-term sponsor deals (Mallon & Heijmans, 2011).

While in a top-tier team, riders generally have access to nutritionists, a team doctor, coaches, massage therapists, and a salary that allows them to be full-time cyclists. The bigger teams are identified by higher-paying sponsors, good management, access to coaching, support, training camps, and facilities, i.e., aspects that make teams "professional." In practice, the professionalism of women's teams is often measured along the standards of men's teams and how well women's teams meet those standards.

The lack of resources in smaller teams makes riders face more difficulties in their pursuit of their best performance, to develop into the best bike rider they can be, and to be safe and healthy. At the races, the difference between the teams becomes clear in the team zones. For example, at Omloop Het Nieuwsblad, the *Boels Dolmans* and *CCC-Liv* teams would make use of a big coach, while most other teams would arrive in much smaller camper vans or just team cars.

The UCI mandates teams to be not-for-profit organizations. The teams depend on their sponsors because they have no other streams of revenue. Road cycling is organized on public roads, which means there is no ticketing revenue teams can rely on. Rebeggiani (2016) explains how teams also lack an income from merchandising. Amateur cyclists are a large part of the professional cycling fan base and even though they dress similarly to professionals, in many countries there seems to be a taboo on wearing the actual kit of a professional team (Fretz, 2019; Velominati, 2020). This sentiment was reiterated by Camille in her interview:

> Now, if you're a cyclist and you buy, you know, some pro-team kit, if you wear that riding your bike, everyone says you look silly. (Camille)

While wearing team-related apparel is an important part of sports fandom (Shane-Nichols et al., 2021; Sveinson et al., 2019), not much is known about cycling fans wearing women's teams' apparel. The observations of the original study on professional women's cycling show that little opportunity is offered to purchase teams' merchandise. When merchandise is offered for sale at races, this apparel is limited to items representing men's teams. The most surprising was a merchandise van at the Giro Rosa (a women's stage race) from which a man sold products featuring the Giro d'Italia (a men's *Grand Tour*). Interestingly, these two races are organized by different race organizers and have no organizational ties. These examples show how, while cycling teams lack a significant income from selling merchandise, women's cycling teams face even more difficulty to generate such income as men's cycling is dominating.

Another important income that lacks in cycling teams is broadcasting (Rebeggiani, 2016). The race organizers hold the TV rights to the races, and they do not share their revenue with the teams. Race organizers who organize WWT race are mandated by the UCI to broadcast at least 45 minutes of the race. The broadcasting of women's race is discussed in more detail further into the chapter.

Race organizers such as *Courage Events*, *ASO* (*Amaury Sport Organisation*), and *Flanders Classics* are private organizations, and their main interest is a commercial one. For WWT races, the organization needs to be accredited by the UCI and they must pay an event fee. The organizer must invite between 15 and 24 teams, including a minimum of 8 WWT teams, and pay them a participation fee. The organizers also have to pay the best performing riders of their races. They can determine the prize money themselves, but the UCI requires a minimum of €7005 for the top 20 for 1-day WWT races, €3040 for prologues, and €3930 per stage for multiple day events. These costs to the race organizers are streams of income for the other stakeholders: fees to the UCI, invitation money for the teams, and prize money for the riders.

These agents, the UCI, the riders, the unions, the teams, and the race organizers, together form the web of stakeholders that have power in the organizational structure of women's professional road cycling. This structure, however, does not create equal opportunities for women, nor does it provide safe working conditions. In the next section, the chapter offers a further explanation of how the power to change the sport is a challenging problem.

3.3 The Power to Change

Reform has been proven difficult in the field of professional cycling as change was extremely slow and illustrated by harsh conflicts. Rebeggiani (2016) suggests the difficulties to reform are based on the absence of a powerful enough agent in the web of stakeholders. The UCI is the only legally entitled institute to implement and legitimize change, but they lack power because they do not control the most important events, such as the Tour de France owned by *ASO*. In professional men's cycling, the overall competition (UCI WorldTour) does not have the same importance as winning a *Grand Tour* or a *Cycling Monument*. This lack of importance also relates to the UCI World Championships, and some people doubt if the event will ever reach similar importance in cycling. According to Rebeggiani (2016), the prestige of individual events over the overall competition implies a weaker bargaining power of the governing body. This means that the UCI has a different power position as an international sporting federation than, for example, FIFA in football: "the governing federations manage and have to market 'products' of a lower value than some race organizers, and therefore, they do not have an economic or decision-making power comparable to that of federations in other sports" (Rebeggiani, 2016). However, it could be argued that things are more nuanced in women's cycling. The UCI holds more power over women's cycling than over men's cycling. The UCI is the only agent who establishes the women's calendar, whereas the men's calendar is established in consultation with the Professional Cycling Council (PCC), a council existing of representatives of the riders, race organizers, teams, CPA and UCI. While the UCI is dependent on race organizers setting up races for women, they clearly declare their exclusive ownership of the WWT in their regulations and set the criteria for races that seek to join the calendar. Without interference of other parties, the UCI can solely decide which race joins the ranks and which are "excessive" (Lucas, 2012).

The women's calendar includes many young races instead of old *Cycling Monuments*, and there are no 3-week *Grand Tours* for women. None of the women's races have the overwhelming impact that a race like the Tour de France has in men's cycling. Since this is not the case for the women's competition, women's cycling is more dependent on the UCI. As a result, this makes the World Championships, an event owned by the UCI, more significant in women's cycling than in men's cycling. This means that the UCI could exercise more power in women's cycling than in men's cycling and, with that, have it easier to (re)form the sport for the better.

The importance of individual events stems from the mythologizing of the *Grand Tours* and the *Cycling Monuments*. For these events, created for male participants originally, race organizers have slowly started to organize women's versions as well. Table 13.1 shows the *Grand Tours* and *Monument* races for men and the equivalent races for women.

Table 13.1 indicates how women's cycling is and has been organized unequally, because although women's events are "included," it cannot be concluded that this is evidence of progress in terms of equality between the sexes (McLachlan, 2016). For over a century, men's cycling could develop into the sport it is today with many iconic events and millions of viewers, while women's cycling was not seriously considered until the 2000s, with the exceptions of the Giro Rosa and a Tour de France for women in the 1980s, which discontinued after 2009. With the announcement of the first Il Lombardia Femminile in 2022, four of the five *Monuments of Cycling* now have both men and women's races (only Milano-Sanremo has not) but

Table 13.1 Grand Tours, Monuments, and their editions for women

Version	Race name	First-last organized	Organizer	Duration
Men	Tour de France	1903	ASO	3 weeks
Women	Tour Féminin Cycliste	1955–1955	Fédération Francaise de Cyclisme and Fédération Sportive et Gymnique du Travail	5 days
	Tour Cycliste Féminin	1984–1989	Société du Tour de France (also organizers of men's race at the time)	10–15 stages
	Grande Boucle Féminine Internationale	1992–2009	Pierre Boué	4 days (2009)
	La Course by le Tour de France	2014	ASO	1–2 days
	Tour de France Femmes avec Zwift	2022	ASO	8 days
Men	Vuelta a España	1935	ASO	3 weeks
Women	The Ceratizit Challenge (La Madrid Challenge by La Vuelta)	2015	Unipublic/ASO	1–3 days
Men	Giro d'Italia	1909	RCS Sport	3 weeks
Women	Giro Rosa/Giro Donne	1988	PMG Sport/Starlight SSD	9–10 days
Men	Milano-Sanremo	1907	RCS Sport	1 day
Women	La Primavera Rosa	1999–2005	RCS Sport	1 day
Men	Ronde van Vlaanderen	1913	Flanders Classics	1 day
Women	Ronde van Vlaanderen	2014	Flanders Classics	1 day
Men	Paris-Roubaix	1896	ASO	1 day
Women	Paris-Roubaix Femmes	2021	ASO	1 day
Men	Liège-Bastogne-Liège	1892	ASO	1 day
Women	Liège-Bastogne-Liège Femmes	2017	ASO	1 day
Men	Il Lombardia	1905	RCS Sport	1 day
Women	Il Lombardia Femminile	2022	RCS Sport	1 day

none of the women's races are a *Grand Tour* (lasting 3 weeks). Moreover, when women's events are included, they are gender marked, e.g., by using "*Rosa*" or "*Femmes*" or "*Donne*." Gender marking is a practice where gender modifiers are added only for women's sport while leaving men's sport unmarked (Bruce, 2016), which situates the men's event as *the* event and women's races as *girl* racing. This is done more so by *ASO*, while *Flanders Classics* named their race the same for women and men, i.e., Ronde van Vlaanderen, and distinguishes it into "elite men" and "elite women" on their website (Flanders Classics, 2021).

Even though the race organizers of the above races currently organize women's events, these races are often organized in a side-show manner. The main event is the men's race and there is less promotion for the women's event in advertisements and social media, no women's teams' merchandise available, only the men's race on the screens at finish locations, the use of sexualized or over-feminized imagery, and sponsors that only cater to an audience of men. Recent changes for some women's races suggest improvements in the field of women's cycling, such as increased live coverage and prize parity in races like the Ronde van Vlaanderen or the Amstel Gold Race. Nonetheless, less and lower-quality coverage (in some cases only motorbike footage and no helicopter or commentators) and discrepancies between prize money for the male and female winners continue to exist as two major shortcomings in the sport. Also, where the importance of the history of men's events is strongly emphasized, women's racing history is largely ignored, such as the lack of mention of the Tour Cycliste Féminin on the Tour de France website (Best, 2018).

Despite the reality of being overshadowed by men's cycling, the power and prestige of *Grand Tours* and *Cycling Monuments* affect the preferences and organization in women's cycling. During fieldwork at the Healthy Ageing Tour – a stage race in the Netherlands – the organizers expressed their concern that the tour might be jeopardized if the *ASO* decided to start a Paris-Roubaix for women because the timing of the races would clash. Their prediction was that if a Paris-Roubaix would become reality, fewer teams would participate in their race. During the interview with Liza, a professional cyclist, a hypothetical Paris-Roubaix and its impact on the racing calendar of her team was discussed. She said:

> We would do Paris-Roubaix, definitely. I think, like the Healthy Ageing Tour, I don't think that they should get WorldTour status, because it's actually good the way it is. But I just feel bad for them because they do everything right and they don't have the WorldTour status, whereas other races actually don't do everything right and they do have it. (Liza)

The high quality of the Healthy Ageing Tour is not enough to ignore the appeal of a Paris-Roubaix. Additionally, the sentiment of long-established races derived from *Grand Tours* has found roots in the Giro Rosa, a 9- or 10-day Italian stage race for women. The "crazy" routes on dangerous, badly maintained roads, little TV coverage of the race, the sexist prizes (e.g., cookware), and the questionable accommodation for lower-ranked teams are no reasons for many of the women riders to disregard the Giro Rosa (see, e.g., Benson, 2020). It is considered the most important stage race in women's cycling covering many iconic mountain passes, making it like those *Grand Tours* exclusive to men. Abigail, a relatively new rider to the professional peloton, said the following about the old Italian race:

> The Giro is a lot of fun, the Giro is a kind of a special race, because it's our Grand Tour and it's the longest one and it's very prestigious, that's kind of a cool one. (Abigail)

One explanation why there are only two *Grand Tour like races* in women's cycling is a structural barrier the UCI implemented. The UCI limits women's elite races to 6 days, unless a race organization applies for and is granted a special waiver from the UCI management committee (UCI, 2021c). This rule creates an extra barrier for any organizer to put on a *Grand Tour* for women. It is unclear why this rule is in place but considering the male dominance of the UCI and the historical impact of such dominance, the rule is gendered and sexist.

The bureaucratic control of the UCI is mainly in the hands of men, as two-thirds of the UCI management committee consists of men. The male dominance of the organization strongly relates to the prioritizing of men's cycling. As discussed in Ryder et al. (2021), on April 15, 2020, the UCI announced the broad lines of the post-COVID calendar. However, they announced only the men's side at first without clarity about the women's competition and without consulting the women's union (The Cyclists' Alliance, 2020a; UCI, 2020). On 5 May 2020, they announced both new calendars. The UCI clearly prioritized men's cycling over women's cycling. That priority is at the root of the organization and it biases the people in decision-making positions. This priority and bias translate into a negative reputation in the women's peloton. For example, Sandra, a professional cyclist, said the following about her perceptions of the UCI:

> I just imagine a bunch of old men sitting in an office, you know, drinking beers and eating chips and running these races and not really having any passion for women's cycling; not really caring about it, just making sure that the money is flowing in and you know, the women's cycling is kind of just a thing that they have to do, not what they want to do. (Sandra)

The male dominance in both representation and practices obstructs the UCI's organizational actions towards creating change for professional cycling, which in turn leads to an unfavorable reputation among the riders who rely on adequate leadership. An example of how the UCI can create change is the implemented structural changes to the elite women's competition, which is partly due to the proactive, organized advocacy from The Cyclists' Alliance and their recommendations.

3.4 Competition Structure

From 2020 onwards, the structure of the women's competition changed. Women's racing is divided into four categories that make up the racing calendar: UCI Women's World Tour, UCI ProSeries, Class 1, and Class 2. Events in both the WWT and ProSeries division are required to abide by organizational standards, which means, among other things, they need to improve their television production. The teams that compete in these divisions have changed from a one-tier system (UCI Women's teams) to a two-tier system (UCI WWT and UCI Continental teams). Each WWT team comprises of 9 to 16 riders, but in 2022, these teams cannot have fewer than 10 or more than 20 riders. The nine teams that attained the WWT status in 2021 were *Alé BTC Ljubljana*, *Canyon//Sram Racing*, *FDJ Nouvelle-Aquitaine Futuroscope*, *Liv Racing*, *Movistar Team Women*, *Team BikeExchange*, *Team DSM*, *Team SD Worx*, and *Trek-Segafredo*. Four of these teams (*Alé BTC Ljubljana*, *Canyon//Sram Racing*, *Liv Racing*, and *Team SD Worx*) are women-only entities, while the others have an equivalent men's team in the men's WorldTour. To be associated with a men's team is often considered a positive development because, theoretically, it means that the women teams have access to the same resources which would positively impact their performances and increase professionalism. This argument was used to attract one of the most successful riders, Marianne Vos, to the new established women's team of *Jumbo-Visma* (Frattini, 2020). On the other hand, women's teams have been the first to be cut from budgets when the teams' management start to lack funds, both at the amateur and elite level. In the original study of Ryder et al. (2021), several of the interviewed cyclists had experienced such a reorganization. Hannah, an elite Australian cyclist, told me she was part of a well-structured and managed cycling team that ran both a women's and a men's team. She explained the team discontinued.

Hannah: "So, basically, like with all things, they kept the men's team and then the funding was cut for the women's team."

Me: "Why did they cut the women's?"

Hannah: "Uhm, I think, with everything, you know, there's a lot more exposure with men's racing. All the financial support that they could get was directed towards the men's team, so something sort of had to give so yeah, they just put all their focus into the men's team, so there was no longer a women's road team." (Hannah)

While women might benefit from such a structure, there remains a dependence on the men's side and a risk to be cut when the financial status of teams is not ideal. Part of this might also relate to the male dominance in teams. Most of the teams are run by men and sponsored by organizations led by men. On their website, the UCI considers general managers, directors, and assistant sport directors as part of team management. In 2021, 9.1% of the management positions in the nine WWT teams were held by women. This was 10.3% in 2020, when there were eight WWT teams. *Team SD Worx* joined as a WWT team and added four management positions, all covered by men. However, two current riders of *Team SD Worx*, Chantal van den Broek-Blaak and Anna van der Breggen, announced their retirement after the 2022 and 2021 season and are planning on taking on a directeur sportif (DS) role in the team (Cash, 2020).

Just three teams had women in their management team: Alessia Piccolo as general manager for *Alé BTC Ljubljana*, Beth Duryea as assistant DS for *Canyon//Sram Racing*, and Ina Teutenberg and Giorgia Bronzini as DS for *Trek-Segafredo*. These are the only 4 women that are part of the 44 management positions mentioned on the UCI website (UCI, 2021a).

The majority of the women's peloton exists of Continental teams. The 50 Continental teams have 173 management positions in total (the *China Liv Pro Cycling Team* did not show any management positions). Women serve in 26 of these positions, resulting in a 15.0% representation of women in leadership positions. The lower 9.1% in WWT teams and the slightly higher 15.0% in Continental teams signal a larger trend of how higher positions have fewer women represented. Schlesinger and Weigelt-Schlesinger (2012) argue that while formal barriers (such as rules) can no longer explain why women are clearly underrepresented in leadership positions, there are factors and processes at work on an informal level that often remain invisible (such as gender stereotypes) but are nonetheless effective in preventing women from striving for these positions. Ryan and Dickson (2018) clearly state that when discussing the relationship between leadership and gender, it is the dominant presence of groups of men and valued forms of masculinity that are the problem, not the underrepresentation of women. The masculine norms in professional road cycling have a clear impact on the presence of women in leadership positions.

The organization of UCI Continental teams differs from the WWT teams. Continental teams are registered via their national federation. These teams can have 8 to 16 riders (UCI, 2021c). Unless a Continental team is registered as a professional team, there is no minimum wage required (UCI, 2021c). Continental teams also receive a participation fee from race organizers (UCI, 2018). In 2019, national teams also received an allowance, but that is no longer the case since 2020. This lack of allowance makes it more difficult for local national talent to participate, gain experience, and showcase their capabilities at important races because there is no funding.

The teams pay fees to the UCI and salaries to their riders, and they receive a fee when they compete in races. The fees for the different teams are shown in Table 13.2. It costs €15,500 more to register a WWT team than a Continental team but it is €198,274 less costly than registering a men's WT team.

The chance to be a paid as a full-time professional athlete is larger with a WWT team. These teams are mandated to pay their riders a minimum wage. This salary does not include prize money. When the reform was announced in 2019, the UCI determined that WWT teams need to pay their riders at least €15,000 in 2020, €20,000 in 2021, and €27,500 in 2022, and from 2023, the salary will be the same as that paid to existing men's UCI Professional Continental Teams (currently around €32,000). Besides a minimum salary, WWT teams must offer benefits, such as a maximum of 75 racing days, 30 vacation days, sickness and maternity leave, and a pension savings scheme from 2022 onwards (UCI, 2019). One of the UCI WorldTeams, *Trek-Segafredo*, went beyond these measures and announced that the

Table 13.2 Team fees 2022

Type of team	Fees to be paid		Participation fees received	
Women's WorldTeam	UCI fee	€12,000	1-day race	€3000
	Anti-doping contribution	€10,000	Stage race	€2000 per day + accommodation
Continental women	UCI fee	€4250	1-day race	€2000
	Anti-doping contribution	€2250	Stage race	€500 per day + accommodation
Men's WorldTeam	UCI fee	€85,500	1-day race	€8500
	Anti-doping contribution	€134,774	Stage race	Amount negotiated between partners

Source: UCI (2018, 2021e)

team offers all their riders, regardless of gender, a minimum salary equal to the mandated men's minimum (Coulon, 2021). However, as stated previously, most riders ride with a Continental team which do not require to pay their riders. A recent survey of the women's peloton by TCA showed that the discrepancy between the paid and unpaid riders has increased. While a little over a third earns more than €15,000, the percentage of riders without a salary has increased from 17% in 2018 to 25% in 2020, and 33% worked a second job (The Cyclists' Alliance, 2020b). Even though salaries seem to be on the rise, as framed positively by the UCI (2021b), the disparity within the women's peloton is growing which could negatively affect the sport and riders. A combination of WWT, Continental, national, and club teams could be competing in the same race. The many differences between the teams and with that the opportunity for an athlete to excel and perform obstruct the creation of a level playing field.

The narrative around creating an equal and better field for professional women's road cycling is heavily focused on increased media coverage and especially live television broadcasting. In the following part, this narrative is discussed in more detail.

4 Media Coverage, Broadcasting, and Professional Women's Road Cycling

The UCI has some regulations in place for the current media infrastructure of women's professional road cycling. With the introduction of the WWT and the restructuring of the competition, the UCI implemented a mandate to increase media exposure. WWT race events are required to provide coverage of at least 45 minutes of the race. This minimum coverage is 60 minutes for men's WorldTour races. All events need a website in French and/or English and must create social media accounts on both *Facebook* and *Twitter*. Hashtags for each event must be defined by the promoter early in the season and be promoted. All events must also provide live coverage of racing on their *Twitter* accounts (UCI, 2016). The UCI runs their own *Twitter* and *Instagram* account for the Women's WorldTour and provides short clips after each race with highlights.

All WWT teams and most Continental teams have their own website and social media pages and provide their fans and followers with updates and insights. At races, several photographers line up at the finish line to capture the winning moments and riders are filmed, photographed, and interviewed before and after the race. Cycling journalists are organized in the Association Internationale des Journalistes du Cyclisme (AIJC), an organization dominated by journalists from Belgium, Italy, France, the Netherlands, Spain, and the United States. Men form a significant majority of the membership base (AIJC, 2021).

As argued in the author's original study (Ryder, 2021), the media play a crucial part in the history of road racing. Many bike races in the late 1800s and early 1900s were organized by newspapers to promote their products and increase their sales

(Oosterhuis, 2016; Van Reeth, 2016). The journalists covering the bike races did not only report on this exciting novelty with commercial interests. They also functioned as gatekeepers to the social associations of the sport. For example, with the development of the Tour de France, journalists, commentators, and the organizers portrayed Tour de France riders as hypermasculine "giants of the road" to implicitly counter the national anxiety in France of the lack of virility in French men due to its defeat in the Franco-Prussian War of 1870 and the death toll of World War I (Thompson, 2006). Considering both this fear of loss of masculinity and the athletic heroism fueled by sports fiction and new visual images, the race aimed to celebrate a new, hypermasculine French manhood (Thompson, 2006). This relation between cycling, racing, and masculinity remains today (Falcous & Masucci, 2020) and shapes the lived experiences of professional women road cyclists.

The lack of media coverage and exposure is a very prominent topic in discussions about women's cycling. Many agents in the sport are concerned with growing the sport which mostly entails more TV coverage and media exposure. A common belief is that the "rest" will follow, meaning more professionalism, better working conditions, and a safer environment. Especially (live) TV coverage is regarded as essential for women's cycling existence and growth. Every rider interviewed in Ryder et al. (2021) commented on media exposure and TV coverage.

> I honestly think that TV coverage is the most, the single most important thing. If we could get good TV coverage, then everything else would follow. Uhm, and it's slowly improving, slowly improving. (Abigail)

> Like it's huge, HUGE prize money Tour Down Under and at Cadel's, but at the end of the day you don't care about that. You care about TV coverage. (Jodie)

> It's not exactly easy to find it [broadcasting of women's races] and easily accessible. Unless you're already like a fan of cycling and women's cycling. If you're not necessarily and not seek it out, it's not like you're just flicking through channels and happen to come across a race. So, I, yeah, it's harder to, to gain your fans when you don't have, when they don't have easy exposure to racing. (Violet)

> I think there still needs to be better coverage of women's cycling and I think that's one of the things that's really behind now. The racing is really exciting and interesting and the professionalism is really high and it's worth watching now, but there's not a lot of opportunity for people to watch so I think that's the biggest thing that needs to change. (Liza)

These riders criticize the lack of media coverage, which is a relative safe way for the cyclists to acknowledge their inferior social position in the realm of professional road cycling, while at the same time upholding the logic that they indeed are physically inferior and, therefore, get what they deserve (Ryder et al., 2021).

The importance of TV coverage of road cycling was thoroughly explained in Chap. 6. A road race can only be fully understood through access to the media, because spectating a race on the side of the road only exposes the audience to the peloton and convoy for several minutes. Fans need television or radio reporting to appreciate a day's racing. However, non-sport fans are also a major group of viewers of road cycling races. According to Van Reeth (2016), this is due to the accessibility of the sport as the sport is reasonably straightforward: the first rider over the finish line wins. This simplicity stimulates family and social watching. Road races are also ideal to promote tourism since cyclists compete on public roads through diverse regions. This factor allows for a spontaneous mix of live sport images and showings of the scenery that almost no other sport offers and consequently makes road cycling one of the most watched sports by non-sport fans. The importance of regional promotion during cycling races has grown and led to an increase in broadcasting races from start to finish. Van Reeth (2016) used men's cycling as his frame of reference, and I argue that the above factors can be and are also offered by women's races. The problem is the myth of the lack of interest. Kane (2013) argues that the lack of media coverage of women's sport suggests that "the media do not just ignore sportswomen; they construct and actively perpetuate a false narrative that women are not interested in sports and are not very skilled when they do participate." Sport media are an effective tool to preserve male power and privilege by reproducing dominant ideologies and practices that systematically position sport as an exclusive male terrain, essentially creating a false narrative that suppresses knowledge about, and deny the reality of, the ever-expanding and highly accomplished world of women's sport (Kane, 2013). There is a demand to consume women's cycling which is exemplified in the comments of Maria, an elite Australian cyclist, in her discussion of her lived experience related to the discrepancy between the demand and the media upholding the lack of interest myth.

> The public are starting to scream out for women's cycling. The last two years of the Tour Down Under, the crit, which is the last stage for the women, and the prologue for the men, uhm, they are recording it. They have it on big television screens and they have Scott McGrory [Australian commentator] commentating, yet they can't livestream it. Because we [the organization] don't have the $30,000 that require that timeslot on SBS, but they'll do the men's [race]. But then the amount of outrage from the public, saying: 'there's a women's race happening right now, and my Twitter-finger is fatiguing because it's only on Twitter. I want to see this. You're filming it, why can't you just put a link up?' The public is starting to realise how exciting and how awesome women's cycling is. (Maria)

From a structural perspective, the minimal broadcasting of women's races may impact rider's opportunities and careers. The little coverage of women's races makes it difficult for domestiques to attract attention of the fans, sponsors, and potential future employers: the DSs of the bigger teams. These riders might have already done their part during the race and are riding in the *grupetto* (a group of cyclists dropped from the peloton) or have been picked up by the broom wagon (the last vehicle in the convoy that picks up riders who are too far behind) before the broadcasting starts. This is a limiting factor for these riders to have their labor and talent recognized because they do not have the results on paper and no footage of their performances.

Online and social media can play an important role in women's sport (Bruce, 2016; Toffoletti & Thorpe, 2018; Vann, 2014). For women's cycling, the Internet has provided the opportunity for races to be (live) streamed. Though this might be seen as an improvement since women's races could now be followed, it is often unclear where the links to the races can be found or what time the streaming starts.

Not all streams have commentators, and the connection is often poor with grainy images. Also, the (live) streams do not allow for spontaneous viewership as people have to actively look for the coverage. While Van Reeth (2016) suggests that non-sport/cycling fans are a huge chunk of the viewers of cycling races, this is not the case for women's cycling as much of their coverage remains hidden on the Internet. In 2020, *Eurosport*, in partnership with *Global Cycling Network* (*GCN*), invested in professional women's road cycling coverage, which also could be considered as a step forward. However, as a result of this investment, most races were almost exclusively available via the *Eurosport Player* or a *GCN* pass, which means that women's cycling became a niche product for fans and less accessible to the broader public (Van Reeth, 2020). Although this way of broadcasting was reversed in 2021, it shows that the broadcasting of women's cycling is not yet mainstream.

In his report on TV viewings of professional road cycling, Van Reeth (2020) considered an additional difficulty with this way of broadcasting: the collection of data on coverage on women's cycling. Streaming data are harder to find and TV audiences for niche channels are rarely communicated to the public, so the data presented in Van Reeth's (2020) report are limited to the viewings and audiences of major public channels. Nonetheless, the report shows in most countries a solid increase in TV broadcasts from 2014 onwards. Despite warning to be cautious with the limited numbers in his report, Van Reeth's (2020) data suggest an increase in viewership in many territories that have high viewership of cycling, such as the Netherlands and Flanders. For example, with over 730,000 TV viewers, the Ronde van Vlaanderen was the best watched women's race in Flanders and only 5 men's races recorded higher TV audiences in Flanders in 2020 (Van Reeth, 2020). Interestingly, Flemish fans watching women's races were older (2% more viewers in the 65+ category) and more often male (1.4% more male viewers) compared to the viewers of men's races (Van Reeth, 2020).

The increased broadcasting of women's races most likely influenced the progress narrative in women's cycling, as many would argue that "it is getting better." At the same time, riders acknowledge there is space for more growth and the current increase is slow and unlikely to be equal to men.

> I think it's getting better, in some ways, and then other ways, it's really slow, the progress, for like media coverage. TV coverage. I guess that will help us the biggest in our sport, is this [tv coverage]. I guess the TV sponsors, uh, the men's races, they are already fully covered, so… yeah, I guess there's always gonna be a difference between the men and the women in sport, but I think where we're making positive steps with this. (Christine)

> I don't know a whole lot about the politics of everything, but something to do with ASO and the UCI and money. For some reason, a lot of the races don't get televised. I think that's what needs to change for the WorldTour. We need to start showing people these races, because otherwise it doesn't grow. Like the sport can't grow unless there's people who've seen the races, otherwise the sponsors have no reason to sponsor the teams and then the teams have no money and then… it keeps going around in a circle. (Sandra)

The stimulated development of men's cycling and the obstructed development for women's cycling have resulted in unequal coverage of the races. While online and reduced coverage (e.g., last 35 kilometers of the race or only 25 minutes) may be considered progress, to catch up with the men is seen as impossible. At the same time, a dependence on men and men's cycling is formulated. An associated logic was that the infrastructure for TV coverage was already in place which theoretically would make it easier to cover the women's race as well. In that way, Abigail, a professional cyclist, said:

> If that's how it needs to start to get coverage then people can see the races and they can see that it's really good and then, you know, a women's only race can get the investment. (Abigail)

Her sentiment could be translated as: "if we need men to get us coverage and a viable sport, then that's what we'll have to do." The disparity in media coverage between women's and men's sport is long existing as men's sport are viewed by the media and, by extension, society in general as being of fundamentally better value than women's sport (Shaw & Amis, 2001). This value is socially constructed through the ignoring and ambivalent representation of women's sport in the media which feeds into the myth that no one watches women's sport (Leberman & Froggat, 2019). A recent study by the Women's Sport Trust showed that two-thirds of UK sport fans follows some form of women's sport, but the sports industry has underinvested in the visibility of women's athletes and sports, making it difficult for the fans to consume it. When the industry invests in creating more visibility, women's sport could generate £1 billion per year by 2030 (up from £350 million) (Women's Sport Trust, 2021). This study supports the progress narrative in women's cycling: it is getting there but the sport needs more to be truly successful.

5 Conclusion

The aim of this chapter was to provide a historical, structural, and cultural analysis of professional women's road cycling. The historical background of women's cycling and women's racing specifically showed how women's road racing commenced at the same time as men's racing. However, the history of women's racing is mostly forgotten and structurally ignored. The dominant ideologies related to gender constructed women as unsuitable for the activity of riding and racing. The "scientific," medical, and moral norms prevented women's racing from developing equally with men's racing, as the female body was regarded unfit for racing, and a woman's duty was her devotion to maternity. The masculine associations with the first bicycles made it seem natural that women were excluded, despite many women defying these ideologies by riding bikes.

Science caught up, medical experts revised their opinions, and moral arguments began to consider riding elegantly as a support of higher social status. Nonetheless, more than a hundred years after the first account of women racing, the persistent patriarchal ideas of what women's bodies can, cannot, should, and should not do impacted the development of the sport.

The legacy of this history undeniably impacts the current organizational structure and culture of professional women's road cycling. The UCI, the teams, the race organizers, and the media are all dominated by men and men leaders. This male dominance obstructs progress in women's cycling because these actors respond to women's demand and gain for legitimacy, respect, and space as a loss of their power.

This chapter presented how the economics of women's road cycling were gender sensitive and continue to be. Women were discouraged and shamed for engaging in riding and racing bicycles, but they managed to defy (some) societal ideologies, resulting in a successful bike racing scene at the end of 1800s. If progress in women's road cycling was linear, the professional road racing scene would look different today. A scene where women's races are fully respected and legitimized in their own right, where the standard of media coverage and broadcasting is of a high standard, where women's apparel is sold to fans and spectators, where women are naturally part of leadership, where women do not need to emphasize their femininity to "attract" an audience, and where all women can count on a minimum wage for their labor.

While inequality structurally persists in the sport, e.g., no full inclusion in iconic races, the cultural meanings related to these races continue to frame women's racing as lesser than, both by outsiders and the riders themselves (Ryder et al., 2021). The cultural meanings in women's road racing, such as the meanings of distance (Lucas, 2012), are maintained by the male dominance. These meanings are at the root of the sport which in turn impact the structure and economics of professional women's road cycling. The meanings relate to norms and ideologies that shape people's choices in terms of production, consumption, and distribution of the product that is women's road cycling. When the history, structure, and culture of a product are strongly phallocentric, the economics of the product need to be considered in this light.

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Chapter 14
Globalization in Professional Road Cycling

Daam Van Reeth

1 Introduction

Road cycling has its historical roots in four European countries: France, Belgium, Italy and Spain. The five *Cycling Monuments* as well as the three *Grand Tours* all take place in one of those four core countries and for decades the vast majority of the cycling peloton consisted of riders from these countries. It is therefore no surprise that until the 1980s almost all important cycling competitions were won by French, Belgian, Italian or Spanish cyclists, only occasionally interrupted by wins from riders from neighbouring European countries like the Netherlands (Janssen, Zoetemelk), Germany (Altig, Wolfshohl), Switzerland (Suter, Kübler, Koblet) or Luxembourg (Faber, Frantz, Gaul). Things started to change in the second half of the 1980s. With the arrival of the first non-European professional cycling teams, such as the American *7-Eleven* team and the Colombian *Café de Colombia*, for the first time important races were won by non-European cyclists like Greg LeMond (Tour de France 1986, 1989, 1990), Andy Hampsten (Giro d'Italia 1988) and Lucho Herrera (Vuelta a España 1987). Since the early 1990s, the International Cycling Union (UCI) has repeatedly indicated that globalization of cycling is a priority.

We evaluate this objective and measure the significance of the globalization process in professional road cycling from three angles. First, *globalization at the rider level* is measured by a breakdown by nationality of the peloton (Sect. 3). We also compare the nationalities of the top 100 riders and the winners of the major cycling competitions over the years to specifically check the significance of globalization at the top level of cycling. Next, we analyse *the globalization of cycling teams.* Two indicators, one measuring the international diversity within teams and one

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measuring the international breakdown of teams, are combined to assess the historical evolution of the internationalization of top-level cycling teams (Sect. 4). Finally, *globalization at the competition level* is examined by a detailed analysis of the UCI professional road cycling calendar (Sect. 5). In Sect. 6 we focus on the globalization of the current women's WorldTour using the same three angles, and we compare the findings for the men's and women's WorldTour.

The analysis covers the 1990–2020 period and data for 4 reference years are compared: 1990, 2000, 2010 and 2020. The focus on the past 30 years allows to evaluate the impact of both the pursued internationalization by UCI chairman Hein Verbruggen from 1991 on and the introduction of the ProTour (later renamed WorldTour) in 2005. In the analysis we constantly make a distinction between the aforementioned four 'core countries' of cycling, the four neighbouring our 'peripheral' countries (Germany, Switzerland, the Netherlands, Luxembourg), the other European countries and the non-European continents. Furthermore, although *internationalization* is primarily used to describe the geographical spread of economic activity across national borders with little functional integration, a change that is more quantitative in nature, and *globalization* usually refers to an evolution that is more qualitative in nature with a higher degree of functional integration (Poli, 2010), for the sake of readability we will not make this distinction and use globalization and internationalization as equivalent terms throughout this chapter.

2 Globalization and the UCI

Globalization is a key characteristic of the world today. For decades, cross-national activities have continued to spread across economies, politics, sciences, media and culture throughout the planet. The world of sports has also witnessed a radical process of globalization. Although the 1896 Summer Olympics in Athens could be looked upon as the first truly global sports competition, it was still restricted to amateur participants of only 14 countries. The World Soccer Cup emerged in 1930 as the first global competition that allowed professional athletes, but until 1978 the tournament was restricted to a mere 16 countries. More international championships would arise throughout the world from the mid-twentieth century on. Since the 1990s globalization accelerated with technological advances significantly increasing global media access and mobility. Transportation became easier, faster and cheaper, and new communication tools allowed athletes to stay in contact with family and friends around the world.

As of today, the prestige of a sport is often measured by the number of countries in which the sport is practised at a professional level. Also the International Olympic Committee uses this criterion when determining whether or not a sport can become Olympic. But the worldwide appeal of a sport is of importance as well to attract multinational sponsors and to receive the all-important media coverage, essential to the long-term survival of any sport given the ever-increasing competition for sponsor money and for media and fan attention.

The first reports on globalization in cycling date back to the early 1990s. Under the reign of Hein Verbruggen, the UCI regularly declared that globalization of professional road cycling was a priority. His first major realization was the creation of a single road cycling federation under the auspices of the UCI in 1991. By bringing together the then still separate amateur and professional federations of cycling, Verbruggen wanted to boost the internationalization of the sport and achieve greater recognition by the Olympic movement. Hein Verbruggen was also the conceptual father of the *Centre Mondial du Cyclisme* or *World Cycling Centre* (WCC) that opened its doors in 2002. Located in Aigle (Switzerland), the long-term goal of the WCC, set up as a 'centre of excellence and learning', is to help to globalize cycling by developing athletes and in turn developing and promoting the sport in smaller and less mainstream cycling nations (UCI, 2012). In 2015 Rwandan cyclist Jeanne d'Arc Girubuntu became the thousandth trainee at the Centre (https://amp.blog.shops-net.com/48415322/1/world-cycling-centre.html). Chris Froome (Kenya), Ramunas Navardauskas (Lithuania) and Biniam Girmay Hailu (Eritrea) are three of today's professional riders that received training at the WCC.

Verbruggen's last significant decision was the structural reform of professional road cycling in 2005, resulting in the creation of the UCI ProTour, a series of major cycling competitions that included all the important 1-day classic races as well as the biggest stage races. For races not included in the ProTour, five continental tours were created: the UCI Europe Tour, the UCI Africa Tour, the UCI Asia Tour, the UCI Oceania Tour and the UCI America Tour. The objective was to develop cycling in a manner which suited each continent, in particular to encourage expansion through the introduction of new UCI races and teams while supporting the development of existing structures (UCI, 2014).

The creation of a ProTour and continental circuits was not motivated exclusively by the objective of the UCI to globalize cycling and to stimulate the development of cycling on the five continents. Indeed, at the same time a licensing system for ProTour teams was developed to establish some kind of top cycling league. To promote professional structures in cycling, only teams that met a number of strict quality norms set out by the UCI were granted ProTour status. Since licences were valid for at least 4 years, the survival of teams was guaranteed for a few cycling seasons and sponsors could count on the team's participation in all major events. This was a radical break with the past. Before, teams could only participate in races when invited by the race organizers. In 2011, after many years of disputes between the UCI, race organizers and cycling teams, the UCI ProTour was renamed UCI WorldTour, although the basic structures remained. Fast forward 10 years, the UCI WorldTour calendar has grown in volume to close to 40 races but otherwise little has changed.

There have been unsuccessful initiatives as well. The much-hyped creation of *Global Cycling Promotion* (GCP) under the direction of Alain Rumpf in 2009 'to develop durable products and events in new and existing markets as well as promoting and protecting cycling globally, for the good of the sport' (UCI, 2011) was a failure. The first tangible result, the agreement signed with the city of Beijing for the organization of a UCI WorldTour event over the 2011–2014 period, turned out to be only a temporary success story, as the contract was not renewed. Additionally, plans for stage races in emerging markets such as India, Brazil and Russia never materialized. GCP revenues were insufficient to cover all expenses and the UCI subsidiary could only survive because of the financial support it got from the UCI. As a result, in 2014 the newly elected president of the UCI, Brian Cookson, was eager to wind down the CGP, the brainchild of his predecessor Pat McQuaid who had led the UCI between 2005 and 2013 (Cyclingnews, 2014). It is a painful observation that neither McQuaid nor Cookson nor the current UCI president David Lappartient has been able to initiate significant new steps towards a further globalization of professional men's road cycling.

3 Globalization at the Rider Level

The first perspective on globalization is the internationalization of the men's cycling peloton, or globalization at the rider level. A detailed breakdown by nationality of the professional peloton is presented first. Next, the significance of globalization in cycling relative to other sports is checked. The section concludes with a discussion on the globalization in the results of cycling's major competitions.

3.1 The Internationalization of the Peloton

Appendix 1 presents a detailed breakdown by nationality of the professional cycling peloton. The raw data for the table were downloaded from the cycling statistics website www.cqranking.com. Because the website only provides historical information from 2000 onwards, we consulted the French historical cycling database www.memoire-du-cyclisme.net and a Belgian cycling yearbook (Van den Bremt, 1991) for the data on the 1990 peloton. The table aggregates the number of professional riders per country for all reference years. In addition, for each continent (and in the case of Europe also for the three distinctive subgroups of countries) the percentage share of professional riders in the global cycling peloton is given with the number of countries from where these riders originate from in parentheses. We look at the complete peloton, defined as all cyclists that had signed a contract as a professional rider in a tier 1 or tier 2 professional cycling team for that year, as well as at the selected subset of cyclists in the WorldTour (or its historical equivalent). For example: Germany counted 36 professional riders in the 2020 cycling peloton, of which 33 were part of a UCI WorldTeam, and riders from just 3 countries in Africa represented 1.6% of the global cycling peloton and 2.2% of the WorldTour peloton.

The introduction of the ProTour in 2005 created a clearly defined top league of up to 20 cycling teams with globally over 500 contracted cyclists. The 2010 and 2020 data in Appendix 1 refer to the cyclists of these top teams. Between 1996 and 2005, cycling teams were subdivided by the UCI into three categories: trade teams

1 (TT1), trade teams 2 (TT2) and trade teams 3 (TT3). The data for 2000 are therefore based on the 522 cyclists in that year's TT1 cycling teams. Since prior to 1996 there was no official UCI team classification system, we had to determine the 1990 top teams ourselves. The 17 teams that scored points in the then existing World Cup ranking (based on a dozen of classics races) were complemented with 9 teams that participated in at least 2 of the 3 *Grand Tours* of cycling. It is safe to assume that those 26 teams implicitly formed the top league of cycling at that moment. In total, these teams counted 536 cyclists, a number very much in line with our findings for the other years.

At first sight, there is a clear process of internationalization. While in 1990 the professional peloton consisted of cyclists from just 30 countries, by 2020 this had risen to 52. For all four reference years combined we even have 62 nationalities in total, with riders from 34 European countries, 6 African countries, 8 Asian countries, 12 American countries and 2 Oceanian countries. The number of countries that have riders at cycling's top level is smaller, of course, but also increased from 28 (1990) to 43 (2020).

Italy is the best represented nation in the 2020 cycling peloton with 129 professional riders, ahead of the other core countries of cycling: France (123), Belgium (122) and Spain (86). The top 10 of most represented countries in the 2020 peloton is made complete with the Netherlands (57), Australia (38), Denmark (37), Germany (36), Great Britain (34), Colombia (32) and Norway (32), while the USA (29) and Switzerland (22) are the only other countries to have at least 20 professional riders. Remarkably, the only non-European countries listed here are countries that already for decades deliver a substantial amount of cyclists to the professional peloton: Colombia and the USA since the second half of the 1980s with home country cycling teams like *Café de Colombia*, *Postobon* and *7-Eleven* and Australia with a significant amount of riders imported in European teams from the 1990s on. Just 5 other non-European countries have more than 5 professional riders in 2020: Canada (13), Kazakhstan (11), New Zealand (10), South Africa (9) and Japan (6). Clearly, the number of *new* countries to which road cycling has expanded meaningfully in the last 30 years remains rather small. In 2020, professional road cycling continues to be primarily a European phenomenon with a limited but intense spread to a handful of countries on other continents.

Figure 14.1 (all professional riders) and Fig. 14.2 (WorldTour riders only) better visualize the trends from the table in Appendix 1. Over this period, the share of the core European countries of cycling has fallen from 58% to 48% for the whole peloton and from 58% to 38% for the top cycling teams. A closer look at the data, however, reveals a more subtle picture. Between 1990 and 2020 the global European rider share only dropped from 89% to 82%. Thirty years after globalization became a major policy goal with the UCI, still fewer than 20% of all professional cyclists are non-European. Although at WorldTour level the non-European rider share doubled since 1990 to 23%, in 2020 three out of four WorldTour riders are still European. The figures also make clear that the process of globalization only started after the year 2000 and that the European rider share even increased from 88% to 93% between 1990 and 2000.

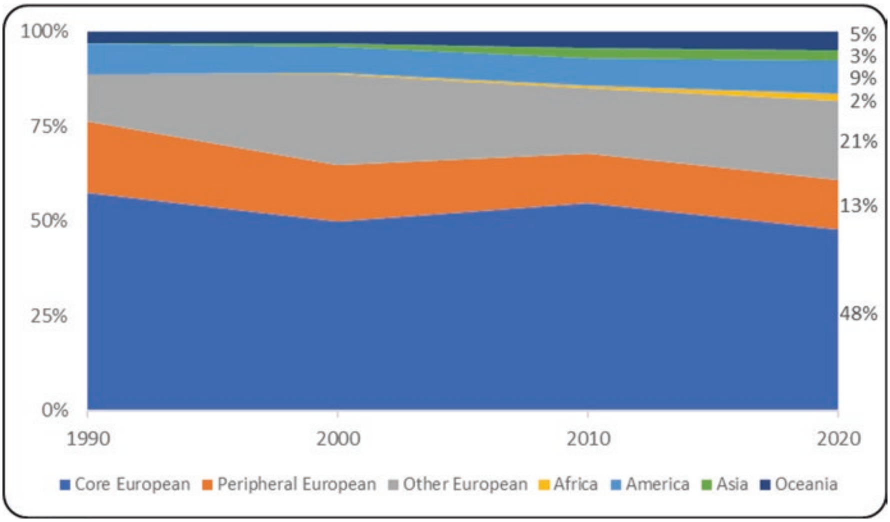

Fig. 14.1 Breakdown by nationality of all professional riders (1990–2020). (*Sources* Van den Bremt (1991), www.memoire-du-cyclisme.net and www.cqranking.com (own calculations))

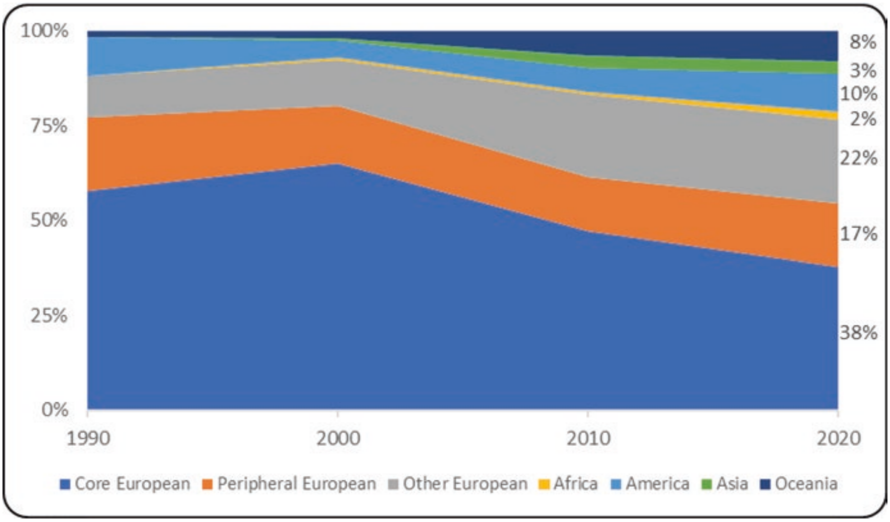

Fig. 14.2 Breakdown by nationality of WorldTour riders (or equivalent) (1990–2020). (*Sources* Van den Bremt (1991), www.memoire-du-cyclisme.net and www.cqranking.com (own calculations))

When we compare the percentage shares of all professional cyclists with the percentage shares of the cyclists in top-level cycling teams only, we see that in 2020 Oceania and the peripheral European countries are overrepresented at the top level of cycling. For instance, while riders from Oceania account for 5% of the entire cycling peloton, they represent almost 8% of the WorldTour peloton. The opposite is the case for the core countries of cycling with almost 48% of all professional riders but a share in the WorldTour peloton of 'only' 38%. For Africa, Asia and America, the share of riders in the WorldTour is rather similar to the share in the entire cycling peloton.

3.2 Globalization Relative to Other Sports

To evaluate the level of globalization in professional road cycling relative to other individual sports, the nationalities of the top 100 athletes in alpine skiing, biathlon, golf and tennis were analysed. The 2000 as well as the 2020 end-of-the-year rankings were used to create a historical reference.

Three key indicators were developed to compare all rankings. The most straightforward indicator is *the number of nationalities* in the top 100. This indicator is easy to understand and offers a rough first impression. However, in many cases it is not refined enough since it does not take into account the number of athletes per nationality. For instance, the indicator does not allow to differentiate between a situation where in one sport 10 countries each have 10 athletes in the top 100 and in another sport a single country has 91 athletes in the top 100 and 9 more countries only have 1 athlete each. In economics literature a number of concentration ratios (CR) have been developed to measure market power by the largest firms in an industry. Two of the most common concentration measures are used here to analyse the concentration of nationalities in the yearly sports rankings. The *CR4 ratio* adds up the shares of the four most represented nationalities in a ranking. For road cycling, this ratio equals 44 in 2020, this number being the sum of 13 French, 12 Italian, 12 Belgian and 7 Spanish cyclists in the top 100 rider ranking over 2020. When applied to yearly top 100 rankings in sport, the CR4 can vary between 4 (if 100 countries all have just 1 athlete in the top 100) and 100 (if all athletes in the top 100 originate from no more than 4 countries). A low CR4 thus points to a globalized sport, while the opposite is the case with a high CR4. The *Herfindahl-Hirschman Index* (HHI) is a more subtle indicator because it gives more weight to countries with a larger number of athletes in the top 100. It is calculated as the sum of the squares of the shares of all the nationalities divided by 100. When applied to yearly top 100 rankings in sport, the HHI can vary between 1 (if 100 countries all have just 1 athlete in the top 100) and 100 (if all athletes in the top 100 originate from a single country). Clearly, similar to the CR4 a low HHI points to a globalized sport, while a high HHI signals only a small degree of internationalization.

Table 14.1 ranks the sports according to their 2020 HHI score, from lowest (most globalized) to highest (least globalized). Tennis and biathlon are by far the most globalized sports in our sample with a HHI of about 5.5 and CR4 scores below 40. But road cycling as well has relatively low HHI and CR4 scores in 2020 and all 3 sports count at least 25 nationalities in the top 100 ranking. Alpine skiing and golf have much higher HHI and CR4 scores and could thus be considered far less

Table 14.1 Comparison of globalization for some individual sports

	2000			2020		
	HHI	CR4	Number of nationalities	HHI	CR4	Number of nationalities
Tennis	6.4	38	29	5.4	38	37
Biathlon	6.5	29	21	5.5	34	28
Road cycling	***11.2***	***58***	***21***	***7.2***	***44***	***26***
Alpine skiing	12.3	59	14	12.4	62	15
Golf	28.5	73	17	25.5	75	20

Sources own calculations based on www.cqranking.com, services.biathlonresults.com, www.atp-worldtour.com, www.ski-db.com and http://www.owgr.com/ranking

globalized than road cycling. Furthermore, along with tennis and biathlon, road cycling has further globalized between 2000 and 2020, with a lower HHI score (7.2 instead of 11.2), a lower CR4 (44 instead of 58) and a much larger number of nationalities in the top 100 ranking (26 instead of 21). Alpine skiing and golf, however, did not seem to make any significant progress at all with similar HHI and CR4 scores in both years and only a marginal increase in the number of nationalities in the top 100 ranking.

3.3 Globalization in Race Results

In Table 14.2 we check whether globalization in cycling is also observable from the results of major cycling competitions: the three *Grand Tours*, the World Championships road race and the five *Cycling Monuments*. For each competition the percentage share of wins before and after 1990 was compared for the different categories of countries used throughout this chapter. From the totals in the bottom row it becomes clear that after 1990 a significant change occurred. While before 1990 86.7% of all victories went to riders from the four core countries, in the period after 1990 this percentage dropped to 59.8%. Other European riders and non-European riders on the other hand accounted for 3.4% of all victories before 1990 and have won 25% of all top cycling races after 1990. This percentage would have been even higher if Lance Armstrong and Floyd Landis had not been stripped from their combined total of eight Tour de France victories.

Table 14.2 also shows some races are more often won by cyclists from non-core countries than others. The Tour de France and Liège-Bastogne-Liège are the only races that since 1990 have had more winners from non-core countries than from core countries (the core countries' share is 45.8% and 48.4%, respectively), while the Ronde van Vlaanderen is the race that is the least frequently won by riders from nontraditional cycling countries (71.0% core country wins).

The *Grand Tours* were the first major cycling competitions to have non-European winners. Between 1986 and 1988, the American riders Greg LeMond (Tour 1986) and Andrew Hampsten (Giro 1988) and the Colombian pocket climber Lucho Herrera (Vuelta 1987) were the first to defeat European cyclists on their home soil.

Table 14.2 Geographical breakdown of victories in major races before and after 1990

	From first edition until 1989				From 1990 until 2021			
	Core countries	Peripheral countries	Other European countries	Other continents	Core countries	Peripheral countries	Other European countries	Other continents
Tour de France	85.5	10.5	1.3	2.6	45.8	8.3	33.3	12.5
Giro d'Italia	90.3	5.6	2.8	1.4	67.7	6.5	16.1	9.7
Vuelta a España	86.4	9.1	2.3	2.3	54.8	19.4	16.1	9.7
World Championship	73.2	19.6	3.6	3.6	61.3	3.2	29.0	6.5
Milano-Sanremo	91.3	6.3	2.5	/	58.1	22.6	12.9	6.5
Ronde van Vlaanderen	83.6	15.1	1.4	/	71.0	19.4	9.7	/
Paris-Roubaix	89.5	8.1	2.3	/	63.3	20.0	10.0	6.7
Liège-Bastogne-Liège	85.5	11.8	2.6	/	48.4	19.4	16.1	16.1
Il Lombardia	90.4	6.0	3.6	/	64.5	16.1	16.1	3.2
All races	***86.7***	***9.9***	***2.5***	***0.9***	***59.8***	***15.1***	***17.3***	***7.7***

Source Own calculations based on official rolls of honour

Remarkably, none of the great classics of cycling had been won by a non-European rider before the turn of the century. The American rider Tyler Hamilton was the first non-European cyclist to win a *Cycling Monument* (Liège-Bastogne-Liège in 2003). Paris-Roubaix (Stuart O'Grady in 2007), Milano-Sanremo (Matthew Goss in 2011) and Il Lombardia (Esteban Chaves in 2016) were the next races with overseas winners. In 2022, the Ronde van Vlaanderen is the only major cycling race still without a non-European victory.

On 28 March 2022 another milestone in the globalization process of professional road cycling was reached when Eritrean rider Biniam Girmay Hailu outsprinted three companions to win Gent-Wevelgem. He became the first African winner of a major cycling classic, ironically just months after the first African UCI WorldTeam had folded (see Sect. 4).

4 Globalization of Cycling Teams

The analysis of globalization at the team level is less straightforward than the analysis at the rider level because the 'nationality' of a cycling team can be ambiguous. The nationality may, for instance, be determined by the country where its UCI licence is officially registered, but may also be based on the majority nationality of its riders, on the country of its main sponsor(s) or even on the nationality of its team manager or staff. In the analysis below we first use the country of registration and next consider the different cyclist nationalities within the teams. We then bring both elements together to present a historical perspective on the globalization of cycling teams.

4.1 Geographical Breakdown of Cycling Teams Based on Licence Registration

Appendix 2 presents the detailed geographical breakdown of all professional road cycling teams registered with the UCI. The raw data for 2000, 2010 and 2020 were downloaded from the cycling statistics website www.cqranking.com, while for the 1990 data a French historical cycling database www.memoire-du-cyclisme.net and a Belgian cycling yearbook (Van den Bremt 1991) were consulted. The data in the table refer to the number of professional cycling teams per country for all the reference years. In addition, for each continent and in the case of Europe also for the three distinctive groups of countries, the percentage share of professional cycling teams in the global cycling peloton is presented with the number of countries in which these teams are registered put in parentheses. Both the situations for all professional cycling teams and for the top-level cycling teams only are given. As before, we use the term *top-level cycling teams* to refer to the current UCI WorldTeams and their historical equivalents ('ProTour teams' and 'trade teams 1').

Since the country of licence registration of the team is used to determine the nationality of a team, some caution is needed when analysing the data. For instance, two cycling teams from San Marino in 1990 were, in fact, a homogeneous Soviet team and a team that consisted of Italian riders only. Even more striking is the case of the three Irish cycling teams in 2010. Not a single Irish rider was part of any of these teams and almost the complete staff and riders were Italian. These teams should therefore be assumed to be Italian teams licensed in Ireland for fiscal reasons. Consequently, the Italian share for 2010 is strongly underestimated in the table.

The relatively large number of American, Australian, South African and Kazakh riders in the non-European segment of top-level professional road cycling observed in Appendix 1 ran parallel to the rise of teams from those countries at the WorldTour level. *Astana* has been in the WorldTour as a Kazahk team since 2009 (it had been registered as a Swiss and Luxembourg team before) and in 2012 the *Orica-GreenEDGE* cycling team became the first Australian team at the top level of cycling. The number of UCI ProTeams from the USA has been at least two each season since 2009 with a maximum of four in 2011. In 2015, *MTN-Qhubeka* was the first African team to take part in the Tour de France. Under the new name *Team Dimension Data* it was promoted to WorldTour status in 2016. While at the start over half of the riders were African, in 2021 only 2 (out of 27) still were. Although the pressure to deliver results changed the team's African-oriented composition, *Team Qhubeka-NextHash*, as it was called in its final year of existence, did remain true to its unique mission until the end. 'Qhubeka' is a Zulu or Nguni word that means 'to carry on' or 'to move forward'. The Qhubeka charity project developed and supported by the team aims to help rural communities move forward by giving bicycles to children in return for work done to improve their environment and their community: 'In the face of extreme and persistent poverty, bicycles can change lives by helping to address socioeconomic challenges at the most basic level - helping people to get where they need to go' (https://teamqhubeka.com/qhubeka).

Figures 14.3 (all professional cycling teams) and 14.4 (UCI WorldTeams only) better visualize the trends from the table in Appendix 2. Measured by the number of top cycling teams, France is now the leading nation (three teams), while Belgium, Germany and the USA have two UCI WorldTeams. In 2020, 42% of the top teams (8 out of 19) are registered outside Europe, while at the start of the ProTour in 2005 only 1 team out of 20 was non-European. Although Europe still accounts for close to 60% of all top cycling teams, there are indications that the implementation of the ProTour in 2005 did stimulate the globalization of teams. Indeed, between 1990 and 2005 the share of the European countries remained stable at roughly 90 to 95%, and things thus only started to change after 2005 (Fig. 14.4). Two countries have lost much of their importance at the top level of cycling since the start of the WorldTour. There is only one UCI WorldTeam left in Spain and Italy has none, while in 2005 both countries still had four each. As a result, the share of the core countries has more than halved from about 70% at the start of the ProTour to 32% in 2020.

The number of countries with top-level cycling teams increased from 9 in 1990 to 11 in 2010 and 14 in 2020. But the globalization process is even more visible when smaller cycling teams are included in the analysis as well. The complete

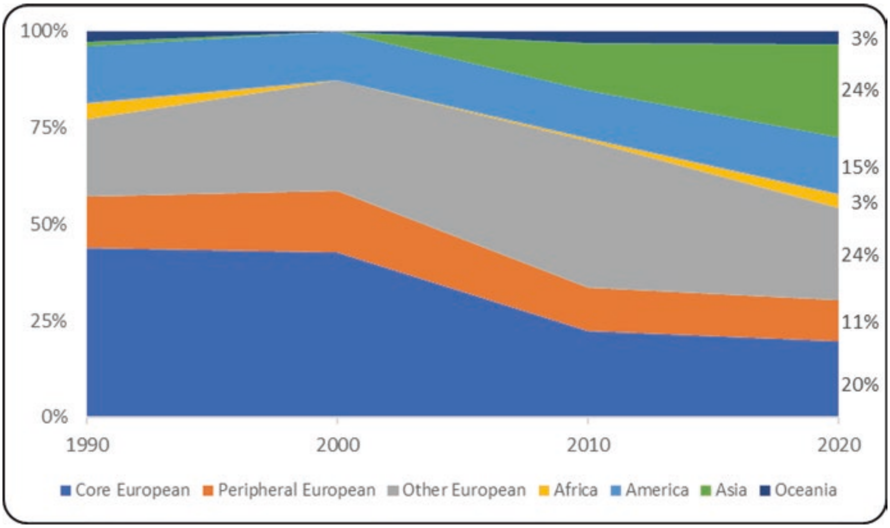

Fig. 14.3 Geographical breakdown of all professional cycling teams (1990–2020). (*Sources* Van den Bremt (1991), www.memoire-du-cyclisme.net and www.cqranking.com (own calculations))

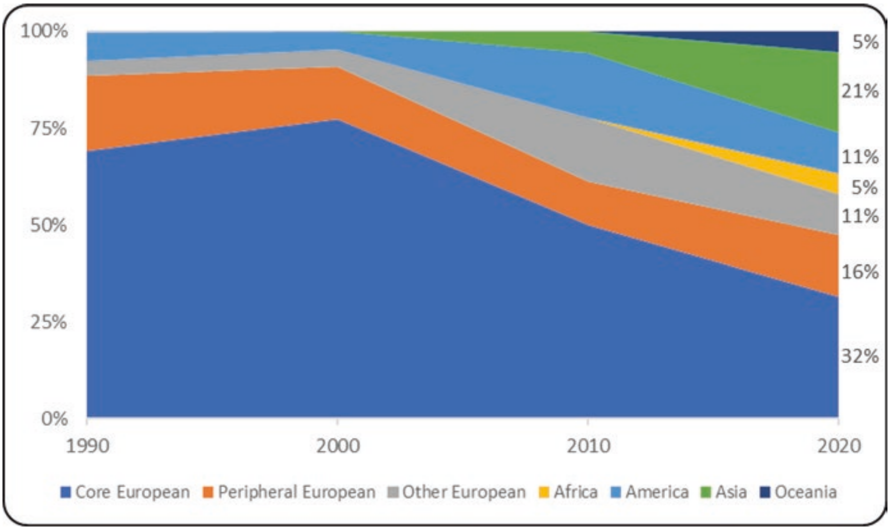

Fig. 14.4 Geographical breakdown of UCI WorldTeams (or equivalent) (1990–2020). (*Sources* Van den Bremt (1991), www.memoire-du-cyclisme.net and www.cqranking.com (own calculations))

cycling peloton counted approximately 75 professional teams from 17 countries in 1990 and has grown substantially to 208 professional teams from 56 countries in 2020. The share of the core countries has decreased substantially over the years from 44% in 1990 to 20% in 2020 (Fig. 14.3). The regions that have gained significant importance are the other European countries (from 20% to 24%), with for instance nine teams in Portugal and six in Austria, and especially Asia (from 1% to 24%). There are seven countries with at least ten professional cycling teams. Italy is the leading nation with 14 teams (but, as mentioned, no team at cycling's top level), followed by China (12 teams), Germany and the USA (both 11 teams) and Belgium, France and Japan (10 teams).

When we compare the regional shares for all cycling teams with the respective shares for the top-level teams, we conclude that the core and peripheral European countries and Oceania are over-represented at the WorldTour level, while Asia, America and the other European countries are under-represented. A successful globalization of cycling at the top level nevertheless necessitates UCI WorldTeams across all continents, a view already expressed by former Giro boss Michele Acquarone in 2012: 'I wouldn't be surprised to see anytime soon in the WorldTour a team from China, one from India, one from South America. It's our role to reach cycling fans all over the world' (Cyclingnews, 2012). Yet, 10 years later, we lost the only African UCI WorldTeam and we still did not welcome a UCI WorldTeam from South America nor from South or East Asia in spite of the abundance of smaller teams in both regions: 6 in Argentina and 5 in Colombia, 12 in China, 10 in Japan and 7 in South Korea. In Europe, with *Uno-X Pro Cycling Team* a new Scandinavian UCI WorldTeam could be expected in the near future.

4.2 International Heterogeneity of Cycling Teams

Another way to look at globalization at the team level is to analyse the nationality mix within cycling teams. Genuine globalization would imply cycling teams becoming more diverse over the years. We focus upon top-level cycling teams only here, since such an evolution would primarily take place in teams operating at the worldwide level.

At the WorldTour level, *EF Pro Cycling* and *Israel Start-Up Nation* are the most diverse cycling teams in 2020 with 17 and 16 rider nationalities, respectively, while *Deceuninck-Quick-Step*, *Mitchelton-Scott* and *NTT Pro Cycling Team* have 14. At the other end of the scale, we find the French teams *Ag2r La Mondiale* and *Cofidis* with just eight rider nationalities each. *Ag2r La Mondiale* is also the team with the highest share of domestic riders (66%, 19 out of 29). Only 4 more teams have a majority of domestic riders: Belgian team *Lotto-Soudal* (61%, 17/28), French team *Groupama-FDJ* (59%, 17/29), Spanish *Movistar Team* (54%, 15/28) and Dutch *Team Jumbo-Visma* (52%, 14/27). A lot has changed in this respect. Back in 2000, still 19 out of the 22 top-level cycling teams had a majority of domestic riders and only 2 teams counted at least 10 rider nationalities.

Table 14.3 summarizes a number of key indicators on team heterogeneity from 1990 to 2020. We see a strong growth in the average number of rider nationalities in top-level cycling teams from only 4.1 in 1990 to 11.6 in 2020. This growth cannot be attributed solely to the creation of the WorldTour since we see a steady pattern of

Table 14.3 Key indicators of international heterogeneity of top cycling teams (1990–2020)

	1990	2000	2010	2020
Average number of rider nationalities per team	4.1	5.8	8.9	11.6
Average share of best represented nation in a team	73.6%	66.0%	54.7%	34.7%
Average share of domestic riders in a team	71.5%	66.2%	54.6%	28.7%
Percentage of riders contracted in a native country team	72.2%	64.4%	53.9%	31.3%
Average Herfindahl-Hirschman Index per team	55.8	51.1	37.6	20.3

Sources Own calculations based on www.memoire-du-cyclisme.net and www.cqranking.com

growth throughout the complete observation period. The share of the best represented nation in a team, averaged over all cycling teams, confirms this conclusion. This share has fallen from 73.6% in 1990 to 34.7% in 2020. This implies that while in 1990 almost three out of four riders in a top cycling team shared the same nationality, in 2020 this number is down to about just one out of three.

Additionally, three more indicators were developed. The average share of domestic riders in a team measures the percentage of the riders from the country in which the team is licensed. Since, with a few exceptions, the best represented nation in a team is also the country in which the team's licence is registered, this indicator correlates strongly with the previous indicator. Next, for each year we counted the number of riders that were under contract in a team of their native country. As a percentage, this number fell from 72.2% in 1990 (387 out of 536 cyclists) to 31.3% in 2020 (170 out of 544). There are some important differences between countries though. While in 2020 only 11 out of 35 Australian WorldTour riders were part of the Australian-based *Mitchelton-Scott* team (31%), for Israeli cyclists and for riders from Kazakhstan this was 100%. We observe a remarkable historical evolution with respect to the core countries. In 1990 all Spanish riders were part of a Spanish team. Likewise, 98% of the Italian riders were in an Italian team. Thirty years later, only 15 out of 38 Spanish WorldTour riders (39%) were still in a Spanish team, and without any Italian UCI WorldTeams, all Italian riders were riding for non-Italian teams. In fact, Italian riders are now the most widespread of them all with 18 out of 19 UCI WorldTeams having Italian riders under contract. The share of Belgian riders in Belgian teams (68% in 1990, 51% in 2020) and the French share (84% in 1990, 86% in 2020) have hardly changed meanwhile.

The final indicator of team heterogeneity needs some more explanation since again we use the economic concept of a Herfindahl-Hirschman Index. The percentage shares for all the different nationalities in a cycling team are squared and summed to obtain a score between, theoretically, 0 and 100. The latter occurs when all riders in a team originate from the same country and we have a situation that we could describe as complete homogeneity. In the almost hypothetical situation in which all cyclists in a cycling team have a different nationality we obtain complete heterogeneity with a HHI value close to zero. Note that a zero value is impossible because between 1990 and 2020 UCI WorldTeams consisted of 20 to 30 riders and thus each country's share will automatically be at least 3% to 5%. By using a HHI-based indicator, it becomes possible to make a distinction between a situation in which 2 countries each supply half of the riders of a cycling team (HHI = 50) and another 2 countries situation in which one country now supplies 95% of the riders and a second country only 5% (HHI = 90.5). The average HHI score across all teams falls substantially over the years. Up to 2000 this index was slowly decreasing but remained over 50. The implementation of the WorldTour corresponded to the index falling sharply from 51.1 in 2000 over 37.6 in 2010 to just 20.3 in 2020.

There are significant differences in HHI scores between teams. In 2020, the most heterogeneous teams are *Israel Start-Up Nation* (8.2), *EF Pro Cycling* (9.6), *NTT Pro Cycling Team* and *Bahrain-McLaren* (both 10.8). Three teams have a HHI score of over 35 and are the most homogeneous: *Ag2r La Mondiale* (45.1), *Lotto-Soudal* (39.0) and *Groupama-FDJ* (37.2). Differences in team heterogeneity can in some cases be explained by the nature and the intentions of the team sponsors. It comes as no surprise that UCI WorldTeams that are sponsored by national lotteries (*FDJ* in France, *Lotto* in Belgium) are amongst the lowest ranked teams in terms of team heterogeneity. Since *FDJ* cannot sell any lottery products outside of France and neither can *Lotto* do outside of Belgium, for these teams it makes little sense to contract popular foreign riders. Things are quite different for sponsors that look for worldwide sales, like bike manufacturers (*Trek*) or consumer product developers (*Bora*). Note that an ambitious, internationally oriented co-sponsor might bring along some changes as well. When *OmegaPharma*, under the product name *Davitamon*, joined forces with *Lotto* in 2005, Cadel Evans was offered a generous contract in a bid to win the Tour de France. Sponsors might also have some (limited) say in the recruitment of new riders in light of their commercial goals, as has been demonstrated on several occasions by Lefevere's *Quick-Step* team. For example, when *Quick-Step* was looking for a French rider to target the French consumer market in the first decade of this century, they hired Richard Virenque who, in spite of being suspended for doping use some years before, was still a big favourite with the French public. Similarly, a high-profile British rider, Mark Cavendish, was brought into the team in 2013 to get a foothold on the British consumer market. Later, also as a result of Czech benefactor Bakala supporting the team, the East European market has been targeted with top Czech (Stybar) and top Polish (Kwiatkowski) riders.

4.3 From Import to Globalization

To better understand the evolution of the internationalization process at the team level, we use the model Gueguen (2009) developed to analyse the internationalization of Tour de France participants. He distinguishes between four phases of internationalization based on the interaction between two indicators. A first indicator measures what could be described as 'external' internationalization since it looks at the geographical breakdown of the top-level cycling teams. In our analysis, we define this indicator as *the number of top teams per country*. As an example: the value for this indicator equals 1.36 in 2020 because the 19 UCI WorldTeams were licensed in 14 countries (=19/14). From this definition it follows that when cycling teams are licensed in a larger number of countries and country concentration thus decreases, the value for this indicator decreases. If all teams come from different countries (maximal internationalization), the value for the indicator becomes one, the theoretical minimum value. The theoretical maximum value is variable and equals the number of teams. If all top teams come from the same country, the value for the indicator equals the number of teams. The second indicator measures 'internal' internationalization and is based on team diversity. We use the average HHI per team, as described before, to adequately determine the level of team diversity in a given year. The larger the number of nationalities in a team, the stronger team diversity and the lower the value of the HHI will be. As an example: in 2020 the average HHI was 20.3 (Table 14.3).

Table 14.4 illustrates how the combined changes in the indicators should be understood. If cycling teams are concentrated in a small number of countries only (high country concentration) and team diversity is low, cycling teams are still in the 'import' phase: a relatively small number of top cyclists from nontraditional cycling countries are under contract or 'imported' by teams from traditional cycling countries. It is the weakest form of internationalization. This is where professional road cycling stood in the 1980s illustrated, for instance, by the Australian Phil Anderson—the first non-European yellow jersey wearer—in the Dutch *Panasonic* team or the American Greg LeMond, the first non-European Tour de France winner, in the French *La Vie Claire* team. When new top cycling teams emerge around the world (lower country concentration) and when team diversity increases, cycling moves towards a situation of 'globalization', the strongest form of internationalization. The evolution from 'import' to 'globalization' has two dimensions. 'Homogeneous internationalization' occurs when cycling teams from new countries primarily consist of domestic riders, as was the case in 1990 with the Colombian teams *Café de Colombia* and *Postobon*. 'Heterogeneous internationalization' occurs when globalization is realized by bringing together a large number of nationalities in a team. The *Columbia-Highroad* team of 2008 is a good example of one of the first truly diverse cycling teams. Its nine men strong Tour de France team roster was drawn from eight different nationalities.

Table 14.4 The four dimensions of internationalization

		Within-team diversity (internal internationalization)	
		Low	High
Number of top teams per country (external internationalization)	High	Import	Heterogeneous internationalization
	Low	Homogeneous internationalization	Globalization

Based on Gueguen (2009)

We use the data for the two indicators that measure external and internal internalization to show how cycling made a significant step towards globalization between 1990 and 2020 (Fig. 14.5). Note that because of the definitions we use for these indicators, we had to invert the horizontal axis to make a figure that could be compared with the theoretical analysis in Table 14.4.

In the 1990s we first witnessed a period of heterogeneous internationalization. Team diversity increased somewhat, while the number of top teams per country remained rather stable. As can indeed be concluded from the table in Appendix 2, the geographical breakdown of top-level cycling teams hardly changed between 1990 and 2000. However, some teams clearly took a more international approach during that decade. For instance, the Spanish *Banesto* team only had 3 'foreign' riders (from 2 countries) on its 1990 roster of 20 cyclists, while in 2000 this had increased to 8 'foreign' cyclists (from 5 countries) on a total of 22 cyclists. With the creation of the ProTour in 2005, this internal dynamic was reinforced with a strong decrease in country concentration of top-level cycling teams. More teams from the USA and new teams from Russia, Great Britain and Kazakhstan, often with a smaller core of domestic riders, were the catalysts for these developments. Between 2000 and 2015 we therefore see a strong evolution towards a situation of globalization in Fig. 14.5. The within-team diversity increased over the whole period, illustrated by a low HHI of 32.7 in 2015, while at the same time the number of top teams per country decreased from close to 3 in 2000 to 1.4 in 2015 and is getting closer to the minimum value of 1. In the 2015–2020 period, the focus again shifted to internal

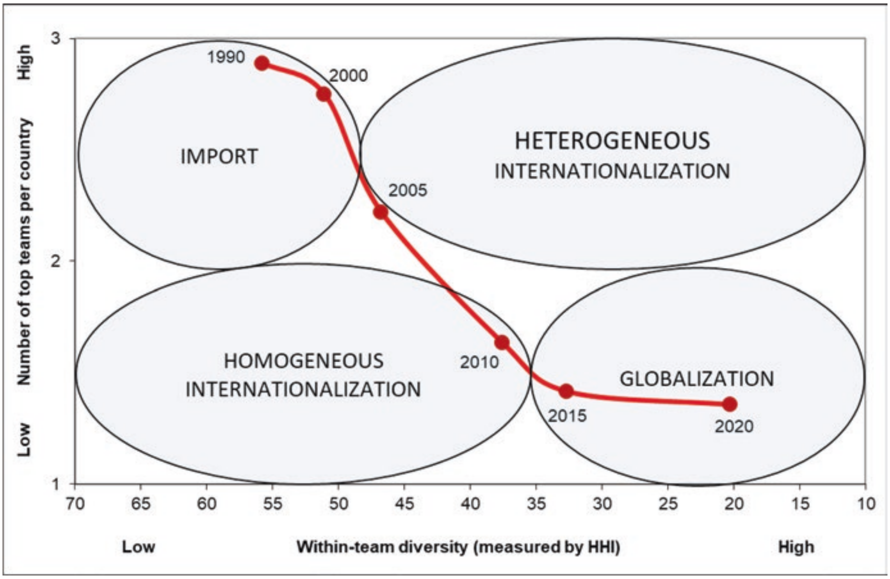

Fig. 14.5 Historical evolution of internationalization of top-level cycling teams (1990–2020). (Sources Own calculations based on www.memoire-du-cyclisme.net and www.cqranking.com)

internationalization with a value for the HHI of just 20.3 in 2020 and a more or less stable number of top teams per country.

5 Globalization of the UCI Road Cycling Calendar

A third dimension of globalization is the internationalization of the race calendar. We first discuss the geographical breakdown of all cycling races on the UCI road cycling calendar and then turn our attention to the competitions at the highest level only, the WorldTour. We conclude with some thoughts on the problems associated with a globalized calendar.

5.1 The Internationalization of the UCI Road Cycling Calendar

Appendix 3 presents the geographical breakdown of all cycling competitions on the official UCI calendar, with the number in parentheses representing the total number of countries that host at least one official UCI race. The 2019 racing calendar was used to make abstraction of the impact of the Covid-19 pandemic on the 2020 cycling season. Unfortunately, on its website the UCI only publishes calendar information from 2005 on. To collect older information, we therefore had to use secondary data sources such as www.cyclingnews.com for the 2000 calendar, and a cycling yearbook (Van den Bremt, 1991) and a cycling magazine (Het Nieuwsblad, 1990) for the 1990 calendar.

We first note how the calendar has expanded in volume over the years. In 2019, the official UCI road cycling calendar counted 368 events, excluding championships and criterium races. Between 1990 and 2000 the number of races more than doubled, while between 2000 and 2019 there was a smaller increase of 10%. The internationalization trend becomes immediately clear from an analysis of the countries organizing at least one official cycling race. The 156 races of the 1990 calendar were spread over 17 countries only, an average of 9.2 races per country. In 2019, 66 countries hosted the 368 cycling competitions on the UCI calendar, reducing the average to 5.6 races per country. However, we also notice that the number of countries no longer grew between 2010 and 2019. The decrease from 70 to 66 is almost entirely the result from fewer American countries organizing cycling races in 2019: from 16 to 13.

Figure 14.6 visualizes the trends from the table in Appendix 3. Although the vast majority of UCI cycling competitions still take place in Europe, the share of European races has decreased from 95% in 1990 to 77% in 2019. During that period, we observe some interesting evolutions within Europe. While in 1990 still almost eight out of ten cycling races were held in the core countries of cycling (79%), by 2019 their part had almost halved to 43%. But this reduction was a discontinuous

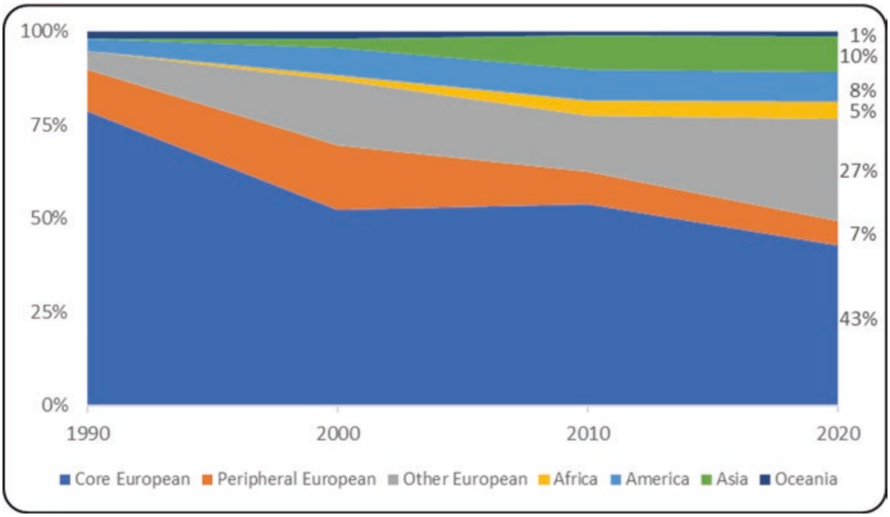

Fig. 14.6 Geographical breakdown of all UCI road cycling races (1990–2019). (*Sources* www.uci.ch, Van Den Bremt (1991) and Het Nieuwsblad (1990) (own calculations))

process. A first significant decline occurred in the 1990s when especially the peripheral countries and the other European countries, both accounting for 17 to 18% of all cycling competitions by 2000, gained a significantly larger share of the UCI road cycling calendar. But in the noughties, cycling races within Europe again became more concentrated in the traditional countries of cycling, with falling market shares for the non-core countries between 2000 and 2010. The growth in the non-European calendar during that decade (from 13% to 23%) was entirely at the expense of the peripheral and other European countries, while the core countries even succeeded in gaining back some market share (from 52% to 54%).

After 2010, the situation changed drastically. The total number of races in Belgium, France, Italy and Spain fell from 194 to 158 or, in worldwide percentages, from 54% to 43%. This reduction in the core countries' share became highly visible in Spain where in 2019 only 21 races were scheduled down from 36 in 2000. France still counts the largest number of races (61), followed by Belgium (47) and Italy (29). The peripheral countries also lost a significant share since 2000: from 17% down to 7%. This is mainly due to the important reduction in the number of German and Swiss races, from 30 races for the 2 countries combined in 2000 down to only 9 in 2019. The other European countries, however, have gained a lot of importance and now account for over a quarter of all cycling competitions worldwide. In countries such as Norway (8), Poland (15) or Turkey (18), a growing number of professional road cycling races are being organized.

To encourage cycling's expansion outside of Europe, in 2005 the UCI created four continental circuits. Following this reform, the Asian continent witnessed the most significant increase in cycling competitions: from 8 races (2%) in 2000 to 35 races (10%) in 2019. The share of (North and South) American races remained rather stable at about 8% (29 races in 2019), which implies that Asia has become the second most prolific continent when it comes to organizing cycling competitions. Also the African share grew from only 1% (4 races) in 2000 to 5% (17 races) in 2019. In fact, only the Oceania Tour did not witness a similar development (6 races in 2000 versus 5 races in 2019). A number of reasons can logically explain this observation. For instance, all races in Oceania are concentrated in January because many Australian riders are part of European teams that focus on the Europe Tour or the WorldTour and thus spend the rest of the year in Europe. Moreover, the continent only counts two large countries, greatly limiting the potential growth of the local cycling calendar. Therefore, just like the America Tour is conceived as a unified competition between North and South American races, a merger of the Oceania Tour with the Asia Tour could further stimulate professional road cycling in Australia as well as in Asia.

5.2 The Internationalization of the UCI WorldTour Calendar

The WorldTour does not yet really live up to its name. In 2019, the last fully completed WorldTour season, six out of ten races and two thirds of the racing days were still organized in one of the four core cycling countries. By hosting 9 out of 38 races, Belgium has the lion's share of the WorldTour calendar. Yet, it is France that counts the most WorldTour racing days: 39 out of 180 (22%). The difference follows from the fact that the Belgian races in the WorldTour are mostly 1-day classics and that Belgium, unlike the other three core countries, hosts no national *Grand Tour*.

Top-level cycling seems to be crawling out of its European shell only very slowly. The non-European share in WorldTour races is just 18% and the percentage of racing days on non-European soil is even less (13%). Since at the start of the WorldTour in 2005 the calendar was still completely European, one could argue that at least some progress has been made. However, the scope of the current non-European component of the WorldTour is too limited to be called a successful step towards globalization of professional road cycling, especially as it has been an outspoken policy goal to the UCI for about three decades now. Furthermore, it is remarkable that the expansion to other continents is primarily at the expense of races in the peripheral European countries. For example, since 2005 the Netherlands, Germany and Switzerland all saw ProTour races replaced by races in, e.g. Canada, Australia, China, the USA and the Middle East. The core countries, on the other hand, kept a stable share over the 2005–2019 period. With the help of the bargaining power of their organizers, Belgium and France even saw a few extra races added to the WorldTour calendar, such as E3 Harelbeke, Driedaagse Brugge-De Panne, Dwars door Vlaanderen and the Bretagne Classic-Ouest-France.

Consequently, only firms which target primarily the European consumer market are likely to invest in cycling and big multinational companies may deliberately stay away from the sport. For a global brand, cycling still remains too European. This became very clear in June 2014 when *Belkin* decided to end its one and a half year only sponsorship of a cycling team because cycling was not the optimal sport to fulfil the worldwide ambitions of the company. If cycling teams want to offer brands like *Nike* or *Sony* a valuable return on investment, professional road cycling has to be present at the worldwide level and deliver the sport to a truly global audience. Just like in tennis (where the calendar consists of the historically important Grand Slam tournaments as well as smaller events around the world) and in Formula One Racing (where races in historic locations like Monaco are alternated with new races in, e.g. Malaysia, China and Bahrain), cycling has to look for the right balance between maintaining a selected number of traditional top events in the core countries of cycling and creating new races in growth markets. UCI's choice for new WorldTour races outside the four core countries of cycling is therefore crucial to the success of the further development of cycling as a global sport. Failure to seize this opportunity, e.g. because of historical sentiments, implies that it will become increasingly difficult for cycling to outgrow its current regional European status.

Note the pre-pandemic calendar was being discussed here. In 2022, it seems that the non-European races are hit the hardest by Covid-19 restrictions. While since the start of the pandemic most of the European WorldTour races have been organized at least once (and sometimes even three times), as of July 2022 there is only one WorldTour competition that has meanwhile taken place outside of Europe: the UAE Tour. It remains to be seen if the other non-European races in Australia, Canada and China will even survive post-Covid-19, which constitutes a further threat to the internationalization of the UCI cycling calendar.

5.3 The Problems of a Globalized Cycling Calendar

Although a more globalized cycling calendar is vital to the development of professional road cycling, it involves a number of important practical issues as well. First, moving a cycling peloton of 200 riders around the world is a costly operation. In contrast to some other globalized sports like, for instance, tennis or athletics, where transportation costs almost exclusively relate to personnel costs, in professional road cycling there are significant transportation costs for equipment as well. For a week-long stage race, a cycling team with 8 riders easily needs 25 bikes (2 road bikes and 1 time trial bike per rider) and sufficient spare components. But also the costs for organizing 1-day races at other continents are huge. In 2010, over €3 million (a third of the budget of the average UCI WorldTeam at that time) was spent on logistics to move the WorldTour peloton mid-season from Europe to Canada for two WorldTour races in the city of Québec and in Montreal. Four planes were chartered for a direct flight from Paris to Québec: 3 carrying the equipment and 1 transporting all personnel, 14 persons per team (8 riders and 6 staff members). In total 15 tons of equipment (260 cubic metres) was transported, including, on average, 14 bikes and 20 spare wheels per team (Het Nieuwsblad, 2010).

This illustrates a catch 22 problem professional road cycling is facing. On the one hand, more global races are needed to attract the financially strong international brands that stay away from cycling at the moment. But most of these global races, on the other hand, offer little or no benefit to smaller sponsors focused on local markets, who prefer local media coverage. Most of the non-European races do not even got solid media coverage in cycling's core TV markets. Teams are thus faced with the financial burden of increased travel costs for races their sponsors are hardly interested in. It also explains the sponsorship struggle team managers face year after year: cycling at the top level has become too global (and thus too expensive) for smaller local sponsors but, at the same time, is not global enough for big multinational companies.

Moving a cycling peloton around the world does not only involve financial costs. Riders themselves also have more immaterial concerns, especially when they have to travel to countries where sanitary and/or climatic conditions create a health risk. For example, races in China have been questioned by riders on many occasions: 'During the competition, the day on which there was the least pollution we had 210 mg/m3 (of carbon dioxide) in the air. The maximum limit in Europe is 40 mg/m3. You really felt the lacking oxygen', one Spanish rider said (Cyclingnews, 2011). Another concern amongst cyclists appears to be the fear of eating contaminated meat. In the autumn of 2013, Australian top rider Michael Rogers and the little known Belgian pro Jonathan Breyne both tested positive for clenbuterol after racing in China. They were cleared in April 2014 after sufficiently demonstrating that they had ingested tainted food, but at a huge personal cost. Michael Rogers was suspended for half a year, while Jonathan Breyne attempted suicide. In her cycling column, Dutch female pro cyclist Marijn De Vries explains: 'The UCI wants to globalise cycling. Races in exotic places such as China, are becoming increasingly important. But every time you put something in your mouth, you have to ask yourself: is this okay? This constant fear makes it almost impossible to practice this sport in a decent way' (de Vries, 2013).

In a sport as demanding as road cycling it is recommended to limit the number of racing days and the number of long trips in between races. A season can only be so long and riders cannot race the full year. A third practical concern therefore is to have a well-balanced calendar that allows top riders to take part in a significant number of non-European races. The last fully completed WorldTour (in 2019) counted 180 days of racing, with a stage race in Australia in January, mid-season journeys to North America in May (California) and September (Canada) and a season-closing stage race in China (October). Most top cycling teams take part in races that do not belong to the WorldTour as well. Because of the overloaded European calendar, few top riders make more than one trip to these non-European WorldTour races. This jeopardizes the long-term survival of such non-European races. As cycling continues to globalize more calendar issues will arise. More WorldTour races outside of Europe therefore imply a careful reorganization of the racing calendar with longer periods of mid-season racing outside Europe and a smaller European calendar. Inevitably this means that some European races that based on historical merits have claimed a popular date on the professional road cycling calendar for many years will either have to agree with a different (less interesting) spot on the calendar or, in the case of stage races, reduce their overall number of stages. It will be challenging for the UCI to implement such radical calendar changes knowing that in the past 30 years only a small number of structural calendar switches have taken place. Yet, from how cycling dealt with the pandemic in 2020, we have learnt there is definitely much more room for flexibility in the racing calendar than generally believed before.

6 Globalization in the Women's WorldTour

The UCI Women's WorldTour was created in 2016. It replaced the women's World Cup Cycling that existed between 1998 and 2015. The women's WorldTour is much smaller than the men's: the 2020 peloton counted 106 cyclists in just 8 teams, and in 2019, the last fully completed season, it included 23 events. The geographical and nationality breakdown of riders, teams and races is presented in Table 14.5. The table also includes the men's WorldTour percentages for comparison.

The breakdown by continent of the women's WorldTour peloton is very similar to the men's, with a slightly larger share of riders from Oceania and a slightly smaller share of American riders. Just as is the case for the men's peloton, three out of four riders are European but there is a remarkable difference though. Within Europe, the women's peloton is much less concentrated in the traditional cycling countries than the men's. The share of women riders from the core European countries is only 26%, while for the men's it is 38%, and it is about equal to the number of riders from the peripheral countries (22%) or the other European countries (27%).

Figure 14.7 presents choropleth maps for the number of male and female professional riders per country in 2020. Both maps roughly look the same, with riders mainly concentrated in Western and Southern Europe, Australia and North America. Differences between the women's and men's peloton are found mainly in South America (much more male riders), Scandinavia (slightly more female riders) and Eastern Europe (slightly more male riders).

Table 14.5 Globalization in the women's WorldTour (2020)

	Riders		Teams		Races	
	Women (106)	Men (544)	Women (8)	Men (19)	Women (23)	Men (38)
Europe	75%	77%	75%	59%	87%	82%
Core countries	26%	38%	38%	32%	52%	59%
Peripheral countries	22%	17%	25%	16%	13%	14%
Other European countries	27%	22%	13%	11%	22%	8%
Oceania	13%	8%	13%	5%	0%	5%
America	7%	10%	13%	11%	4%	8%
Asia	4%	3%	0%	21%	9%	5%
Africa	1%	2%	0%	5%	0%	0%

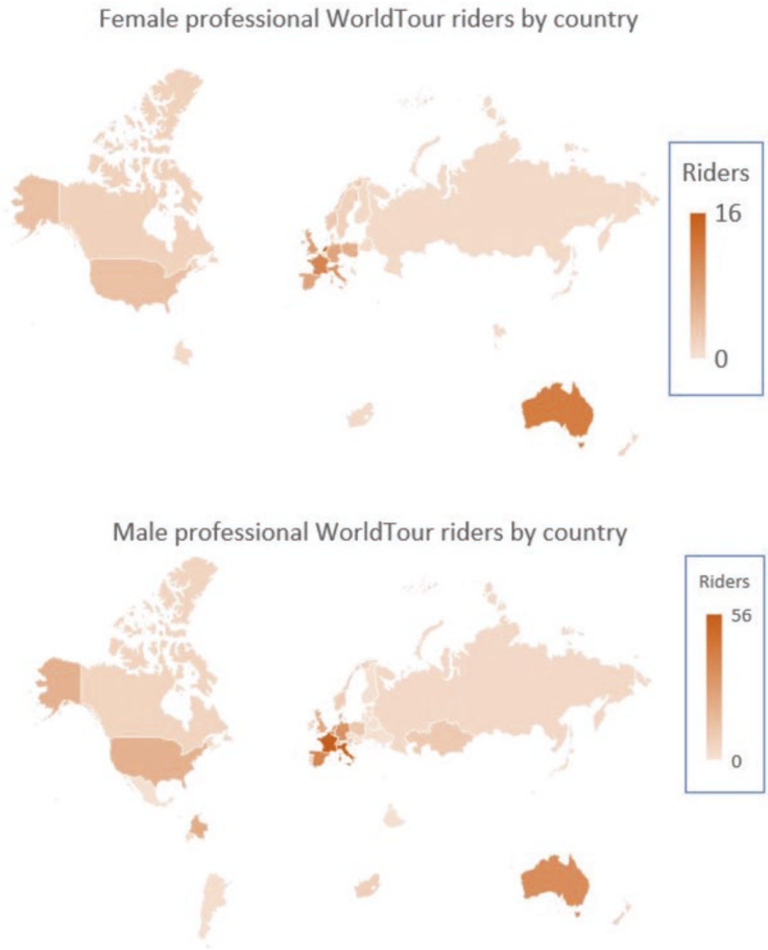

Fig. 14.7 Number of female and male professional WorldTour riders by country (2021). (*Source* Own calculations based on www.cqranking.com)

Women's WorldTour cycling teams are a bit more concentrated in traditional cycling countries than men's teams currently are. In 2020, six out of eight teams were European (75%), with half of them being registered in the core countries of cycling. The current situation in the first few years of the women's WorldTour thus very much reflects the situation at the beginning of the men's WorldTour, when the peloton was also dominated by a majority of European teams.

The Women's WorldTour calendar is even more saturated with European races than the men's calendar: 87% versus 82%. About half of all women's WorldTour events (12 out of 23) take place in cycling's core countries. There are only three non-European WorldTour races for women: two in China and one in the USA. A noteworthy difference is that the women's WorldTour includes three Scandinavian races, whereas the men's WorldTour has none.

Overall we conclude that at the moment the women's WorldTour tends to be a bit more European oriented and less global than the men's WorldTour. At the same time, however, women's professional cycling seems to be slightly more widespread across Europe and less concentrated in the four core countries of cycling than men's professional cycling.

7 Conclusion and Policy Proposals

From the early 1990s on the UCI has repeatedly cited globalization of cycling as one of its major policy goals. To this end, over the years a number of measures have been initiated by the UCI (see Sect. 2). In Sects. 3, 4, and 5 we therefore analysed internationalization of cycling from three different angles to check whether or not professional men's road cycling has become a truly globalized sport over the years. From a comparison of the men's and women's WorldTour (Sect. 6), we also learnt that the level of globalization is not that much different between the two.

European countries still have a dominant share of 70% to 80% of the riders and races and account for 50 to 60% of all cycling teams. Yet, we can conclude that professional road cycling did make some significant steps towards globalization in the past 30 years. Especially at the lower levels of professional cycling, there is an ongoing process of internationalization. But, as could be seen from a comparison with other sports (Table 14.1) and from an analysis of team diversity (Fig. 14.5), a clear trend towards globalization is also present at the top rider and top team levels of professional road cycling. There remain some important challenges for further internationalization though, for instance: (1) how to reduce the far too dominant share of the core countries in the WorldTour calendar; (2) how to encourage a better representation at the WorldTour level of cyclists from countries that already have a solid base of cyclists at the lower level, such as Argentina or China; and (3) how to secure more non-European and non-American teams at the WorldTour level.

We conclude with three policy proposals to the UCI, some of them already touched upon earlier in this chapter, as a partial answer to the challenges outlined above. First, create a better balanced worldwide calendar of top races by reducing the current number of 38 WorldTour races to 25 at most, of which at least a third are non-European. Can we really talk about a WorldTour if it still includes 5 weeks of stage racing in France, 5 weeks in Spain and 4 weeks in Italy? To reduce the amount of travelling, the WorldTour peloton could, just like the Formula One, move from one continent to another rather than have races scheduled more or less randomly around the world. Second, reduce the five continental tours in which cycling can develop to just three. Next to the America Tour (including all North-, Central- and South American continental races), there could be an Euro-Africa Tour (all European and African continental races) and an Eastern Tour (all Australian and Asian continental races). This would increase racing opportunities and competition at lower levels of professional road cycling and could lead to a better and more regular inflow of especially African and Asian cyclists to top teams. Third, promote a cycling team from East Asia and a cycling team from South America to WorldTour level. Since in these regions there seems to be a solid base for professional road cycling, a regional team at WorldTour level could give the necessary extra boost for a firm anchoring of cycling in these important markets.

Appendix 1: Breakdown of the Professional Peloton by Nationality (1990–2020)

	All professional cyclists				*Cyclists in WorldTour (or equivalent)*			
	1990	***2000***	***2010***	***2020***	***1990***	***2000***	***2010***	***2020***
Total number of riders	***859***	***1136***	***893***	***962***	***536***	***522***	***505***	***544***
Total number of countries	***30***	***47***	***44***	***52***	***28***	***31***	***40***	***43***
Europe	***88.8% (20)***	***88.6% (31)***	***85.3% (29)***	***81.9% (31)***	***88.0% (19)***	***92.5% (24)***	***83.4% (28)***	***76.6% (26)***
Core European countries	***57.5% (4)***	***49.8% (4)***	***54.8% (4)***	***47.8% (4)***	***57.8% (4)***	***65.1% (4)***	***47.1% (4)***	***37.7% (4)***
Belgium	145	99	96	122	73	52	50	55
France	77	109	124	123	73	66	53	56
Italy	137	222	175	129	84	134	66	56
Spain	135	136	94	86	80	88	69	38
Peripheral European countries	***18.7% (4)***	***14.9% (4)***	***13.0% (4)***	***12.9% (4)***	***19.4% (3)***	***15.3% (4)***	***14.5% (4)***	***16.7% (4)***
Germany	33	57	37	36	16	24	31	33
Luxembourg	1	6	5	9		3	5	6
Switzerland	41	47	21	22	24	21	8	18
The Netherlands	86	59	53	57	64	32	29	34
Other European countries	***12.6% (12)***	***23.9% (23)***	***17.5% (21)***	***21.2% (23)***	***10.8% (12)***	***12.1% (16)***	***21.8% (20)***	***22.2% (18)***
Austria	4	18	6	11	2	3	5	10
Belarus		2	6	2			6	1
Bulgaria		2						
Croatia		2	3	1			2	
Czech Republic	1	23	2	5		3	2	4
Denmark	18	32	17	37	13	16	16	22
Estonia		4	3	6	1	4	1	4
Finland		2	2	2			2	1
Great Britain	32	9	17	34	3	3	14	25
Hungary		3		4		1		2
Ireland	4	4	4	6	5		3	5
Latvia		6	3	3	2	4	2	3
Lithuania		12	2	3		2	1	1
Moldova		3	1			1	1	

Monaco				1				
Norway	5	7	7	32	6	1	3	9
Poland	5	44	23	12	5	4	5	11
Portugal	12	37	5	9	2	2	4	6
Romania			1	1				
The Russian Federation	21	20	27	18	13	8	24	4
San Marino	3							
Serbia		2		2				
Slovakia	1	2	4	3			4	3
Slovenia	2	15	9	9	2	4	6	9
Sweden		13	4	2		4	4	
Ukraine		10	10	1	4	3	4	1
Africa	***0.0% (0)***	***0.4% (3)***	***0.4% (2)***	***1.6% (3)***	***0.0% (0)***	***0.4% (1)***	***0.6% (1)***	***2.2% (3)***
Algeria		1						
Eritrea				4				3
Ethiopia				2				1
South Africa		3	3	9		2	3	8
Tunisia			1					
Zimbabwe		1						
America	***7.9% (7)***	***7.0% (8)***	***7.4% (7)***	***9.0% (10)***	***10.4% (6)***	***4.6% (3)***	***6.3% (5)***	***10.1% (7)***
Argentina	2	1	7	2			3	2
Brazil	2	1	13	1	1	1	1	
Canada	2	11	5	13	3		4	6
Chile			1					
Colombia	36	18	6	32	32	7	3	22
Costa Rica				2				1
Ecuador				5				3
Guatemala		2						
Mexico	3	2		1	2			1
Panama				1				
The USA	21	44	31	29	17	16	21	20
Venezuela	2	1	3	1	1			
Asia	***0.2% (1)***	***0.9% (3)***	***2.7% (4)***	***2.5% (6)***	***0.2% (1)***	***0.8% (1)***	***3.4% (4)***	***3.3% (5)***
China			4				1	
Israel			2	4			1	4
Japan	2	1	3	6			1	2
Kazakhstan		8	15	11		4	15	10
Kyrgyzstan		1						
Taiwan				1				1
The United Arab Emirates				1				1
Uzbekistan				1	1			

Oceania	*3.0% (2)*	*3.0% (2)*	*4.3% (2)*	*5.0% (2)*	*1.3% (2)*	*1.7% (2)*	*6.3% (2)*	*7.7% (2)*
Australia	25	26	31	38	6	8	25	35
New Zealand	1	8	7	10	1	1	7	7

Sources Van den Bremt (1991), www.memoire-du-cyclisme.net and www.cqranking.com (own calculations)

Appendix 2: Geographical Breakdown of Professional Cycling Teams (1990–2020)

	All professional cycling teams				*Top-level cycling teams*			
	1990	*2000*	*2010*	*2020*	*1990*	*2000*	*2010*	*2020*
Total number of teams	*75*	*94*	*161*	*208*	*26*	*22*	*18*	*19*
Total number of countries	*17*	*19*	*44*	*56*	*9*	*8*	*11*	*14*
Europe	*77.3% (12)*	*87.2% (16)*	*71.5% (29)*	*54.3% (25)*	*92.4% (7)*	*95.5% (7)*	*77.7% (9)*	*57.9% (7)*
Core European countries	*44.0% (4)*	*42.6% (4)*	*22.4% (4)*	*19.7% (4)*	*69.2% (4)*	*77.3% (4)*	*50.0% (4)*	*31.6% (3)*
Belgium	8	8	13	10	3	1	2	2
France	4	10	8	10	4	4	2	3
Italy	10	15	7	14	6	8	2	
Spain	11	7	8	7	5	4	3	1
Peripheral European countries	*13.3% (3)*	*16.0% (3)*	*11.2% (4)*	*10.6% (4)*	*19.2% (2)*	*13.6% (2)*	*11.1% (2)*	*15.8% (2)*
Germany	1	8	8	11		1	1	2
Luxembourg			1	1				
Switzerland	4	3	3	2	1			
The Netherlands	5	4	6	8	4	2	1	1
Other European countries	*20.0% (5)*	*28.7% (9)*	*37.9% (21)*	*24.0% (17)*	*3.8% (1)*	*4.5% (1)*	*16.7% (3)*	*10.5% (2)*
Armenia			1					
Austria	1	2	4	6				
Belarus				2				
Bulgaria			1					
Croatia			2	1				
Czech Republic		3	2	4				
Denmark		3	5	3		1	1	
Estonia			1					
Great Britain	3	1	7	5			1	1
Greece			3					
Hungary			1					
Ireland			3	1				
Latvia				1				

Norway			4	3				
Poland		5	6	5				1
Portugal	8	10	5	9				
Romania			1	2				
The Russian Federation	1		5	2	1		1	
San Marino	2							
Serbia			1					
Slovakia		1	1	1				
Slovenia		1	4	2				
Sweden		1	1	1				
Turkey				2				
Ukraine			3					
Africa	***4.0% (1)***	***0.0% (0)***	***0.6% (1)***	***3.4% (5)***	***0.0% (0)***	***0.0% (0)***	***0.0% (0)***	***5.3% (1)***
Algeria				***1***				
Angola				***1***				
Morocco				***1***				
Rwanda				***2***				
South Africa	***3***		***1***	***2***				***1***
America	***14.7% (2)***	***12.8% (3)***	***12.4% (4)***	***14.9% (10)***	***7.6% (2)***	***4.5% (1)***	***16.7% (1)***	***10.5% (1)***
Argentina				6				
Brazil			2	1				
Canada		1	1	2				
Colombia	3	1	2	5	1			
Ecuador				1				
Guam				1				
Mexico				2				
Paraguay				1				
Venezuela				1				
The USA	8	10	15	11	1	1	3	2
Asia	***1.3% (1)***	***0.0% (0)***	***12.4% (8)***	***24.0% (14)***	***0.0% (0)***	***0.0% (0)***	***5.6% (1)***	***21.1% (4)***
Bahrain				2				1
Cambodia				1				
China			4	12				
Hong Kong				1				
Indonesia			1	2				
Iran			3	4				
Israel				2				1
Japan	1		5	10				
Kazakhstan			1	3			1	1
Malaysia			1	2				
South Korea			3	7				
Taiwan			2					

Thailand				1				
The Philippines				2				
The United Arab Emirates				1				1
Oceania	***2.7% (1)***	***0.0% (0)***	***3.1% (2)***	***3.4% (2)***	***0.0% (0)***	***0.0% (0)***	***0.0% (0)***	***5.3% (1)***
Australia	2		4	6				1
New Zealand			1	1				

Sources Van den Bremt (1991), www.memoire-du-cyclisme.net and www.cqranking.com (own calculations)

Appendix 3: Geographical Breakdown of UCI Road Cycling Races (1990–2019)

	1990	***2000***	***2010***	***2019***
Number of races	***156***	***328***	***360***	***368***
Number of countries	***17***	***40***	***70***	***66***
Average number of races per country	***9.2***	***8.2***	***5.1***	***5.6***
Europe	**94.9% (12)**	**87.2% (19)**	**77.5% (31)**	**76.6% (32)**
Core countries	78.9% (4)	52.4% (4)	53.8% (4)	42.9% (4)
Peripheral countries	10.9% (4)	17.1% (4)	8.8% (4)	6.5% (4)
Other European countries	5.1% (4)	17.7% (11)	15.0% (23)	27.2% (24)
Rest of the world	**5.1% (5)**	**12.8% (21)**	**22.5% (39)**	**23.4% (34)**
Africa	0.0% (0)	1.2% (3)	3.9% (8)	4.6% (7)
America	3.2% (4)	7.3% (11)	8.3% (16)	7.9% (13)
Asia	0.0% (0)	2.4% (6)	9.2% (13)	9.5% (12)
Oceania	1.9% (1)	1.8% (1)	1.1% (2)	1.4% (2)

Sources www.uci.ch, Van Den Bremt (1991) and Het Nieuwsblad (1990) (own calculations)

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