Essays in sports economics and sports management

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Framework paper

In recent decades, economists have used rigorous methods to analyze phenomena in fields of social sciences, such as sociology, political science, law, psychology, and behavioral sciences. Levitt and Dubner's (2005) best-selling book, *Freakonomics*, presents economics research to a wider audience. It is a collection of such phenomena, ranging from topics of crime and abortions (Donohue III & Levitt, 2001) to cheating in sports, i.e., sumo wrestling (Duggan & Levitt, 2002). Similarly, other economics research has delved into the analysis of sports. Researchers have used economics to learn more about sports but also treated sports as a laboratory or used data from professional sports to learn more about, inter alia, human behavior (Apesteguia & Palacios-Huerta, 2010), labor markets (Kahane, Longley, & Simmons, 2013), or domestic violence (Card & Dahl, 2011).

The birth of academic research in the economics of professional team sports dates back to Rottenberg's (1956) seminal article in which he analyzes the baseball labor market. In contrast to traditional industries, sports clubs jointly produce the product, i.e., the competition (e.g., a single game or a season), and not only compete as rivals but also need to cooperate (Neale, 1964). In doing so, no club is willing to get too strong, so that competitions are still uncertain and entertaining enough. In any other industry, companies would seek monopoly powers but clubs in sports leagues cannot strive for those same market powers, lest the joint product becomes obsolete in the long run. This pushes league organizers towards incentive schemes and various cross-subsidizing mechanisms, i.e., revenue sharing salary caps, or luxury taxes, which economists have studied for years. Hence, Fort & Quirk (1995) call sports leagues "classic, text-book examples of business cartels".

Technological developments (e.g., live TV broadcasts) facilitated the tremendous growth of the sports industry in the last decades of the 20th century; an industry that continued to grow, even when other major industries incurred

unprecedented losses during the 2008 global financial crisis[1]. As the industry kept growing, so too did the interest of management and economics scholars, because numerous business problems and research questions need to be analyzed from an economics perspective (including, valuation of broadcasting rights, revenue distribution, labor market outcomes of professional sports leagues, and design of sports competitions).

Researchers have emphasized the importance of sports as data galaxies for social sciences (Ennis, 1964) and have pointed out that sports provides an ideal laboratory (Kahn, 2000; Palacios-Huerta, 2014) for economics research: Sports generates an abundance of data, and through digitalization, we have improved the data measuring and gathering process. The data are readily accessible, either publicly or via professional data providers, and are usually of very high quality. Because outcomes are often very clear and standardized rules are applied (e.g., size of the pitch, size of the goals, and the number of players in a team) and enforced (e.g., by professional associations and referees), the analysis of economic phenomena is more tractable (Rosen & Sanderson, 2001).

In recent decades, researchers have analyzed the sports industry or used data from professional sports leagues and competitions to understand broader phenomena and published them in leading economics and management science journals. What can we learn as economists (or in a broader sense as social scientists) when we use economic theories to understand sports, and what can sports teach us about economics and human interactions? This is the guiding research question that motivates this dissertation. In the first paper, we clearly focus on using economic theories to better understand sports, particularly sports sponsorship activities. The second paper uses data from sports to learn more about facial attractiveness and consumer choices in tennis, but the paper also provides insights into sports itself, particularly with regards

[1] For the first time in many years, sports events came to a complete halt in 2020 due to the outbreak of the novel Coronavirus (COVID-19) and the subsequent global pandemic that led many countries to introduce severe measures to cope with the threat. We will be able to measure the effects this had on the global sports industry in due time.

to the business implications of our findings. In the third paper, sports is used as a laboratory to better understand whether workers are rewarded for inconsistent performances. Hence, the dissertation starts using theories from economics to better understand sports and ends by treating sports as a laboratory for social science research and using sports data to learn more about economics — consumption choices and labor markets.

In the first paper, *Outsourcing sports sponsorship activities: a multi-theoretical approach*, we apply a multi-theoretical approach to outsourcing sports sponsorship activities and develop a conceptual framework that includes Transaction Cost Economics, the Resource-based View, and Contingency Theory (see Appendix A1; a version of this paper has been published in *Sport, Business and Management: An International Journal*). A large majority of sports clubs and associations seek and rely on sponsorship income as a crucial revenue stream to run their businesses. We define them as sponsees in our paper. Some sponsees partly or fully outsource sponsorship-related activities to sports marketing agencies, others, for example, the German football club Bayern Munich, fully manage their sponsorship activities in-house. This is a classic make-or-buy decision that sponsees approach differently. The central question that motivates the paper is as follows: What factors are likely to influence a sponsee's decision to outsource, that is, to make-or-buy its sponsorship activities? Moreover, we analyze activities that are likely to be outsourced and additional sponsee characteristics that likely lead to outsourcing.

We define outsourceable sponsorship activities in a first step (e.g., sponsorship management and execution; regional and/or supraregional sponsorship acquisition; sponsorship strategy formulation; and brand-building, positioning, and management), and introduce five stylized sponsorship sourcing models that range from total outsourcing (Model 1) to total insourcing (Model 5).

Applying Transaction Cost Economics and the Resource-based View, we analyze how the determinants, such as *asset specificity*, *uncertainty*, and *strategic relevance,* influence a sponsee's decision to outsource its sponsorship activities. These

determinants improve our understanding of those sponsorship-related activities that are more (less) likely to be outsourced. However, different types of sponsees outsource their activities differently, some may outsource fully while others might only outsource part of their activities. Transaction Cost Economics and the Resource-based View are insufficient to answer these questions. Hence, we refer to Contingency Theory and propose that a sponsee's size and its management's degree of professionalism are additional determinants for the sourcing decision. Based on these three theories, we make a number of propositions from which managers in the sports industry may benefit.

This is the first paper that applies an integrative approach using Transaction Cost Economics, Resource-based View, and Contingency Theory to conceptually analyze sports sponsorship outsourcing from a sponsee's perspective. Future research could try to measure our proposed determinants, such as the degree of professionalism or include further factors that affect the degree of professionalism, e.g., a sponsee's level of confidence or experience.

In the second paper, *The role of facial attractiveness in tennis TV-viewership,* we analyze TV-demand for live tennis matches and ask whether facial attractiveness is a significant determinant for the consumption behavior of TV viewers (see Appendix A2; a version of this paper has been published in *Sport Management Review*). The concept of beauty was of great interest to societies for centuries. Hatfield and Sprecher (1986) extensively summarize the topic from an anthropological perspective, while Hamermesh (2011) gives great insights into the economic effects of beauty, a subfield called pulchronomics. The effects of beauty on human perceptions are manifold. To name a few, researchers have shown that attractive people earn more, are trusted more often, hired faster and more often, receive better grades, and are less likely to be convicted.

We analyze 622 live tennis matches from 66 Grand Slam tournaments (the most prestigious competitions in tennis) between 2000 and 2016. To examine the relationship between facial attractiveness and TV-viewership, we proceed as follows:

(1) We use a software algorithm to measure the facial symmetry of both women and men players. Previous findings support our decision to only focus on facial symmetry because facial symmetry consistently has been shown to play a significant role in attractiveness ratings. We analyze 644 pictures and calculate average facial symmetry scores for each player that occurs in our sample. (2) We then regress TV-audience size on facial attractiveness scores and a set of control variables (i.e., player quality, outcome uncertainty, home bias, tournaments, tournament rounds, and broadcast times).

Our results show that facial symmetry plays a positive role for female matches while there is no significant effect for male matches. An additional unit in the combined facial symmetry score for women players increases TV-viewership by 2.2%. If the combined facial symmetry score increases by one standard deviation, TV-viewership is increased by 24.3%. The general direction and significance of the effect persist in subsample regressions and robustness checks.

Our findings have important implications for researchers and managers. We extend the literature in the consumption of sports as we apply a new method to calculate facial attractiveness. This allows us to show a direct relationship between facial attractiveness and TV-viewership. As for managers, we believe our results need to be interpreted with caution: Public broadcasters have a public service function and therefore should be careful because exploiting consumer biases would only reinforce non-sports taste-based discrimination types. On the other hand, we believe that profit-maximizing private media organizations will exploit these consumer biases and calculate additional revenue-generating potential by factoring in beauty perceptions as additional demand determinants.

Future research could analyze selection biases that already affect young athletes (e.g., some coaches and/or agents might focus more of their time on better-looking athletes and hence they would have better chances to shine in comparison to others) before they appear on a global level. Moreover, future research could collect TV-viewership data from broader regions (e.g., Europe) to test these relationships.

The third paper *Are workers rewarded for inconsistent performance?* focuses on labor markets and asks whether workers earn higher salaries when they show inconsistent performances (see Appendix A3). Lazear's (1998) theoretical paper argues that workers with inconsistent performance should earn higher salaries because they would be capable to offer extraordinary high productivity, even if they are only able to do so on a few occasions. This extraordinary high performance would be viewed as an option value and therefore firms would reward these inconsistent performers more highly.

Our paper is motivated by Lazear's seminal work and other researchers' attempts to empirically answer the research question. Do workers who show greater performance inconsistency than comparable workers of similar average productivity earn higher salaries? Recent findings remain ambiguous because there is evidence for either case. To answer our research question, we exploit data from European football, i.e., the Italian Serie A. In total, we analyze 78,302 player match observations in the seasons from 2009 to 2017. When we use a single performance indicator called IVG (i.e., a grade that is an overall score for the performance and calculated by *PaniniDigital*, the data providers from whom we purchased the data) to measure a player's performance, we replicate previous findings that performance inconsistency leads to increased salaries. However, our rich data set, which includes numerous on-field actions (e.g., balls played, successful passes, recovered balls, shots on target) for 78,302 player match observations allows us to apply factor analysis. Through factor analysis, we reduce the number of performance variables to a more representative number of variables. This is important because players on the field have different tasks, e.g., an attacker is not measured with the same metrics as a defender. The remaining factors summarize more accurately the different skillsets for different players (e.g., defenders, midfielders, forwards).

Our results indicate that performance inconsistency in defensive tasks is penalized while performance inconsistency in attacking and goal scoring is rewarded. If the standard deviation of defensive skills increases by one unit, salaries decrease by

24.7%. In contrast, a one-unit increase in standard deviation in striker skills increases salaries by 16.6%. We extend previous findings by showing that salary premia are offered only for particular dimensions of performance. In contrast to previous research, we focus not only on the inconsistency of performance but also differentiate the effect of performance inconsistency between different tasks within a team. Workers are required to provide a number of skillsets for different tasks: Some tasks will be more repetitive and others require more creative and problem-solving skills, where effort, productivity, and salary returns might have disproportionate relationships to performance.

Future research will largely benefit from developments in methods and technology of sports analytics because measuring individual player performances in a team competition is hard. For instance, an attacking player's individual performance can be measured in the number of shots on target, goals, or dribbles. However, measuring a defensive player's performance is more difficult because good defending is not only an outcome of positional play but also a team effort and therefore very difficult to illustrate using individual metrics. Moreover, data providers can measure events that are happening, while those events that do not occur are never measured, e.g., a team losing an attacking chance because the opponent's team positioned themselves perfectly. With improved methods and measures, we believe that the analysis of salaries in team sports will be greatly enhanced.

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Appendix A: Papers included in this dissertation

A.1

Outsourcing sports sponsorship activities: A multi-theoretical approach[†]

Helmut Dietl, Anil Özdemir, Nicolas Schweizer

Abstract

Applying Transaction Cost Economics and the Resource-Based View to outsourcing of sports sponsorship activities, we examine how the determinants influence the sourcing choices of professional sports organizations. We argue that determinants derived from Transaction Cost Economics and the Resourced-based View are useful to understand the factors likely to influence an outsourcing decision and to analyze which sponsorship-related activities are more or less likely to be outsourced. However, these determinants are insufficient to shed light on why sports organizations arrive at different conclusions about their internal and external environments. With recourse to Contingency Theory, we propose two additional contingencies that affect the sourcing decision: a sports organization's size and its degree of professionalism.

JEL Classification: L140, M10, Z2

Keywords: transaction cost economics, outsourcing, resource-based view, sports sponsorship, sports organizations, sports marketing agencies

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1. Introduction

Sports sponsorship – marketing and selling commercial rights to sponsors – is an important income source for professional sports organizations (Deloitte, 2014; Nufer and Bühler, 2010). A crucial task of professional sports organizations is to manage these sponsorship-related activities, such as strategy formulation, sponsor acquisition, and day-to-day sponsorship execution.

Professional sports clubs and associations that receive funds from sponsors (henceforth referred to as "sponsees") may often seek external support for their sponsorship activities to increase their sponsorship income. While many sponsees fully or partly outsource sponsorship-related activities to sports marketing agencies, other sponsees, like the German football club Bayern Munich, fully manage their sponsorship activities in-house. Why do sponsees approach this make-or-buy decision differently? In this article, we seek an answer by exploring the determinants of the sourcing decision from a sponsee perspective. We apply classical theories of Transaction Cost Economics (TCE), the Resource-based View (RBV), and Contingency Theory (CT). Specifically, we focus on three questions; the first is very central: (1) What factors are likely to influence a sponsee's decision to outsource its sponsorship activities? (2) Which activities are likely to be outsourced? (3) What additional sponsee characteristics are likely to lead to outsourcing their sponsorship-related activities?

Previous research in sponsorship largely focuses on the sponsor's perspective (Cornwell and Maignan, 1998; Walliser, 2003) but there is little research on the management of sponsorship activities from the sport organization's perspective (Berret and Slack, 2001). Studies of outsourcing of sports marketing concentrate on US college sports (e.g., Bouchet, 2010; Burden and Li, 2005; Lee and Walsh, 2011; Li and Burden, 2002), on minor league baseball (Burden and Li, 2009), and on legal aspects of outsourcing sponsorship activities to external specialists (e.g., Kupfer and Neuß, 2013; Von Appen, 2012).

Li and Burden (2002) investigate the type of marketing operations (mainly the production of media material) that are likely to be outsourced by college athletic

programs and the reason they decide to outsource (e.g., to maximize guaranteed revenue). Burden and Li (2005) analyze situational factors that affect the decision to outsource marketing activities. Both papers slightly touch on the sales of sponsorship rights. Dietl and Schweizer (2014) derive six sources of inefficiencies and their underlying drivers in managing sponsorship activities.

Although the papers above do not apply theories of TCE and RBV to outsourcing sports sponsorship activities from a sponsee perspective, applying TCE and RBV is a common approach to investigate outsourcing in other industries (Busi and McIvor, 2008; Espino-Rodríguez and Padrón-Robaina, 2006). Some studies apply TCE and RBV in the context of sports sponsorship (although not outsourcing), particularly taking the sponsor perspective, the sponsor-sponsee relationship, and, to a lesser extent, the sponsee perspective (Amis et al., 1997; Daellenbach et al., 2006; Fahy et al., 2004; Sam et al., 2005). Other relationships in sports (e.g., players to team, player agent to players, and league to players' association) are also investigated using these classical theoretical concepts (e.g., Mason and Slack, 2005); nevertheless, the relationship between sponsees and agencies in sports remains undertheorized, and underconceptualized, hence, poorly understood.

In this paper, we argue that TCE- and RBV-related determinants are useful to understand the factors that are likely to influence a sponsee's outsourcing decision and to analyze those sponsorship-related activities that are more or less likely to be outsourced. Yet, these determinants are insufficient to shed light on why sports organizations differently assess their internal and external environments and thus why they choose various sourcing arrangements. To address this shortfall, we turn to Contingency Theory (CT) and propose two additional determinants, a sponsee's size and its degree of professionalism, as key drivers for the sourcing decision. Size is an important contingency factor and may affect outsourcing decisions (e.g., Abraham and Taylor, 1996; Cusmano et al., 2010). On the other hand, several authors (e.g., Dietl and Schweizer, 2014; Sam et al., 2005; Stotlar, 2009) point out that lack of professionalism may cause problems with regards to sports sponsorship.

The remainder of this paper is organized as follows: In the second section, we briefly present outsourceable sponsorship-related activities, sports sponsorship outsourcing, and different sponsorship-sourcing models. In section three, we discuss our conceptual framework in detail and focus on the classical theoretical concepts of TCE, RBV, and CT to derive determinants for the sponsorship-sourcing decision. We make propositions as we develop our theoretical framework and conclude our paper in section four.

2. Outsourcing sports sponsorship activities

2.1 Sports sponsorship activities

An analysis of sports sponsorship outsourcing requires a review of a sponsee's sponsorship-related activities. They have an essential task to manage their sponsorship-related activities. According to Dietl and Schweizer (2014), sponsees' objectives include maximizing sponsorship income and sponsors' satisfaction and creating a positive image and positive brand effects. Satisfied sponsors are more likely to extend their sponsorship agreements, which results in additional sponsorship income and cost savings. Moreover, sponsors will more readily engage with stronger sponsee brands, likely increasing sponsorship income. The sports sponsorship function can be broken into several activities. Referring to the work by Dietl and Schweizer (2014), we narrow our discussion on five outsourceable sponsorship-related activities (see Figure 1): sponsorship management and execution; regional sponsorship acquisition, supraregional sponsorship acquisition; sponsorship strategy formulation; and brand building, positioning, and management.

Sponsorship management and execution refer to the management of existing sponsorship agreements, including conceptual planning with the sponsor; the actual execution and organization of events; communications; client service; impact control of sponsorship measures; and activities beyond mere sponsorship, like corporate social responsibility. The traditional notion of sponsorship as a pure transaction between sponsor and sponsee is prevalent in previous sponsorship literature

(Cornwell and Maignan, 1998; Walliser; 2003). However, sponsorship management goes beyond a simple transaction between two parties because these parties invest resources other than money and commercial rights into the activity (Nufer and Bühler, 2010).

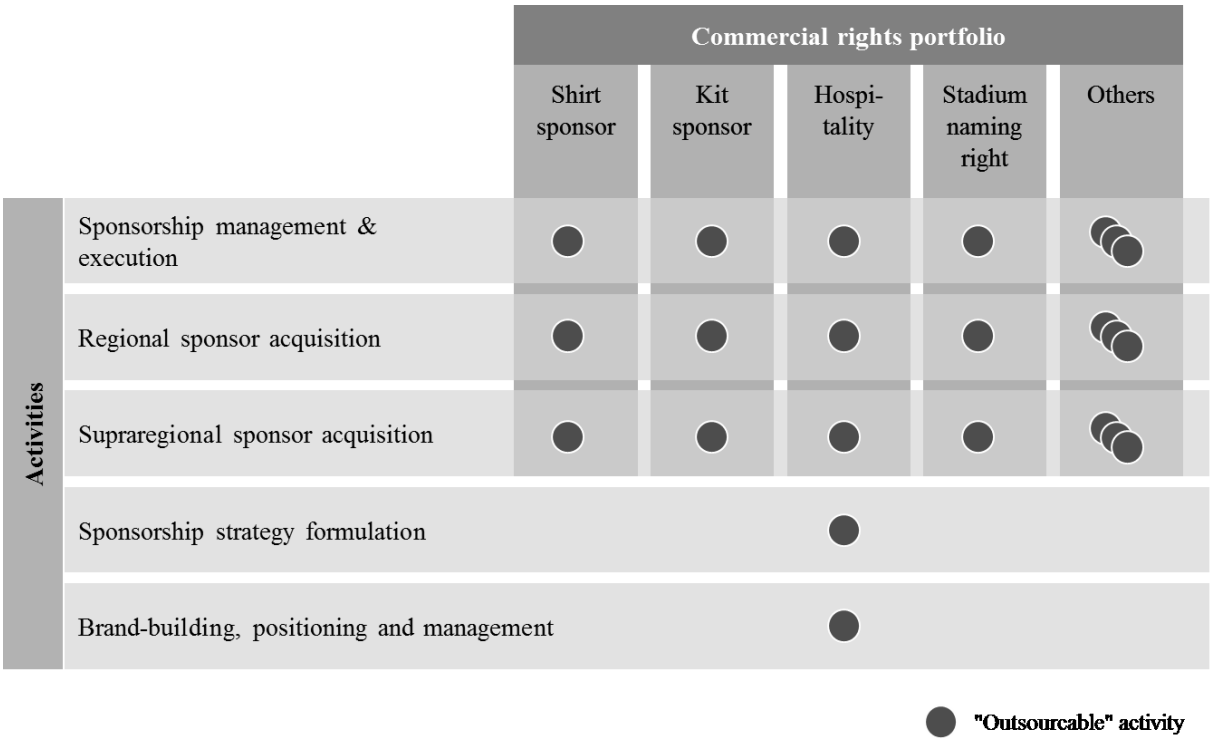

Figure 1: "Outsourcable" sponsorship-related activities in focus.

Regional and supraregional sponsor acquisition includes screening, approaching, and negotiating with them. The commercial rights portfolio of a sponsee typically contains commercial rights bound to the sponsee; stadium-related commercial rights; and naming rights, licenses, and others (Keller, 2008).

Sponsorship strategy formulation is a conceptual activity comprising the development of a sponsorship strategy with quantitative (sponsor hierarchy, rights catalogue, price list) and qualitative (vision, guidelines) elements, which also can be handed to an agency. Strategic marketing activities with an impact on sponsorship, like brand-building, positioning, and management, can be outsourced to external sports marketing agencies too. In addition to these commercial rights, a sponsee may have access to media rights, but they are not a focus of this paper.

2.2 Outsourcing

Outsourcing is a popular, widely-used business strategy for companies in all industries. Busi (2008, p. 8) defines outsourcing as "the strategic decision of a business to stop carrying out an activity in-house." The overarching goal of any strategic management decision, (e.g., sourcing decisions) is to achieve and maintain a superior competitive position (Day, 1994). As in any other industry, outsourcing is adopted in sports. Sponsees seek professional external support for many activities: human resources, facility management, marketing and sponsorship, and media relations. Sponsorship is one of the most common operations outsourced by sponsees and is associated with large amounts of money (Lee and Walsh, 2011; Li and Burden, 2002).

Firms or sponsees seek to outsource for potential cost reductions (Kumar and Eickhoff, 2006; Li and Burden, 2002), quality enhancements (Baldwin et al., 2001; Li and Burden, 2002), financial return and guaranteed revenues (Lee and Walsh, 2011; Li and Burden, 2002), and strategic considerations including the focus on core competencies (Clott, 2004; Kumar and Eickhoff, 2006; Lee and Walsh, 2011; Logan, 2000; Mol, 2007; Yakhlef, 2009). On the other hand, outsourcing bears the risk of losing control over activities (Burden and Li, 2005; Lee and Walsh, 2011), choosing bad and or opportunistic suppliers, limiting learning opportunities, and organizational disharmony (Kumar and Eickhoff, 2006; Mol, 2007; Walker et al., 2009). The financial drivers for sponsees in the outsourcing-insourcing trade-off are higher annual sponsorship returns an agency may generate, guaranteed signing fees, and lower personnel costs versus the agency commissions that must be paid. The crucial factors affecting the quality of an agency are superior experience, networks, and know-how; their innovative capabilities; and the neutral, outside perspective they may provide versus the risk of choosing a bad agency or one that acts opportunistically. Strategically, the trade-off is about control, dependency, risk transfer, and

organizational learning. Partial outsourcing may offer the best organizational learning opportunities for sponsees compared to total in- or outsourcing[1].

A special characteristic of the sports business is the intense and intertwined sporting and economic competition paired with the enormous public interest in sports (Budzinski, 2012). These characteristics pressure sponsees to achieve short-run success. As a result, at least some past outsourcing decisions were made not only because of well-grounded cost, quality, and strategic considerations; in some cases, clubs were looking for short-term financial support in the form of signing fees or other benefits granted by sports marketing agencies (Keller, 2008).

2.3 Different sponsorship sourcing models

Various sponsorship-sourcing models exist with different arrangements regarding the scope of outsourced commercial rights, legal ownership, decision control, and other dimensions (Keller, 2008; Pedersen et al., 2011; Von Appen, 2012). A sponsee may legally sell its commercial rights to an agency for a guaranteed yearly payment, thereby fully or partly leaving additional sponsorship revenues to the agency, leaving in question the control over sponsorship-related decisions. In contrast, a sponsee may retain legal ownership of its commercial rights and control over decisions by commissioning the agency to act in its name, compensating the agency with a percentage of the annual sponsorship revenues. Moreover, the agency may buy into the outsourcing deal with a signing fee and other benefits like loans, financial guarantees, and financial support for a stadium development project (Keller, 2008).

Figure 2 illustrates five stylized sponsorship-sourcing models that focus on sourcing outsourceable activities. The top-level differentiation between the five models is the degree of outsourcing. It ranges from outsourcing (models 1 and 2) o insourcing (model 5). Partial (models 3 and 4) means that sponsee and agency personnel jointly work on activities or that some commercial rights are outsourced to an agency, whereas others are retained in-house.

[1]The arguments for the outsourcing/insourcing trade-off are inspired by Bruhn (2010) and Pedersen et al. (2011), but in some points go beyond these.

Model Outsourcing degree	Model 1 Total outsourcing	Model 2 Nearly-total outsourcing	Model 3 Partial outsourcing (mixed teams)	Model 4 Partial outsourcing (differing per commercial right)	Model 5 Total insourcing
Responsibility for sponsorship management & execution	Agency	Agency	Agency (supported by sponsee)	Differs per commercial right	Sponsee
Responsibility for sponsor acquisition	Agency	Agency	Agency (supported by sponsee)	Differs per commercial right	Sponsee
Sponsorship strategy formulation	Agency	Agency	Sponsee (advised by agency)	Sponsee (advised by agency)	Sponsee
Overall marketing governance (e.g., brand building and positioning)	Agency	Sponsee	Sponsee	Sponsee	Sponsee

Figure 2: *Five stylized sponsorship-sourcing models.*

These stylized models are not exhaustive. When activities are performed in-house, sponsees may still seek temporary support from agencies, regarding the redesign of a sponsorship strategy, for example, or regarding execution support for a particular sponsorship deal. However, the models help illustrate the crucial distinguishing features in sponsee-agency arrangements. FC Bayern Munich is a case in point for the insourcing option of model 5, and the German football club, Werder Bremen, adopts partial outsourcing as in model 4. Werder Bremen's shirt sponsor, perimeter ads, and a certain category of sponsors are marketed by an agency, while other commercial rights are marketed in-house (Rehm, 2012). Models 1, 2, and 3 are difficult to differentiate because they are often referred to as comprehensive marketing models, e.g., at the German football clubs Hamburger SV and Eintracht Frankfurt (Rehm, 2012). Although sponsees and agencies are usually reluctant to disclose any contract details, the authors know from previous interviews with sponsees, sponsors, and agencies that each of the models 1, 2, and 3 do exist.

3. Determinants for the sourcing decision

3.1 Transaction Cost Economics

Coase (1937) proposed that firms and markets are alternative governance structures and market exchanges come at a cost. Accordingly, organizing exchanges within firms may be less costly than managing those exchanges via the market. Williamson (1979, 1981) expanded and elaborated on Coase's ideas stating that firms seek to efficiently organize their governance structure to minimize transaction costs, that is, the ex ante costs of planning and searching for an exchange partner, drafting and negotiating contracts and ex post costs such as adapting, measuring, monitoring and enforcing agreements.

TCE is based on two primary behavioral assumptions: (1) bounded rationality, and (2) opportunism (Williamson, 1981). Because cognitive limits prevent humans from analyzing all contingencies in contract negotiations (Simon, 1957), contracts are always incomplete at best (Williamson, 1981). On the other hand, Williamson (1985) describes opportunism as the behavior of decision-makers who purposefully seek to deceive their partners.

The actual sourcing decision is a response to the transaction costs that occur in conjunction with environmental determinants and human behavior. The sourcing decision is any position on the outsourcing-insourcing continuum, where full outsourcing is one extreme and full insourcing the other; one of the reasons outsourcing is also considered a hybrid governance mechanism. Environmental determinants comprise asset specificity, uncertainty, and transaction frequency (Williamson, 1979, 1981, 1985). We drop frequency in the context of sports sponsorship because the outsourceable activities in our focus typically occur on a recurring or ongoing basis and most previous studies fail to empirically justify a relation between transaction frequency and the tendency to outsource (Rindfleisch and Heide, 1997).

3.1.1 Asset specificity

From a TCE perspective, the most powerful and empirically robust determinant is asset specificity (Holcomb and Hitt, 2007; Parmigiani, 2007; Rindfleisch and Heide, 1997). It refers to the extent assets have a specific value for a particular use versus the value that they have for any other use and for other users. Highly specific assets have little value outside a particular transaction; they are called idiosyncratic because they are customized to the firm and to the transaction. Assets with low specificity are standardized and can be used in various transactions and by different actors (Williamson, 1981).

In sports sponsorship, the most important sponsee assets include human assets, e.g., the personnel's sponsorship-specific qualifications, know-how, sponsee-specific information, and knowledge of sponsor requirements; site-specific assets, e.g., stadium, perimeter advertising space, business seats, and VIP boxes; structural assets, e.g., operational and organizational structure, governance, and control system; cultural assets, e.g., knowledge-management and learning, employee identification, loyalty, and teamwork; and reputation, e.g., brand and image (Keller, 2008).

These assets differ in specificity. Sponsorship activities are most likely to involve human assets, which Williamson (1981) calls learning by doing. Pursuing these activities depends on in-depth knowledge about a sponsee's history, identity, members, and fans. Special knowledge and working relationships within the sport organization, as well as between the sponsee and sponsors, are generated and create specific human capital that is more difficult to apply outside the organization. This knowledge is especially important when long-term sponsorship activities with certain sponsors may turn into transaction-specific investments (e.g., Adidas and Bayern Munich) that are very unlikely to be outsourced to an agency. Furthermore, human asset specificity may also be high in smaller clubs that lack the necessary resources to retain large sponsorship teams. Consider a small club where only one manager is responsible for sponsorship activities. Not only does one person embody the sponsee's

entire knowledge but this person also has established very close ties to the sponsors. In the extreme case, the sponsors may want to work only with this person.

TCE suggests that firms deploying transaction-specific investments face the danger of opportunistic exploitation by their exchange partner. A hold-up problem (or lock-in) occurs as highly specific assets become quasi-obsolete outside the relationship, creating a safeguarding problem and consequently increasing transaction costs. For example, high asset specificity requires that an external provider make significant ex ante investments to learn and understand the specific situation and requirements of a sponsee (Dibbern and Heinzl, 2009), which can be opportunistically exploited ex post. In contrast, Anderson (1985) hypothesizes that sponsees may also face the danger of opportunism when agents, especially when there are only a few in the market, have gathered so much specific knowledge that they are "uniquely qualified to perform the transaction." Agencies may become opportunistic and inflexible because they know they are difficult to replace.

According to Williamson (1985), firms safeguard specific assets through insourcing. This is supported by Holcomb and Hitt's (2007) contention that in high asset-specificity environments "contracting is difficult, expensive and often counter-productive." Rindfleisch and Heide (1997) confirm the strong evidence for vertical integration mechanisms to cope with safeguarding specific assets. Depending on the sponsee's assessment of its asset specific investments it may opt for total insourcing of all sport sponsorship activities.

> ***Proposition 1a:*** *If sport sponsorship activities involve transaction-specific investments that are too costly to safeguard through market mechanisms, sponsees will pursue their sponsorship activities in-house.*

In contrast to vertical integration, firms may deploy hybrid governance mechanisms to defend their specific investments (Rindfleisch and Heide, 1997). For example, Heide (1994) suggests unilateral structures create a quasi-hierarchical relationship through contractual control, and bilateral ones promote closer

relationships between partners that may have congruent goals and interests. Indeed, Williamson (2008) states that vertical integration serves as a last resort type of solution to the safeguarding problem, and, hence, suggests firms should outsource.

Joskow (1987) finds that firms engage in long-term contracting to safeguard their specific assets, while Dibbern and Heinzl (2009) propose that partners may become protective against opportunistic behavior and employ incentive-based contracts or control mechanisms. In fact, anecdotal evidence indicates that sponsees and agencies engage in long-term relationships over more than 10 years (Borussia Dortmund GmbH & Co. KGaA, 2008; Oediger, 2007). Other forms of safeguarding include bilateral agreements that foster closer relationships of exchange partners through joint action and expectations of continuity (Heide and John, 1990), or the establishment of relational norms (Heide and John, 1992), whereby sponsees and agencies work closely together, cooperate, and establish mixed-teams. The sponsorship-sourcing models outlined demonstrate some of the contractual agreements in which sponsees and agencies may engage. In fact, these agreements are safeguarding mechanisms for both exchange partners.

> ***Proposition 1b:*** *Sponsees and agencies employ several safeguarding mechanisms in outsourcing relationships: long-term contracting, exclusive contract agreements, incentive-based contracting or facilitating closer relationships through cooperation and mixed-teams.*

3.1.2 Uncertainty

The dimension of uncertainty, in TCE, refers to unpredictable changes in the environment, i.e., environmental uncertainty, and to difficulties evaluating the performance of exchange partners, i.e., behavioral uncertainty (Williamson, 1985). Because decision-makers are boundedly rational, they can never include all conceivable contingencies when negotiating contracts, therefore adjusting contractual agreements as changes in the external environment occur is problematic (Rindfleisch and Heide, 1997). On the other hand, bounded rationality also limits decision-makers

in monitoring the contract compliance of their exchange partners. The extant literature uses external and environmental uncertainty or internal and behavioral uncertainty interchangeably (Anderson, 1985; Klein et al., 1990; Rindfleisch and Heide, 1997; Williamson, 1981).

Rindfleisch and Heide (1997) state that environmental uncertainty creates an adaptation problem, primarily regarding unpredictability in demand or volume, but it also includes changes in technological developments (Williamson, 1985). Volume uncertainty refers to the unpredictability of the sponsor demand that the sponsee will face in the future. Although some drivers of sponsor demand are unlikely to be erratic and somewhat controllable (e.g., sponsor satisfaction through good service, brand, and image management) sporting success is highly unpredictable (though a sponsee's fanbase is less volatile in the short-term). Thus, volume uncertainty tends to be high. Technological uncertainty exists when the technology in an industry or in a specific business function is subject to change. It refers to developments like new sponsorship opportunities in social media channels and the rise of rotating LED perimeter advertising boards in stadiums. Sponsees may be reluctant to invest in learning to adapt to new technologies (e.g., social media channels) and therefore misunderstand the importance of new media channels for their sponsors.

There is mixed evidence that high environmental uncertainty eventually leads to more or less outsourcing (Parmigiani, 2007). Williamson (1985) argues that high environmental uncertainty leads to more adaptation and coordination challenges, making outsourcing less attractive compared to insourcing. Rindfleisch and Heide (1997) find only limited empirical support in TCE literature for vertical integration in uncertain environments. Levy's (1985) findings confirm that firms are likely to insource in uncertain environments, but Anderson (1985) finds evidence that environmental uncertainty only in combination with transaction-specific investments leads to insourcing. Klein et al. (1990) posit that environmental volatility in foreign markets has a positive effect on insourcing while environmental diversity is positively related to outsourcing. Furthermore, Holcomb and Hitt (2007) propose that firms'

governance mechanisms with regards to technological uncertainty are ambiguous. Firms may be reluctant to invest in new technologies because they may become obsolete (Balakrishnan and Wernerfelt, 1986; Heide and John, 1990), or technological uncertainty may increase the risk of opportunistic agent behavior in outsourcing relationships (Holcomb and Hitt, 2007), particularly when sponsees are unaware of current technological realities.

Holcomb and Hitt (2007) summarize the ambiguous effects of environmental uncertainty on outsourcing in that technological uncertainty will have "a non-linear or inverse U-shaped effect on outsourcing". They expect firms will outsource when technological uncertainty is low to moderate and insource when it is high. We agree with Holcomb and Hitt's (2007) suggestion and make our proposition accordingly.

> ***Proposition 2a:*** *Sponsees are more likely to outsource their sponsorship activities with low to moderate levels of environmental and technological uncertainty and insource activities with high levels of environmental and technological uncertainty.*

In contrast to environmental uncertainty, behavioral uncertainty arises from bounded rationality (Rindfleisch and Heide, 1997) and partly from the risk of opportunistic behavior (John and Weitz, 1988). Because it is difficult to assess the contractual compliance of exchange partners (Williamson, 1985), this creates a performance measurement problem (Rindfleisch and Heide, 1997). High behavioral uncertainty drives ex ante screening and selection costs while increasing ex post performance measurement costs (Rindfleisch and Heide, 1997). Anderson and Schmittlein (1984, p. 388) put forward that evaluating sales performance of partners may not be simple because there are several factors "the relative importance of each being hard to ascertain and the value of each being difficult to measure (e.g., satisfaction of prospects approached, value of market intelligence provided)." Since firms try to minimize their transaction costs, Williamson (1985) proposes that vertical integration is the most efficient means to cope with the performance measurement problem. This is not to say that retaining activities in-house fully protects from

opportunistic behavior, but measuring and controlling the own organization is typically easier and cheaper than measuring and controlling the market (John and Weitz, 1988; Poppo and Zenger, 1998).

Parmigiani (2007) finds that activities associated with high behavioral uncertainty are more likely to be retained in-house. Anderson and Schmittlein (1984) and Anderson (1985) find strong evidence that performance measurement difficulties push firms to use direct sales forces (vertical integration). Heide and John (1990) suggest that firms facing behavioral uncertainty engage in ex ante screening of exchange partners that need meet a set of (predetermined) criteria because ex post measurement is likely to be insufficient. Similarly, firms negotiate more specific (explicit) contracts ex ante to lower ex post transaction costs, raising their ex ante contracting costs (Mooi and Ghosh, 2010). Creative tasks are especially difficult to define. Carson (2007) finds evidence that suppliers perform better in creative tasks when firms engage in ex ante control (i.e., comprehensive contracts) and performance decreases with ex post control (i.e., monitoring). Firms pursue less ex ante and ex post control, however, when the nature of the creative task is high.

When outsourcing sponsorship-related activities sponsees essentially buy services that are difficult to define and assess. Implementing a sponsorship strategy takes time and may present its fruitful outcome only after years. It takes years to build positive images and strong brands. Moreover, when sponsees and agencies work closely together, it may be difficult to assign a successful lead or sponsorship deal to any one person because the results are based on team efforts. These are ex ante and ex post transaction costs that lead to inefficiencies because of bounded rationality. On the other hand, opportunistic behavior may also affect behavioral uncertainty (e.g., ex post performance measurement). For instance, sponsees can observe only the sponsorship deals the agency proposes, never those that are not proposed.

Sponsees may need to exert ex ante agency screening by soliciting a request for proposals. Moreover, they may require several case studies or past sponsee references to select the best agency for their sport sponsorship activities. Performance

measurement may be facilitated when sponsees let third-party market researchers assess sponsor's satisfaction and conduct marketing surveys to evaluate sponsorship effectiveness. If ex ante screening costs and ex post measurement costs are too high, Williamson's (1981) TCE framework suggests full insourcing of sport sponsorship activities. Yet, we have seen that firms also engage in hybrid governance mechanisms to counteract behavioral uncertainty.

There is mixed-evidence for the interaction between asset specificity and environmental and behavioral uncertainty (e.g., Anderson, 1985; Anderson and Schmittlein, 1984; Carson, 2007), which makes it difficult to make clear propositions on the interactions between asset specificity and uncertainty.

> ***Proposition 2b:*** *To decrease behavioral uncertainty, sponsees will engage in (1) ex ante screening by carefully assessing potential agencies; (2) ex ante negotiations to write more comprehensive contracts; and (3) ex post performance monitoring of agencies. Sponsees are more likely to insource their activities if these ex ante and ex post transaction costs are higher under an outsourcing agreement.*

3.2 Resource-based View and strategic outsourcing

According to Seth and Thomas (1994, p. 177) the Resource-based View (RBV) suggests that "a firm's distinctive competence is based on the specialized resources, assets, and skills it possesses, and focuses attention on the optimum utilization of these to build competitive advantage and thus economic wealth." The company itself is conceived as a set of resources such as knowledge, physical assets, human capital, and other tangible and intangible assets (Amit and Schoemaker, 1993; Wernerfelt, 1984). Others have used capabilities, skills, assets, core and distinctive competencies, and operant resources (Barney, 1991; Fahy and Smithee, 1999; Prahalad and Hamel, 1990; Vargo and Lusch, 2004) to describe corporate resources that create competitive advantages. We understand capabilities as part of resources along the lines of Barney (1991).

RBV's underlying assumptions are that resources are heterogeneous across firms and imperfectly mobile (Barney, 1991). A firm's ability to create and maintain a

competitive advantage depends on its access to strategic resources that fulfill four criteria – they must be valuable, rare, difficult to imitate, and non-substitutable (Barney, 1991). If a resource is not valuable, competitive advantage cannot arise. If a resource is not rare, its easy obtainability would not generate competitive advantage. Finally, strategic resources must be difficult to imitate and substitute by competitors, otherwise, competitive advantage would not be sustainable.

TCE's asset specificity is closely linked to RBV's strategic resources, making it very difficult to deliberately demarcate both concepts. A site specific asset, such as VIP boxes in stadiums, is immobile and has no use outside the stadium (or sponsee); however, VIP boxes are not necessarily a source of competitive advantage, since they are standard stadium equipment of many sports clubs and thus are not necessarily rare. Access to strategic resources that meet Barney's (1991) criteria, in contrast, leads to sustained competitive advantages. We understand sponsorship activities to be based mainly on human assets, therefore, we set asset specificity and strategic resources as equivalent for our purposes, which is in line with the existing literature (e.g., Balakrishnan and Fox, 1993; Chi, 1994).

3.2.1 Strategic relevance of sponsorship-related activities

RBV helps us understand which of the sponsorship-related activities are more likely to be outsourced. Sponsees will retain in-house activities with high strategic relevance; on the contrary, sponsees will seek to outsource activities with low strategic relevance (Prahalad and Hamel, 1990; Quinn and Hilmer, 1994). This requires a critical self-assessment by sponsees and constant comparisons with the market. Understanding the activities a sponsee does well, especially better than its competitors and better than agencies, and assigning poorly performed activities to outside agencies is key for the sourcing decision (Argyres, 1996).

Strategic resources in the context of sponsorship are mainly related to human capital, but may also include intangible resources. Human capital resources include experience, know-how, and qualified personnel. Intangible resources comprise relational and cultural aspects, like interconnectedness with sponsors and with the

market, internal and external communication, commitment, and a sponsee's culture (Dietl and Schweizer, 2014). Credibility and an authentic representation of the sponsee brand should also be considered potential strategic resources for some sponsorship-related activities. One stream of sponsorship research examines the relationship quality between sponsor and sponsee and identifies trust, mutual understanding, communication, cooperation, and conveyance of a long-term perspective as important relational factors (Nufer and Bühler, 2010). This resembles the previously described transaction-specific investment that may be generated by cooperating with certain sponsors over a very long period of time. Indeed, some sponsees are so strongly interrelated with their sponsors (e.g., FC Bayern Munich with Adidas, Allianz, and Audi) that the sponsoring agreements become shareholder investments with sponsor representatives acting as supervisory board members of sponsees. These relationships between sponsees and their sponsors are highly intertwined, have a long-term focus, and are strategic, thus they are not suitable for outsourcing.

While a sponsee could consider sponsorship management and execution as strategic, some of the sub-activities, such as the production of events or marketing campaigns could be outsourced to agencies. Depending on the sponsee's management team and its skills, sponsorship strategy formulation as well as brand-building, positioning, and management activities may have strategic importance. A sub-activity, such as creating a price benchmark of the sponsee's peer-group, may be outsourced to agencies that may have better market-insights, while vision and guidelines are formulated in-house. Klein et al. (1990) suggest that when only one or a few activities are outsourced, the sponsee may still be in control of the channel, including its transaction costs, asset specificity notwithstanding. Brand-building and positioning are activities that take time and effort to demonstrate effectiveness; the sponsee is likely to have more proximity to and understanding of its main stakeholders (e.g., fans, investors, or city) than an agency, thus making this activity more strategic.

Sponsees could regard some of their commercial rights (e.g., shirt sponsorship or stadium naming rights) more strategic than their other commercial rights (e.g.,

hospitality) because some rights are more strongly related with the sponsee and create more attention. Sponsees may then hierarchically design their sponsorship strategy and architecture by distinguishing their agreements in different kinds of partnerships according to the negotiated rights, marketing activities, and prices.

3.2.2 The combination of TCE and RBV theories

Combining TCE's theoretical foundations and RBV concepts, sponsees' sourcing decisions are essentially based on identifying and safeguarding specific assets and strategic resources.

Indeed, the governance structures we outline earlier resemble varying safeguarding mechanisms for sponsorship activities that require strategic resources. Sponsees will carefully assess their capabilities and compare them with those of the market (i.e., agencies) to distinguish strategic and non-strategic resources. They will outsource those activities that do not require strategic resources.

> ***Proposition 3a:*** *Sponsees will safeguard their transaction-specific investments and strategic resources by (1) vertically integrating sponsorship activities that require strategic resources, (2) retaining those sponsorship relationships they assess to be strategically more important, and (3) by differentiating among several strategic and non-strategic commercial rights and outsourcing only non-strategic ones.*

The overlap between TCE and RBV concepts, however, does not always lead to the same conclusions about boundary decisions. RBV helps us extend TCE's original solutions that are mainly based on minimizing transaction costs (Williamson, 1981). In TCE, strategic resources and capabilities are only assumed implicitly and Barney (1999, p. 140) says "simply do not play a significant role in traditional transaction cost analyses of firm boundaries."

When sponsees lack the necessary strategic resources for success and producing them in-house or by external acquisition is too costly, TCE's original solution set is insufficient. In this case, Barney (1999) suggests that firms may opt for intermediate

governance through complex contracting and long-term agreements even in the face of transaction-specific investments and significant threats of opportunism.

Sponsees may diagnose deficits in relevant strategic resources and seek external support to fill this gap (Dibbern and Heinzl, 2009). Argyres (1996) finds evidence that firms decide to outsource their activities although TCE logic would suggest internalizing activities that include highly specific assets; in cases where TCE logic would suggest outsourcing activities, firms have, indeed, chosen insourcing because of capability considerations. The larger the deficits in strategic resources and the less likely this gap can be closed in-house, the more attractive outsourcing becomes (Dibbern and Heinzl, 2009).

We conclude that sponsees will more likely engage in outsourcing if they lack the necessary strategic resources and are unable to produce them in-house. The focus is clearly set on acquiring capabilities, however, the safeguarding mechanisms introduced earlier still hold true in this case, even if they might not fully prevent opportunism.

> ***Proposition 3b**: Sponsees that lack the necessary strategic resources to pursue sponsorship activities in-house will likely outsource their activities through complex contractual agreements and long-term contracting even if they may be unable to prevent their partners' opportunistic behavior.*

Adding the RBV to our conceptual framework also paves the way for strategic outsourcing considerations that may themselves generate sources of sustained competitive advantage. Holcomb and Hitt (2007) advance the notion that boundary decisions not only separate firms from their environment but also integrate them; this process of creating relationships with intermediaries is called "bridges." Their resource-based strategic outsourcing model proposes four dimensions; we will focus on three: complementarity of capabilities, strategic relatedness, and cooperative experiences.

First, Holcomb and Hitt (2007) suggest that partners invest in complementary specific assets that are difficult to imitate and have no use outside the relationship, i.e.,

relationship-specific (Dyer and Singh, 1998). Both parties would create less value if they pursued those activities alone, only the complementary relationship leads to sustained competitive advantages. Repeated ties with agencies and the generated implicit learning may provide the safeguards needed in TCE considerations. Second, Holcomb and Hitt (2007) propose that strategic relatedness and congruent goals facilitate sustained competitive advantages. Aligning goals by outsourcing reduces monitoring and enforcement costs (behavioral uncertainty) and fosters synergies. Relationship qualities improve, leading to less opportunistic behavior (Granovetter, 1985), and reduce the need for explicit contracts (Dyer and Singh, 1998), consequently, firms more readily accept adaptions (environmental uncertainty; Uzzi, 1997). As such, complex and formal contractual agreements are not always necessary to safeguard specific assets.

Third, cooperative experience with agencies creates sustained competitive advantages (Holcomb and Hitt, 2007). Repeated ties allow sponsees to establish a basis for trust, likely improving performance, decreasing the complexity and costs of negotiation processes, and reducing conflicts (Zaheer et al., 1998). Transaction costs that arise because of opportunism, and environmental and behavioral uncertainty are reduced when sponsees share strong cooperative experiences. Moreover, they involve social processes that promote norms of adaptation and information exchange (Holcomb and Hitt, 2007). We conclude that sponsees may pursue strategic outsourcing and create sustained competitive advantages together with agencies as they join complementary capabilities, establish congruent goals, and have cooperative experiences based on trust.

> ***Proposition 3c:*** *Sponsees can generate sustained competitive advantages through outsourcing and thereby reduce transaction costs if (a) complementary capabilities with agencies exist, (b) if they can establish congruent goals with their partners, and (c) if they have cooperative experiences based on trust.*

3.3 Contingency Theory

TCE determinants help us understand outsourcing decisions from an economizing perspective, while RBV determinants expand our analysis where TCE concepts are insufficient to explain the various sourcing decisions sponsees make. Assuming that each sponsee rationally makes the strategic sourcing decision based on TCE- and RBV-determinants, and the decision is not biased by other non-strategic factors, the reason for choosing disparate sourcing approaches is that sponsees assess their internal and external situation differently. Therefore, we turn to Contingency Theory (CT) and propose additional determinants to understand why sponsees may differently assess the TCE- and RBV-determinants.

According to CT there is no single best organizational structure for a company; the appropriate organizational structure depends on contingencies in a company's internal and external situation (Galbraith, 1973). In our context, this means a sponsee's approach to sponsorship sourcing depends on its characteristics and its situation.

Numerous potential contingencies in sports sponsorship, including sponsee size, sporting and economic success, image and awareness, appeal to potential sponsors, legal structure, professionalism, regional conditions, and the management's risk preference, may influence the classical TCE- and RBV-determinants and, consequently, the sourcing decision. However, we consider two contingencies as most promising for the sourcing decision in sports sponsorship: a sponsee's size and its "degree of professionalism" (DoP).

An organization's size is often regarded as a key contingency for outsourcing and other strategic decisions (e.g., Abraham and Taylor, 1996; Cusmano et al., 2010; Taymaz and Kilicaslan, 2005). We argue that organization size is also an important determinant in sports sponsorship. The sponsee's size may be approximated by its revenue and financial resources, sporting success, image and level of awareness, appeal to potential sponsors, and the attractiveness of the sport. Development and maintenance of sponsorship infrastructure, know-how, and qualified personnel require financial expenses, which are relatively easier to manage for larger sponsees.

TCE literature suggests that sponsee size may lead directly to more insourcing (Anderson and Schmittlein, 1984; Erramilli and Rao, 1993), moderate the sourcing decision towards insourcing (Erramilli and Rao, 1993), or have no significant effects on the sourcing decision (Anderson, 1985). Nooteboom (1993) suggests that small firms face relatively higher transaction costs and higher costs of governance mechanisms to reduce them; hence, transactions tend to gravitate to external suppliers, if there are any. Moreover, large sponsees are more robust to environmental uncertainty and face lower levels of behavioral uncertainty, while small-sized sponsees have more difficulties protecting themselves from opportunistic behavior (Nooteboom, 1993). As for RBV, Abraham and Taylor (1996) posit that small companies are more likely to outsource because they have limited resources and concentrate on core activities.

Anecdotal evidence suggests that large sponsees, such as FC Bayern Munich and Real Madrid, pursue all their sponsorship activities in-house, while smaller sponsees, e.g., Werder Bremen or Hamburger SV, outsource some of their sponsorship-related activities and commercial rights. Barney (1999) suggests that capabilities may depend on historical contexts, i.e., being in the right place at the right time. Consider Adidas' long history sponsoring football clubs; the German national team as well as FC Bayern Munich and Adidas share a history of almost 50 years (Oberhuber, 2015). These long-lasting relationships allow sponsees to create specific capabilities that are very difficult to replicate. These capabilities are reinforced because larger sports clubs win more titles, and create more media attention. Large sponsees had to acquire sponsorship-specific skills very early, and therefore, may be better suited to pursue sponsorship activities in-house.

We believe the larger a sponsee the more likely it is to have created sponsorship-specific skills and capabilities early in its existence, and the less likely it is to face significant deficits in strategic resources. Thus, large sponsees tend to insource.

Proposition 4a: *Larger sponsees are more likely to insource their sponsorship-related activities because (a) their capabilities may stem from historical contexts; (b) they are less likely to face deficits in strategic resources; and (c) even if they face deficits, they usually have the financial power to produce the necessary resources in-house and safeguard their transaction-specific investments.*

Most sponsees are considered small and medium-sized enterprises (Moore and Levermore, 2012; Nufer and Bühler, 2010. Sponsees that are too small and economically uninteresting to agencies are forced to fully insource their sponsorship activities. Other small sponsees may be severely dependent on the agency when outsourcing. Market concentration on the agency side raises transaction costs. When agencies know that they are irreplaceable, they may become opportunistic and inflexible (Anderson, 1985; Williamson, 1981, 1985). Butaney and Wortzel (1988) suggest that agencies' market power is increased if customers' switching costs are high, sponsee competition is strong, and the distribution of sales is relatively equal. Heide (1994) suggests that dependent firms try to solve this problem by establishing formal and informal relationships with other firms. Small sponsees may pool their marketing and sponsorship opportunities with other small sponsees in order to attract agencies and to engage in contracting efforts to cope with the dependency problem.

Proposition 4b: *Smaller sponsees may (1) pool their sponsorship opportunities with other sponsees to counteract the agency availability problem, and (2) increase their cooperation and contracting efforts to cope with the dependency problem.*

To develop and maintain strategic resources, sponsees need a certain degree of professionalism (DoP). We propose DoP as a second important contingency in sports sponsorship. Dietl and Schweizer (2014) emphasize the importance of management's DoP towards sports sponsorship. DoP encompasses the sponsee management's (1) understanding that the development of an appropriate sponsorship architecture including sponsorship strategy, organizational structure, processes, and brand management is essential for successful sponsorship in the long run, and (2) commitment to act and, if necessary, to invest accordingly in qualified personnel and

infrastructure (organizational set-up, processes, tools, equipment, and training). Indeed, some sponsees lack professionalism (Stotlar, 2009), which leads to problems with regard to sponsorship-related activities. This problem is supported by arguments (Cornwell, 2008; Klewenhagen et al., 2011) that sponsees are working to further professionalize their sponsorship operations. Sam et al. (2005) refer to sponsee's professionalization efforts as "moving from the kitchen table to the boardroom."

As the sports industry grew to a multi-billion dollar business, sports clubs underwent professionalization to cope with the increasingly complex challenges of their growing industry. They restructured their organizations from associations to corporations and reorganized their sports and management activities along the legal structures of the newly built entities. As a consequence, sports corporations face stricter laws (e.g., regular financial reports and audits). These changes necessarily led to new organizational structures and key administrative processes for managing sports clubs. Today, sports clubs have dedicated management boards including CEOs, and operations and marketing directors. Furthermore, we think DoP is positively related to size (e.g., large-sized sponsees have dedicated and specialized managers, and likely have more experience with multinational sponsees with stricter and more professional requirements).

A sponsee's DoP does not always provide clear directions to the sourcing decisions. A low DoP may negatively moderate a sponsee's sourcing decision. Moreover, if DoP is understood as a relational norm (Heide and John, 1992), it may act as a safeguard between exchange partners.

We think that less professional sponsees are prone to myopia, which can lead them to erroneously assess their situation and to wrong conclusions for outsourcing. In TCE logic, less professional sponsees are more strongly influenced by bounded rationality leading to wrong evaluations regarding environmental and behavioral uncertainties, as well as threats of opportunism. Transaction costs may be underestimated (overestimated), eventually influencing the sourcing decision towards outsourcing (insourcing), when insourcing (outsourcing) would be the more efficient

option. As for RBV, less professional sponsees may invest in resources that are non-strategic, hampering the creation of sustained competitive advantages. In short, low DoP may lead sponsees to misidentify strategic resources and fail to safeguard transaction-specific investments.

Consider a club owner who is eager to take his sports club to a higher sporting level (Keller, 2008), he needs financial support to invest in new talent. In such a situation the sponsee may overestimate the short-term return of a higher league position and engage in an outsourcing deal with an agency to guarantee up-front investments. The agreement might include activities and control of strategic commercial rights that would otherwise not be readily outsourced. The sponsee may become locked into in a long-term and disadvantageous contract with an agency, especially when the costs of investing in new talent are underestimated.

> ***Proposition 4d:*** *If high DoP is understood as a relational norm between exchange partners, it may constitute a safeguard against environmental and behavioral uncertainty, and opportunistic behavior of exchange partners, thus reducing transaction costs and harmonizing the outsourcing relationship.*

4. Discussion and conclusion

This paper offers an explanatory framework to describe why sponsees approach sourcing sponsorship-related activities in completely different ways, ranging from total outsourcing to total insourcing. The typical determinants used to explain outsourcing decisions derived from TCE and RBV theories are useful to understand the factors likely to influence a sponsee's outsourcing decision and to explain which activities are more or less likely to be outsourced. However, these determinants insufficiently explain why sponsees assess their internal and external situations differently. Drawing from CT, we introduce two additional determinants: the size of a sponsee and the DoP of a sponsee's management.

Developing our integrative framework, we make several propositions with regards to TCE's main assumptions and dimensions. Clearly, if the transaction costs

that arise because asset specificity and uncertainty are too high, sponsees will more likely pursue their sponsorship activities in-house. Sponsees and agencies have found, however, several solutions to cope with transaction-specific investments and uncertainty.

Furthermore, we analyze how RBV considerations may direct a sponsee's boundary decision and expand our previous TCE perspective. We propose that sponsees must identify and safeguard their strategic resources. They are likely to pursue strategic activities in-house. Moreover, we contend sponsees that lack the necessary strategic resource will opt for outsourcing through long-term and complex agreements in spite of considerable threats of opportunism. We demonstrate how TCE theory may lead to different conclusions if the RBV is not taken into account. We also show how outsourcing relationships by themselves may form sustained competitive advantages and, in fact, decrease transaction costs through complementary capabilities, congruent goals, and cooperative experiences.

Both a sponsee's size and its management's DoP may directly affect or moderate a sourcing decision. We find that a sponsee's size is of particular importance and positively influences the likelihood to insource sponsorship activities. Moreover, size and DoP are positively related to each other, and a low DoP may negatively moderate a sourcing decision. In addition, a high DoP, if understood as a relational norm, may act as a safeguard between sponsee and agency.

Our multi-theoretical framework extensively discusses TCE and RBV concepts and adds additional contingencies that may help managers better understand their own organizations and external environments. While we think that managers in the sports industry may (implicitly) base their outsourcing decisions on analyses that parallel our concepts, we believe they may profit from our propositions with regards to potential safeguarding mechanisms for transaction-specific investments, measures to cope with both environmental and behavioral uncertainties, and the importance of strategic resources. Moreover, a sponsee's size may already give an indication for the sourcing considerations, while professionalization initiatives may bear fruit in the long

run, as improved self-assessment and as a safeguard in exchange relationships with agencies.

To the best of our knowledge, sports sponsorship outsourcing has not been conceptually analyzed by applying an integrative TCE-, RBV- and CT approach, particularly not from a sponsee's perspective. In that sense, we add a new view to Sam et al. (2005)'s TCE analysis in sponsee-sponsor relationships. We also expand Holcomb and Hitt's (2007) strategic outsourcing model by including CT- related determinants to the framework. Curiously, in Williamson's (1981) TCE concept and Barney's (1991) RBV concept, size is not explicitly mentioned and appears only later in Barney's (1999) discussion of boundary decisions. DoP is relevant to the sports industry because of the historical context of sports organizations. We expand the discussion on sourcing decisions by explicitly analyzing size and DOP as additional important contingencies.

Our discussion includes conceptual and empirical literature on TCE, RBV, and CT. In addition, we draw from the sports industry literature and take anecdotal evidence into consideration to present our conceptual framework. We believe further research may advance our ideas and propositions, especially by empirically analyzing our propositions. For instance, an in-depth case study analysis may be valuable to better understand how sponsees' management teams approach their sourcing decisions and whether our TCE-, RBV-, and CT determinants play an essential role in their analyses. Just as TCE concepts underwent empirical tests, further research could operationalize our proposed determinants and test their effects on sponsorship-sourcing decisions and safeguarding mechanisms. Such testing could indicate how well the proposed determinants explain actual sourcing approaches and contract agreements.

We have restricted our contingencies to size and DoP; other contingencies, for example, sponsee managers' risk preference and Agency Theory considerations, may also influence the sourcing decision. Our definition of DoP is based on sponsee management's understanding and commitment. Future work might delve into the

measurement of DoP, scrutinize our ideas, and include further factors for DoP, such as a sponsee's level of confidence and its experience (Menkhoff et al., 2013).

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A.2

The role of facial attractiveness in tennis TV-viewership[†]

Helmut Dietl, Anil Özdemir, and Andrew Rendall

Abstract

Social sciences, anthropology, psychology, and economics researchers have shown various effects of physical attractiveness. In this study, the authors analyze 622 live tennis matches from 66 Grand Slam tournaments between 2000 and 2016, examining the relationship between facial attractiveness, measured by tennis players' facial symmetry, and TV-viewership. Results indicate that facial symmetry plays a positive role for female matches while there is no significant effect for male matches. The effect persists in several subsample regressions and robustness checks. The findings have important implications for managers in the field of sports. While public broadcasters have a public service function and therefore should be careful in exploiting consumer biases to avoid reinforcing non-sports taste-based discrimination types. Commercial broadcasters and media institutions with solely profit-maximizing objectives will likely exploit consumer biases.

JEL Classification: L83, D12, Z2
Keywords: physical attractiveness, demand, consumer discrimination, tennis

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What is beautiful is good (Sappho)

1. Introduction

Scholars in social sciences, anthropology, psychology, and economics have analyzed and shown various effects of physical attractiveness. Physically attractive people earned more (Hamermesh & Biddle, 1994; Mobius & Rosenblat, 2006; Rosenblat, 2008), and they were hired (Dipboye, Arvey, & Terpstra, 1977) and trusted more often (Darai & Grätz, 2013; Rosenblat, 2008; Solnick & Schweitzer, 1999; Wilson & Eckel, 2006). Teachers had higher expectations with regard to a student's potential when the student was attractive (Clifford & Walster, 1973). In high school, attractive adolescents scored higher grades and were favored by their teachers (Gordon, Crosnoe, & Wang, 2013). In the courtroom, jurors were not only more likely to convict plain people but also to give harsher sentences if defendants were unattractive (Gunnell & Ceci, 2010).

The concept of beauty also caught attention in the field of sports. Researchers focused on baseball (Trail & James, 2001), American football (Berri, Simmons, van Gilder, & O'Neill, 2011; Carlson & Donavan, 2013), European football (Hoegele, Schmidt, & Torgler, 2016; Mutz & Meier, 2016; Rosar, Hagenah, & Klein, 2010), and tennis (Bakkenbüll, 2017; Bakkenbüll & Kiefer, 2015; Meier & Konjer, 2015). Researchers analyzed the effects of physical attractiveness on salary outcomes, consumption habits, athlete brand building, and gendered presentation of athletes in the sports media commercial complex. Recently Meier and Konjer (2015) empirically analyzed German TV ratings for tennis matches and found no evidence for a beauty premium in sports consumption. Given the methodological issues and the rather unexpected results of the paper, we call for a new attempt to analyze the effect of physical attractiveness on sports consumption as a taste-based discrimination type (Becker, 1971).

To study the relationship between facial attractiveness and TV-viewership, we analyze 622 live tennis matches from 66 Grand Slams between 2000 and 2016, focusing only on quarterfinal, semi-final, and final matches. We use TV-viewership data from

SRG, the Swiss national TV broadcaster. SRG broadcasts on several channels in German, French, and Italian. We use facial symmetry (Perrett et al., 1999; Rhodes, Proffitt, Grady, & Sumich, 1998) as a proxy for facial attractiveness and calculate facial symmetry scores by using a software called Prettyscale. The advantage of focusing our research on tennis is straightforward. In comparison to any other sport (especially team sports), the TV camera focuses only on two players, thus, reducing the noise in the data. In contrast to Meier and Konjer (2015), we analyze data over several years and use more reliable methods to derive attractiveness scores. Our analyses indicate that facial symmetry plays a positive and significant role for female tennis matches, while we do not observe any significant effects for male matches.

2. Literature

2.1 Physical attractiveness and the beauty premium

Beauty is a concept that mesmerized societies for centuries[1]. The extant literature in recent decades concluded that (a) facial symmetry played a significant role in attractiveness ratings (Perrett et al., 1999; Rhodes et al., 1998) and (b) that beauty standards were culturally universal (Cunningham, Roberts, Barbee, Druen, & Wu, 1995; Jones & Hill, 1993; Perrett, May, & Yoshikawa, 1994). Langlois, Ritter, Casey, and Sawin (1995) showed that mothers were more affectionate and playful if their infants were more attractive. Infants had a preference for prototyped, that is, mathematically averaged (Rubenstein, Kalakanis, & Langlois, 1999), and attractive faces (Langlois et al., 1987), thereby questioning the conventional wisdom that standards of attractiveness are mainly socialized and driven by media. Hatfield and Sprecher (1986) summarized that societies broadly agreed on the standards of beauty and that these standards changed slowly over time.

Using household data in the US and Canada, Hamermesh and Biddle (1994) analyzed how beauty affects labor market outcomes: attractive employees' wages were

[1] For an extensive summary on physical attractiveness, see Hatfield and Sprecher (1986) or Hamermesh (2011).

significantly higher (up to five percent); interestingly, the wage penalty for unattractiveness was harsher (up to eight percent). Similar evidence was found for specific jobs (Biddle & Hamermesh, 1998), and in several other countries, such as Britain (Harper, 2000), China (Hamermesh, Meng, & Zhang, 2002), and Australia (Leigh & Borland, 2007). Although numerous researchers replicated these findings, the causality between physical attractiveness and productivity, and therefore income, in these econometric studies remained ambiguous. Attractiveness might have caused increased productivity because attractive individuals were more confident and usually had better social and communication skills (Mobius & Rosenblat, 2006). These social skills might have helped attractive individuals to more productively interact with co-workers or clients (Hamermesh & Biddle, 1994). However, the productivity gains might have been caused by consumer discrimination (i.e., clients preferring to deal with better-looking individuals).

Mobius and Rosenblat (2006) analyzed worker performance in an experimental setting and found that discrimination for attractive workers still remained. When the authors controlled for confidence, attractive workers earned more because of better social and communication skills. Furthermore, the beauty premium persisted in experimental game settings: attractive participants received significantly higher offers in the ultimatum game (Solnick & Schweitzer, 1999), while participants in the dictator game shared a greater part of the surplus with players whose voices and pictures were attractive (Rosenblat, 2008). In repeated games, participants found attractive players more trustworthy (Wilson & Eckel, 2006), and players cooperated more often with attractive contestants of the opposite gender in the prisoner's dilemma game (Darai & Grätz, 2013).

In addition to the aforementioned research, social psychologists suggested a so-called "what is beautiful is good" hypothesis. Attractive individuals were liked more (Byrne, London, & Reeves, 1968), received greater help from strangers (Benson, Karabenick, & Lerner, 1976), were perceived as more likable, more trustworthy, more intelligent, healthier, happier, and more successful (Dion, Berscheid, & Walster, 1972;

Eagly, Ashmore, Makhijani, & Longo, 1991; Feingold, 1992; Jackson, Hunter, & Hodge, 1995).

Given that the beauty bias exists, previous findings strongly suggest similar selection mechanisms and biases in the field of sports. Rosar et al. (2010) suggested these effects led to an attractiveness competitive advantage: the mechanisms would have allowed preferential treatment (e.g., by coaches) and a supportive social environment (e.g., families, friends, and managers) for attractive athletes. This could have led to increased performances, salaries, fan attention, and consumption. For instance, Martinek (1981) posited that physical education teachers had higher expectations of more attractive elementary school children with regard to physical performance and social relations. Berri et al. (2011) analyzed the facial symmetry of 138 NFL quarterbacks from 1995 to 2009 and showed that better-looking quarterbacks attained significant salary premiums. Rosar et al. (2010) asserted that attractive football players performed worse; however, if the attractiveness level within a team was high and homogenous, attractive players seemed to perform better. Hoegele et al. (2016) showed that facial attractiveness positively affected perceptions of behavior, skills, and personalities of Bundesliga football players. Postma (2014) analyzed cyclists' performances and their attractiveness. He suggested that attractiveness might have functioned in both ways: strong performance might have indicated characteristics (e.g., health, strength, and competitiveness) which in turn were perceived as attractive, or facial attractiveness itself might have signaled performance. In tennis, attractive players performed better than unattractive ones (Bakkenbüll, 2017; Bakkenbüll & Kiefer, 2015).

To examine sports consumption, some researchers relied on surveys to derive motivational factors of sports consumers, analyzing aesthetics as the general artistic nature of the sport instead of physical attraction (Wann, Schrader, & Wilson, 1999). Along similar lines, Trail and James (2001) used surveys to analyze motivational factors for sports consumption in the MLB, thereby distinguishing between the aesthetics of the plays and the physical attractiveness of players. Their survey results

showed that players' physical attractiveness motivated consumers to watch MLB games. The authors also found a positive correlation between the physical attractiveness of players and increases in merchandise purchases.

Indeed, athlete endorsements for branding and advertising reasons have been of interest to researchers and practitioners alike. Joseph (1982) summarized experimental evidence in advertising and concluded that physically attractive communicators positively impacted the products they were advertising. Ohanian (1991) examined celebrity endorsers' trustworthiness, attractiveness, and expertise, suggesting that attractiveness supported the endorser-product fit. Based on these findings, different research streams have emerged; inter alia, the athlete brand building literature and the sexualized and gendered presentation of athletes.

Celebrity endorsements have led to further research in athlete brand building, where understanding the effect of brand personalities (Carlson & Donavan, 2013; Parmentier & Fischer, 2012) on identification and consumption has been of focal interest. Carlson and Donavan (2013) conducted a survey with American football fans and analyzed how athlete characteristics, such as being tough, successful, charming, wholesome, and imaginative had an effect on prestige and distinctiveness. These characteristics led to athlete identification and increased the number of games fans watched and the amount of money they spent. Braunstein and Zhang (2005) defined athletic star power through professional trustworthiness, likable personality, characteristic style, social attractiveness, and athletic expertise to show their effects on Generation Y's sports consumption. Having developed a conceptual framework, Arai, Ko, and Ross (2014) suggested that athletes created brand images through their athletic performance, attractive appearance, and marketable lifestyle. The authors of both papers explicitly included physical attractiveness as influencing factors for athletic star power and brand building. Moreover, the "what is beautiful is good" hypothesis strongly suggests that physical attractiveness might have had effects on other brand personality characteristics (e.g., being charming, etc.).

Numerous researchers analyzed gender differences in athlete media reporting and presentation. Scholars criticized (Kane & Greendorfer, 1994; Urquhart & Crossman, 1999) that it was rather female athletes' physical attractiveness and femininity rather than their performances that were heavily mediatized (Spencer & McClung, 1999). Frisby (2017) concluded that female athletes were still sexualized and objectified. She showed that female athletes were often shown in seductive poses wearing scant clothing while male athletes were presented in team uniforms and in a setting that was directly related to their sport. Fink (2015) reviewed qualitative and quantitative differences in female vs. male athlete reporting in the sports media commercial complex. Although female participation in sports was at a record high, there was still a wide gap in reporting of female athletes. More importantly, qualitative differences continued to exist, thereby further strengthening the image of female players' attractiveness and femininity rather than their skills and athleticism. Fink and Cunningham (2004) and Cunningham, Fink, and Kenix (2008) showed that attractive female endorsers had a direct positive impact on endorser-event appropriateness; however, both studies show that athlete expertise had much stronger effects. Mutz and Meier (2016) confirmed these findings, suggesting that football players' attractiveness (both female and male) showed a positive relationship with the number of Google searches at European Championships; the searches increase much stronger when athletes are both successful and attractive.

The aforementioned results suggest that physical attractiveness plays a significant role in various fields; however, in tennis, Meier and Konjer (2015) asserted there was no beauty premium. Using TV ratings from live telecasts of over 1,000 tennis matches on German free TV, they analyzed the relationship between attractiveness and tennis TV-ratings. According to the researchers, attractiveness did not play a significant role when women watched male players while they watched significantly less when attractive female players played. The authors interpreted that the female audience discriminated against attractive female players. In contrast, men seemed to watch more when attractive females played and less when attractive males played.

However, we find difficulties with their analyses of the results. The attractiveness variable, by the researchers' definition based on a single gender (i.e., the female attractiveness variable was defined as the sum of attractiveness for male players as rated by women), was regressed in both male and female matches, which is problematic for the regression models. The regressions for the female audience included attractiveness ratings of only male players; yet, the researchers interpreted the results as if women discriminated against attractive female players. Recalling the researchers' attractiveness definitions, this cannot be possible because the attractiveness ratings for male players cannot be regressed in a regression that includes only female players.

2.2 Measures of physical attractiveness

Researchers that analyzed physical attractiveness primarily focused on facial characteristics. Naturally, beauty perceptions are driven not only by facial characteristics. Anthropometric measures, such as height and weight, or the combination of both, body mass index (BMI), also influence beauty perceptions. For women, the so-called waist-to-hip-ratio was found to influence female attractiveness ratings (Singh, 1993), particularly because a low waist-to-hip-ratio signaled health and higher reproductive capability. Height (Lynn & Shurgot, 1984) was shown to significantly influence male attractiveness perceptions. In this paper, we will focus only on facial attractiveness and use facial symmetry scores as a proxy for physical attractiveness. We believe that facial attractiveness is the most important factor for physical attractiveness. This is supported by numerous research studies (as aforementioned) that relied on facial attractiveness. Moreover, Currie and Little (2009) showed that facial attractiveness ratings perform much better than body attractiveness ratings. Technically, the players' height is not recognizable for consumers that watch tennis on TV or see pictures of players. The players are pictured together only at the end of the game when they shake hands or celebrate at the ceremony. Most of the time, viewers only see one player, making it difficult for them to perceive relative player height. The ATP and the WTA publish height and weight measures of tennis players.

However, these measures are self-reported by tennis players, and need to be treated with caution (e.g., Bakkenbüll & Kiefer, 2015, used the BMI in their analyses). While height does not vary over a career lifecycle of an athlete, weight may change dramatically at different points at a time. Given the aforementioned research findings on physical attractiveness and our measure for facial attractiveness, we can draw the following hypothesis:

> ***Hypothesis 1:*** *Athlete's facial attractiveness will have a positive effect on tennis TV-viewership.*

2.3 Sports demand

Scholars researching sports demand largely focused on team sports (Borland & Macdonald, 2003; García & Rodríguez, 2009), such as European football, baseball, basketball, American football, or ice hockey. Demand was usually measured as live stadium attendance (Coates, Humphreys, & Zhou, 2014; García & Rodríguez, 2009) or TV-viewership (Bizzozero, Flepp, & Franck, 2016; Forrest, Simmons, & Buraimo, 2005; García & Rodríguez, 2006).

While economic and demographic factors were used as explanatory variables for stadium attendance, researchers in sports demand focused on consumer preferences that are peculiar to sports. That is, quality of teams and players (i.e., aggregate talent on the field), superstars (Berri, Schmidt, & Brook, 2004; Kahane & Shmanske, 1997), and outcome uncertainty (i.e., matches between competitors with equal strength). Szymanski (2003) summarized that attendance was highest when the home team was twice as likely to win the game. Fans attended games because they wanted to see their team win; they preferred to watch strong and skillful players and were more likely to attend a game when their team employed superstars.

There is comparatively less research on demand for individual sports. Rodríguez, Pérez, Puente, and Rodríguez (2013) analyzed the determinants of TV-viewership for professional cycling and found that outcome uncertainty played a

significantly positive role for cycling. For tennis, Konjer, Meier, and Wedeking (2015) and Meier and Konjer (2015) controlled for outcome uncertainty and player quality in their analyses. They suggested that player quality and outcome uncertainty, measured by win probabilities via betting odds, attracted more TV-viewers (Meier & Konjer, 2015). Yet, in a larger study over several years, Konjer et al. (2015) found that outcome uncertainty played no role in TV-viewership. They used rankings to measure both player qualities and outcome uncertainty. Based on these findings, we draw the following hypotheses:

Hypothesis 2a*: Match quality will have a positive effect on tennis TV-viewership*

Hypothesis 2b*: Matches including superstars will have a positive effect on tennis TV-viewership*

3. Data and methods

3.1 TV-viewership and tennis

We use TV-viewership data from Mediapulse AG, the official Swiss statistical company for radio and TV usage. Our data consists of TV-viewership numbers for the official Swiss national TV broadcaster SRG that telecasts sports in three languages (German, French, and Italian) and covers all regions in Switzerland. To measure audience size, machines track TV-watching habits of a panel (1870 households) in Switzerland. The machine is equipped with a remote control that allows households to record TV-viewing habits of each member including regular and spontaneous guests. Additional information, such as gender and age group, are also recorded. Each household member that watches TV is required to log-in via the remote control. If certain members decide to stop watching, they must logout. This ensures that the machine correctly records the timing for each household member. For quality control purposes, Mediapulse employees conduct interviews with panel members to test whether the panel members are watching what the machine reports. Whenever a consumer stays on a channel for at least 15 seconds, the machine starts to count. Our

TV audience figures are weighted averages throughout the duration of a live tennis match. For instance, if two people each watch a live tennis match for 45 minutes, while the entire duration of the live match is 90 minutes, the machine calculates the weighted average, that is, one person watching for 90 minutes.

Tennis is mainly an individual sport played between two players. Competitive players regularly meet at different tournaments throughout the year and collect ranking points depending on their performance at these tournaments. Grand Slams are the most prestigious tennis tournaments with the largest prizes. The tournaments take place each year in Australia, France, the United Kingdom, and the USA. To ensure that the best players end up playing each other in the later rounds of the tournaments, organizers use seeding methods based on the Association of Tennis Professionals' (ATP) and the Women's Tennis Association's (WTA) rankings[2]. Grand Slams include 128 participants and winners are decided after seven rounds. For our analysis, we focus only on the last three rounds (i.e., quarterfinal, semi-final, and final matches) from Grand Slam tournaments between 2000 and 2016. We use match data from tennisabstract.com, a website that is run and managed by Jeff Sackmann. In total, this yields 952 match-observations; however, the sample size reduces to 622 match-observations because SRG does not broadcast all quarterfinal, semi-final, and final matches. We do not have any detailed information on SRG's programming strategy. Expecting that decision-makers at SRG are essentially interested in broadcasting matches with Swiss players and high-quality games, we test a Heckman selection model to better understand which variables influence both SRG's decision making and the TV-audience's consumption behavior. The resulting λ that equals -.093 (with a p-value of 0.691) indicates that our model does not suffer from a sample selection problem; hence, we continue with OLS estimation methods and the robustness checks as planned.

[2] For a detailed description of ATP (https://www.atpworldtour.com/en/corporate/rulebook) and WTA rankings (http://www.wtatennis.com/WTA-RULES) and tournament regulations, the authors refer to the respective tennis association websites.

3.2 Facial attractiveness

Other than Berri et al. (2011) and Hoegele et al. (2016), who derived their attractiveness scores using software, the aforementioned researchers heavily relied on survey methods to derive physical attractiveness scores. Although researchers have relied on the Truth of Consensus method, we introduce a novel approach by (a) using facial symmetry scores, the most important predictor for facial attractiveness; and by (b) getting rid of potential biases in surveys. While the Truth of Consensus method is useful to rate the attractiveness of strangers, in the case of sports, the popularity and success of certain athletes are likely to influence attractiveness ratings (Postma, 2014). Moreover, portrait pictures that are taken from WTA/ATP websites and are used for surveys might show different qualities: some are professionally shot, others might have been photoshopped, which further increases potential biases.

To derive facial attractiveness scores, we use software called Prettyscale that calculates facial symmetry scores based on 14 different landmarks that have to be manually placed on the photos of the players. We conduct several rounds of Google

Figure 1: *Facial symmetry analysis on prettyscale.com.*

picture searches to select three photos for each player. Ideally, a picture is a frontal headshot where players' ears, chin, and hairline are visible and players do not smile or grimace. We upload each picture to the software, adjust and zoom in the picture if necessary, select the gender of the player, and then place the 14 different landmarks step-by-step via the mouse cursor (see Figure 1).

For each picture, we document picture anomalies that might occur because the player is smiling or grimacing. Anomalies may also occur because the camera perspective is horizontally or vertically tilted. We deliberately exclude pictures that might have been photo-shopped or are clearly taken outside the career periods of the players. Even so, the pictures might not match the same time the games have been televised, but attractiveness ratings are consistent over time (Hatfield & Sprecher, 1986), it should not cause any problems for our analysis.

In total, we calculate facial symmetry scores for 644 pictures. We then run individual fixed effects regressions for male and female players, controlling for anomalies, such as horizontal tilts *(Horizontal)*, vertical tilts *(Vertical)*, smiling *(Smile)* while lips are closed, grimace *(Grimace)*; Grimace also includes pictures in which players are laughing (i.e., when their lips are open). Some pictures might have horizontal tilts and grimaces *(HoizontalGrimace)* or vertical tilts and grimaces *(VerticalGrimace)*[3].

$$Symmetry_{ij} = \beta_0 + \beta_1 Horizontal_i + \beta_2 Vertical_i + \beta_3 Smile_i + \beta_4 Grimace_i + \beta_5 HorizontalGrimace_i + \beta_6 VerticalGrimace_i + \alpha_j + \varepsilon \quad (1)$$

Table 1 shows the regression results with player fixed effects for the picture corrections. We then predict the individual fixed effects for each player and add the constant of our regressions to the individual fixed effects. Technically, adding a constant to the corrected measures will not change any of the regression results, as this is a simple transformation. This procedure gives us a final corrected measure for facial symmetry, which we will use in our main analyses. Figure 2 shows the histogram of corrected facial symmetry scores: one can see that the average facial symmetry score for male players is slightly higher than the one for female players. Table 2 shows the players with the highest and lowest corrected facial symmetry scores.

[3] We run regressions with more granular clusters of anomalies without any significant differences. Collapsing the anomalies into general clusters is simpler and more appropriate.

Table 1: Regressions with player fixed effects for picture corrections by gender.

Dependent variable: Symmetry	**(1)** Female	**(2)** Male
Horizontal	-7.752***	-0.523
	(1.771)	(1.191)
Vertical	-5.942	-7.546*
	(5.097)	(3.052)
Smile	-3.599*	1.972
	(1.695)	(1.719)
Grimace	-2.690**	-1.643
	(0.959)	(1.059)
HorizontalGrimace	-3.701*	-3.968*
	(1.773)	(1.752)
VerticalGrimace	-3.052	-14.822***
	(3.619)	(2.790)
Constant	75.282***	76.916***
	(0.685)	(0.513)
Observations	313	331
R-squared	0.058	0.102
Number of players	112	114
Player FE	YES	YES

Robust standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

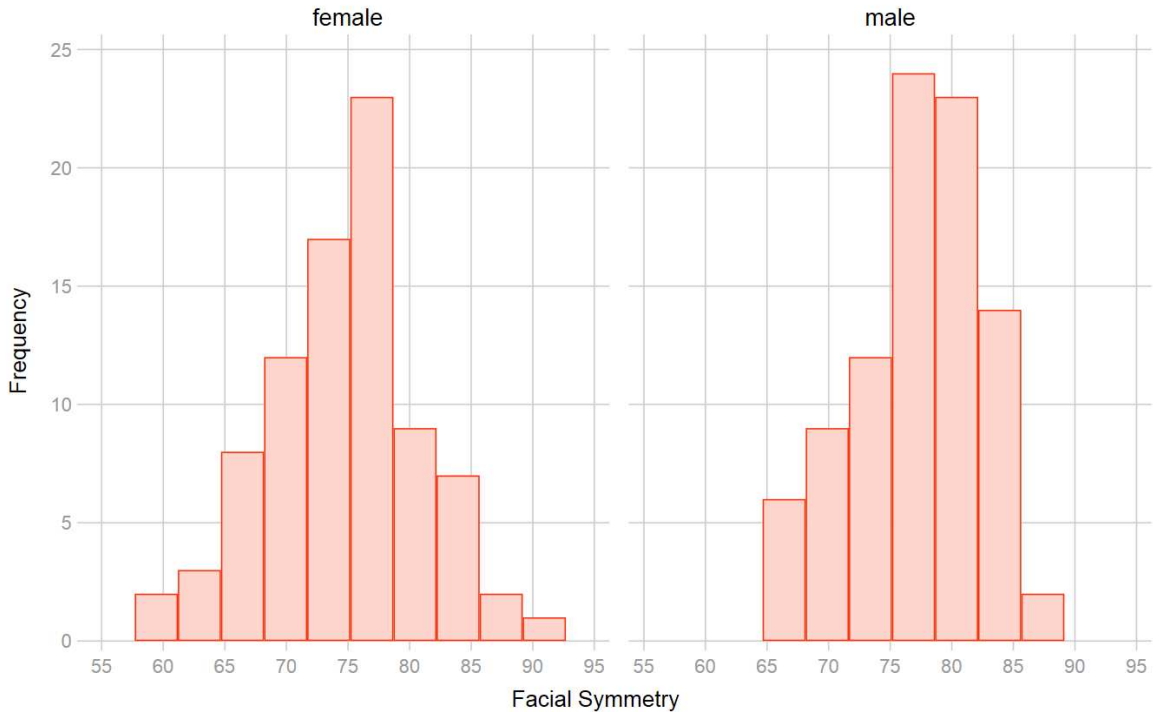

Figure 2: *Distribution of facial symmetry scores in the sample by gender.*

Table 2: Highest and lowest corrected facial symmetry scores by players' gender.

Female Players	**Score**	**Male Players**	**Score**
Belinda Bencic	89.9	Gaston Gaudio	86.8
Nicole Vaidisova	86.9	Albert Costa	86.2
Dominika Cibulkova	86.9	Sebastien Grosjean	85.1
Samantha Stosur	85.1	Juan Ignacio Chela	85.1
Roberta Vinci	84.7	Kei Nishikori	84.5
Maria Sharapova	84.7	Arnaud Clement	84.2
Tsvetana Pironkova	84.1	Mariano Puerta	84.1
Clarisa Fernandez	83.7	Mardy Fish	84.0
Victoria Azarenka	83.3	Robby Ginepri	84.0
Elena Dementieva	82.4	Vasek Pospisil	83.4
Kim Clijsters	67.5	Gael Monfils	69.2
Mary Pierce	66.7	David Goffin	68.7
Marta Marrero	66.2	Chris Woodruff	68.6
Anna Chakvetadze	65.5	Albert Ramos	68.5
Serena Williams	65.0	Goran Ivanisevic	67.5
Justine Henin	63.8	Martin Verkerk	67.2
Karolina Pliskova	63.7	Todd Martin	66.5
Sabine Lisicki	63.5	Marin Cilic	65.7
Kiki Bertens	59.4	Juan Carlos Ferrero	65.0
Lindsay Davenport	57.7	Gustavo Kuerten	64.6

3.3 Model

To test the relationship between facial attractiveness and TV-viewership, we regress TV-audience size on facial attractiveness scores and a set of control variables for matches (i.e., player quality, outcome uncertainty), and home bias (i.e., Swiss players). We include dummy variables for gender, tournaments, rounds, and matches broadcasted on primetime. We estimate the model, using OLS, as follows:

$$\begin{aligned} LN(TV_{ijk}) = {} & \beta_0 + \beta_1 SUMSYMMETRY_i + \beta_2 MALE_i \\ & + \beta_3 MALExSUMSYMMETRY_i + \beta_4 LN(SUMRANK_i) \\ & + \beta_5 LN(DELTARANK_i) + \beta_6 SUMGS_i \\ & + \beta_7 NUMBEROFGAMES_i + \beta_8 SWISS_i + \beta_9 PRIMETIME_i \\ & + \beta_{10j} TOURNAMENT_{ij} + \beta_{11k} ROUND_{ik} + \varepsilon \end{aligned} \quad (2)$$

The dependent variable *LN(TV)* is the natural logarithm of the absolute TV audience for each match in Switzerland. We summarize the previously corrected facial

symmetry scores for each match: *SUMSYMMETRY* controls for the facial symmetry of both players on the field. *MALE* is a dummy variable and takes the value 1 if the match is played between male players. We measure the quality of the match *LN(SUMRANK)* by the natural logarithm of the sum of the ATP and WTA rankings of both players; outcome uncertainty *LN(DELTARANK)* is measured by the natural logarithm of the difference of the ATP and WTA rankings of both players[4]. Because the ATP and WTA rankings are regularly updated and hence control for current (short-term) performance, SUMGS controls for historic performances (e.g., superstar status) that may not be entirely captured by rankings. *SUMGS* is the sum of Grand Slam wins of both players. To derive the variable, we cumulate the number of Grand Slam wins of each player at the beginning of the respective tournament and then summarize both players' number of Grand Slam wins for each match. Both *LN(SUMRANK)* and *LN(DELTARANK)* measure expected quality and expected outcome uncertainty of the match. Moreover, we also control for in-game outcome uncertainty *(NUMBEROFGAMES)* by counting the number of games throughout the sets. In tennis matches, only two-game leads win sets. A larger number of games indicates a closer match.

SWISS is a dummy variable that takes the value 1 if at least one Swiss player is on the field. *PRIMETIME* is a dummy variable that takes value 1 if a match is broadcast in primetime. *TOURNAMENT* is a set of dummy variables that controls for each Grand Slam tournament (Australian Open, French Open, Wimbledon, and US Open), while *ROUND* is a set of dummy variables that controls for the different stages in the tournament (i.e., quarterfinals, semi-finals, and finals). Table 3 lists descriptive statistics for our regression analyses.

[4] In some cases, the difference in the ATP or WTA rank might equal one, such that LN(1) equals zero. In such a case, LN(1) is included in the constant. If we were interested in the specific cases where LN(1) equals zero (e.g., a game between two equally talented players), we could add another dummy variable to control for this. Results, however, do not change significantly.

Table 3: Descriptive statistics of dependent and independent variables.

Variable	Obs.	Mean	SD	Min	Max
LN(TV)	622	10.718	1.516	1.831	13.763
SUMSYMMETRY	622	150.168	9.637	121.512	172.006
MALE	622	0.580	0.494	0	1
LN(SUMRANK)	622	2.752	0.937	1.099	5.861
LN(DELTARANK)	622	2.041	1.229	0	5.849
SUMGS	622	6.241	6.521	0	30
NUMBEROFGAMES	622	30.172	10.703	7	75
SWISS	622	0.264	0.441	0	1
PRIMETIME	622	0.064	0.245	0	1
T. AU OPEN	622	0.209	0.407	0	1
T. FRENCH OPEN	622	0.338	0.473	0	1
T. WIMBLEDON	622	0.262	0.440	0	1
T. US OPEN	622	0.191	0.394	0	1
R. QUARTER-FINAL	622	0.474	0.500	0	1
R. SEMI-FINAL	622	0.338	0.473	0	1
R. FINAL	622	0.188	0.391	0	1

Our focus is on the sign and significance of the coefficient $\beta 1$. Considering the vast research on beauty, we believe that facial symmetry plays a positive role for TV-viewership, and therefore, we expect $\beta 1$ to be positive. Male matches will likely draw more attention relative to female matches. On average, male matches in our sample attract 148,344 viewers while female matches attract 45,819 viewers. However, we are much more interested in the interaction effect between *MALE* and *SUMSYMMETRY*. This will allow us to understand whether there is a significant difference between perceptions of female and male attractiveness for tennis matches.

Depending on the players' world rankings before the tournaments, we believe the audience size will increase when top players compete, leading to a negative sign for $\beta 4$. The number of Grand Slam wins is an indicator for a player's quality and popularity, leading to a positive sign for $\beta 6$. Based on Rosen (1981) and Adler (1985) superstar theories, we rely on a talent-based definition of superstars (Rosen, 1981). The Swiss TV audience should increase when Swiss tennis players are playing. As for our remaining control variables, we expect matches on primetime specifically to draw more viewers. The French Open and Wimbledon are likely to draw more viewers

because the local and time distance of these tournaments is closer (i.e., matches are played in similar time zones). Most of Australian Open and US Open matches are broadcast either in the night or very early in the morning. Because match quality and excitement increase with every stage of the tournament, we expect that the coefficients for our round dummies will have positive signs.

4. Results

4.1 Regression analysis

We run OLS regressions for 622 live tennis matches. Our results (see Table 4, regressions 1 to 3) indicate that facial symmetry plays a significantly positive role for female matches. Our models (1 to 3) explain at least 50% of the variance (see R2 and adjusted R2). The baseline regression (1) shows an overall positive effect of facial symmetry. However, this regression model does not control for gender or for any interaction variables. Regression model (3) controls both for male matches and for the interaction effect between MALE and SUMSYMMETRY. An additional unit in the combined facial symmetry score for female players increases TV-viewership by 2.2%, an increase by one standard deviation in the combined facial symmetry score leads to an increase in TV-viewership by 24.3%, all else being equal. To illustrate a fictional example based on our estimations, consider the Wimbledon 2012 semi-final match between Agnieszka Radwanska and Angelique Kerber. Agnieszka Radwanska's corrected facial symmetry score is 71.2, Angelique Kerber's is 75.3. The predicted results for this match would lead to an audience size of 34,579 people (the actual TV audience size for the match is 21,019). Holding all else constant and only switching Agnieszka Radwanska with Maria Sharapova, who has a corrected facial symmetry score of 84.6, we would predict an additional 12,090 people watching a fictional 2012 Wimbledon semi-final match between Maria Sharapova and Angelique Kerber.

Table 4: Estimation results for OLS regressions.

Dependent variable: LN(TV)	**(1)**	**(2)**	**(3)**
SUMSYMMETRY	0.018***	0.013*	0.022***
	(0.005)	(0.005)	(0.006)
MALE		0.419**	4.560**
		(0.152)	(1.580)
MALE X SUMSYMMETRY			-0.027**
			(0.011)
LN(SUMRANK)	-0.385***	-0.339***	-0.353***
	(0.100)	(0.101)	(0.100)
LN(DELTARANK)	0.184**	0.154*	0.161*
	(0.067)	(0.067)	(0.065)
SUMGS	-0.000	-0.000	0.002
	(0.009)	(0.008)	(0.008)
NUMBEROFGAMES	0.032***	0.022**	0.022**
	(0.005)	(0.007)	(0.007)
SWISS	1.665***	1.583***	1.519***
	(0.101)	(0.108)	(0.107)
PRIMETIME	1.156***	1.186***	1.189***
	(0.207)	(0.205)	(0.203)
T. FRENCH OPEN	0.972***	0.981***	0.946***
	(0.148)	(0.147)	(0.143)
T. WIMBLEDON	1.066***	1.090***	1.056***
	(0.145)	(0.141)	(0.138)
T. US OPEN	-0.350	-0.371	-0.398
	(0.213)	(0.213)	(0.211)
R. SEMI-FINAL	0.461***	0.461***	0.469***
	(0.094)	(0.093)	(0.094)
R. FINAL	0.778***	0.796***	0.815***
	(0.132)	(0.132)	(0.130)
Constant	6.302***	7.212***	5.825***
	(0.784)	(0.800)	(0.932)
Observations	622	622	622
R^2	0.510	0.518	0.524
Adj. R^2	0.500	0.508	0.513

Robust standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Regression model (3) in Table 4 indicates that facial symmetry does not play a significant role for male matches. The slope for male facial symmetry is -0.0052 (difference between $\beta 1$ and $\beta 3$) and not significant. However, the results suggest that the beauty bias is significantly different between female and male tennis matches. A

marginal analysis depicts the difference in the slopes with regards to facial symmetry between female matches and male matches. Only when *SUMSYMMETRY* is greater than 152 does the beauty bias between female and male matches become indistinguishable (see Figure 3). Hence, we partly accept Hypothesis 1. Facial attractiveness has a positive effect on tennis TV-viewership for female tennis matches.

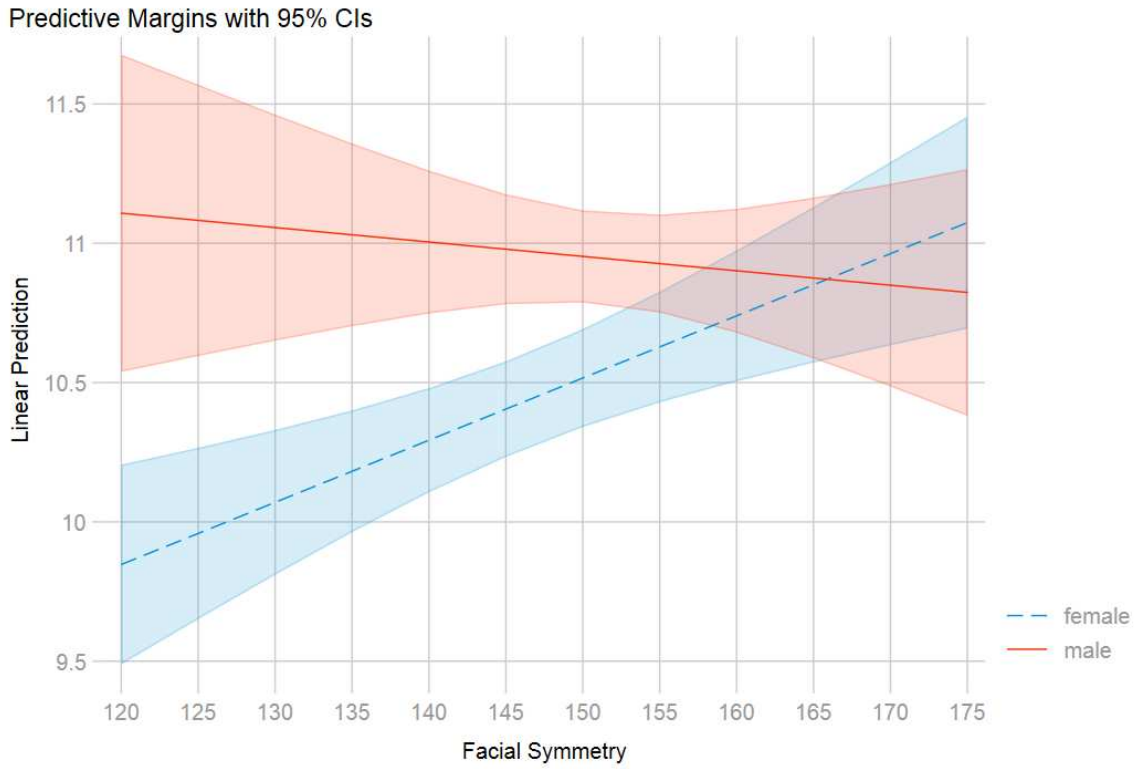

Figure 3: *Predictive margins with 95% confidence intervals separated by gender.*

The TV audience prefers to watch games with higher quality: viewership decreases as the sum of the ordinal ATP or WTA rankings increases, meaning that better-ranked players (those with a lower ordinal rank number) draw more viewers. An increase in the ordinal player rankings by one percent leads to a 0.353% decrease in viewership, in line with previous sports demand research. Interestingly, the coefficient for outcome uncertainty has a positive sign and is significant. A one percent increase in the difference of the ATP or WTA rankings leads to a 0.161% increase in audience size. In contrast, the number of games in a match, our in-game outcome uncertainty measure, increases TV-viewership significantly. An additional game in a match leads to a 2.2% increase in viewership. Viewers prefer close and undecided matches, but they also prefer to watch games between players with higher rank

differences. It is important to note that the matches in our sample are already highly selective: only the best players make it to the last three rounds of Grand Slam tournaments. In this sense, the tournament structure should generally ensure a high quality of the matches. This is supported by our regression results: semi-finals and finals increase the TV-audience by 46% and 82%, respectively. Therefore, we can accept Hypothesis 2a. Consumers prefer to watch matches of high quality.

The combined number of Grand Slam wins has a positive coefficient, yet it is not significant. There is no additional effect of previous Grand Slams wins, suggesting that Hypothesis 2b be rejected. As we expected, Swiss players very strongly attract more viewers; whenever a Swiss player is on the field, TV-viewership more than doubles (increases by 152%), confirming a home bias suggested by previous sports demand studies. A possible explanation for non-significance of our superstar variable might be that the effect is already captured by our quality and uncertainty measures. Moreover, the dummy variable for Swiss players, especially considering Roger Federer, might also capture this effect.

Our results on facial attractiveness are in line with previous findings that suggest beauty biases in different fields (e.g., labor economics and social psychology, etc.). However, we would have expected a consumer preference to watch both attractive female and attractive male tennis players. Both Braunstein and Zhang (2005) and Carlson and Donavan (2013) include physical attractiveness in their models and surveys to analyze their effects on consumption. Our results confirm consumption behavior that was previously hypothesized using surveys or included in conceptual frameworks (Arai et al., 2014). We can especially confirm the increase in games watched that was put forward by Carlson and Donavan (2013).

Moreover, scholars have proposed that both expertise (similar to our match quality and performance control variables) and physical attractiveness (Cunningham et al., 2008; Fink & Cunningham, 2004; Mutz & Meier, 2016) play a key role. In that regard, we put forward that only the best players with the most expertise end up in the last rounds of Grand Slams; here, consumers prefer to watch matches with

attractive female tennis players. Following along the lines of Cunningham et al. (2008) and other research that has criticized sexualized and gendered presentation of female athletes (Fink, 2015; Frisby, 2017), we argue that the more attractive and more successful tennis players are more likely to be mediatized. They will appear more often on TV, newspapers, and advertisements. As shown by Rosen and Adler (1985), superstars (based on talent and popularity) drew most of the attention (and therefore income) to them. This reinforces the general effects of physical attractiveness because (a) popularity is influenced by physical attractiveness and (b) consumers will more readily remember heavily mediatized athletes. Although we control for a talent-based superstar status (expertise), there is likely to be a reinforcing effect beyond the athlete's expertise.

4.2 Robustness checks

To test whether the effects of facial symmetry persist, we run several robustness checks. First, we test if our results are robust to outliers with regards to the outcome variable audience size. A common approach is to reduce the effects of the tails, that is, we will run two subsample regressions by (a) trimming 5% of the largest and smallest audience sizes and (b) by winsorizing the top and bottom 5% of audience sizes. In contrast to trimming, winsorizing does not eliminate outliers but treats them as if they were within the specified percentiles, i.e., any extreme values are replaced by the maximum specified percentiles. Our results are robust to outliers; the beauty bias for female matches remains significant and positive (see Table 5). The trimmed models (1) and (2) explain 47.8% and 38.9% of the variance respectively, while the winsorized models (3) and (4) explain 55.5% and 55.8% of the variance.

Table 5: Robustness checks with trimmed and winsorized outliers.

Dependent variable: LN(TV)	**(1)** trimmed 5th pctile	**(2)** trimmed 10th pctile	**(3)** winsor 5th pctile	**(4)** winsor 10th pctile
SUMSYMMETRY	0.016**	0.010**	0.018***	0.015***
	(0.005)	(0.004)	(0.005)	(0.004)
MALE	2.801*	1.576	3.539*	2.740*
	(1.306)	(1.249)	(1.371)	(1.201)
MALE X SUMSYMMETRY	-0.015	-0.007	-0.020*	-0.015
	(0.009)	(0.008)	(0.009)	(0.008)
LN(SUMRANK)	-0.367***	-0.266**	-0.352***	-0.309***
	(0.088)	(0.084)	(0.089)	(0.075)
LN(DELTARANK)	0.204***	0.148*	0.178**	0.162**
	(0.062)	(0.059)	(0.062)	(0.052)
SUMGS	0.012	0.011	0.007	0.010
	(0.006)	(0.006)	(0.006)	(0.005)
NUMBEROFGAMES	0.009*	0.007	0.013**	0.009*
	(0.004)	(0.004)	(0.004)	(0.004)
Constant	7.575***	8.644***	6.852***	7.623***
	(0.715)	(0.616)	(0.791)	(0.608)
Observations	560	498	622	622
R^2	0.478	0.389	0.555	0.558
Adj. R^2	0.465	0.371	0.545	0.548
Controls	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Second, we run a different type of robust regression by applying quantile regressions, to test whether our results are consistent when regressions are run at different points in the conditional distribution of our dependent variable. In contrast to OLS, which focuses on the average relationship between the dependent and independent variables, quantile regressions test this relationship on percentiles and medians; especially the median regression is more robust to outliers in comparison to OLS. We run quantile regressions at the 10th, 25th, 50th, 75th, and 90th percentiles (see Table 6). Interestingly, the effect of facial symmetry seems to decrease as the percentile of the audience increases from the 10th to the 90th percentile. The effect of expected quality persists, especially in the first quartile, the median, and the 90th percentile distributions. Testing whether the coefficients of the quantile regressions are

significantly different from our main OLS regression, we conclude that there is no significant difference.

Table 6: Robustness checks with quantile regressions.

Dependent variable: LN(TV)	**(1)** 10th pctile	**(2)** 1st qtile	**(3)** Median	**(4)** 3rd qtile	**(5)** 90th pctile
SUMSYMMETRY	0.016	0.025***	0.014*	0.013*	0.012*
	(0.015)	(0.008)	(0.006)	(0.006)	(0.005)
MALE	3.674	4.108*	3.009*	1.546	1.117
	(3.354)	(1.805)	(1.441)	(1.132)	(1.005)
MALE X SUMSYMMETRY	-0.024	-0.025*	-0.016	-0.006	-0.004
	(0.023)	(0.012)	(0.010)	(0.008)	(0.007)
LN(SUMRANK)	-0.027	-0.437***	-0.284**	-0.121	-0.144*
	(0.219)	(0.097)	(0.089)	(0.082)	(0.058)
LN(DELTARANK)	-0.039	0.140	0.088	0.072	0.100**
	(0.171)	(0.075)	(0.063)	(0.060)	(0.036)
SUMGS	-0.001	0.003	0.015*	0.011*	0.011*
	(0.015)	(0.009)	(0.007)	(0.005)	(0.005)
NUMBEROFGAMES	0.026**	0.018**	0.014***	0.014***	0.014***
	(0.010)	(0.007)	(0.004)	(0.003)	(0.003)
Constant	4.051	5.385***	7.470***	8.111***	8.725***
	(2.348)	(1.117)	(0.898)	(0.856)	(0.828)
Observations	622	622	622	622	622
Controls	YES	YES	YES	YES	YES

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Third, we investigate whether our results persist in matches where Swiss players are excluded. Our viewership data comes from Swiss households and as shown previously, there is a strong home bias towards Swiss players. Swiss players not only attract the most viewers but are also broadcast more often. Out of 622 live tennis matches, 164 include a Swiss player. The average audience size for the entire sample is 243,669 while the average audience size for the subsample without Swiss players is 52,730; and admittedly, Roger Federer mainly drives the Swiss results. The results in our subsample regression for foreign players do not change significantly; the beauty bias for female matches persists (see Table 7). Our model that includes only foreign players explains 33.3% of the variance.

Table 7: Robustness checks with subsample regressions excluding Swiss players.

Dependent variable: LN(TV)	**(1)** All players	**(2)** Foreign players
SUMSYMMETRY	0.022***	0.021**
	(0.006)	(0.007)
MALE	4.560**	5.159*
	(1.580)	(2.078)
MALE X SUMSYMMETRY	-0.027**	-0.031*
	(0.011)	(0.014)
LN(SUMRANK)	-0.353***	-0.387**
	(0.100)	(0.118)
LN(DELTARANK)	0.161*	0.152*
	(0.065)	(0.075)
SUMGS	0.002	0.003
	(0.008)	(0.013)
NUMBEROFGAMES	0.022**	0.026*
	(0.007)	(0.010)
Constant	5.825***	5.921***
	(0.932)	(1.052)
Observations	622	458
R^2	0.524	0.333
Adj. R^2	0.513	0.313
Controls	YES	YES

Robust standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Fourth, we run separate regressions for female and male matches. Our main regression results might show stronger (weaker) effects depending on several influential factors. In our pooled regression, we are mainly interested in the relationship between TV-audience and facial symmetry for female and male matches. We do not test any additional interaction effects. The results might be driven by either female or male matches. In gender-separated regressions, we can isolate the effects of our explanatory variables and see whether viewers have different consumption patterns depending on the players' gender. We have 261 observations for female matches and 361 observations for male matches. Our model for female matches explains 44.2% and our model for male matches explains 50.8% of the variance. Facial symmetry still plays a significant and positive role for female matches, the coefficient, however is smaller compared to the pooled regression (see Table 8). An increase in the

combined symmetry scores for female players leads to a 1.5% increase in TV-viewership. The prediction results indicate a more accurate estimation[5].

Interestingly, neither expected quality nor expected outcome uncertainty plays a significant role for female matches. Both effects are significant only for male matches. This does not necessarily mean that female match quality and outcome uncertainty are not of interest for the TV-audience. One possible interpretation is that viewers rely on other indicators of quality and outcome uncertainty (e.g., number of games, later stages in the tournament). As emphasized before, our sample only includes the most competitive tournaments and matches, thereby, already capturing these effects.

Last, we run gender-separate regressions for the women and men audience as well as female and male matches. Men are more likely to watch sports and therefore may drive our results. The average audience size for men is 55,225 while the average audience size for women is 45,383. The results remain consistent with our main regressions. Although it seems as if women viewers have a stronger beauty bias in female matches (coefficient is larger by 0.004), the difference between both coefficients is not significant (see Table 9).

[5] Repeating the point estimation from the previous subsection, our separate regression model predicts 24,148 (the actual TV audience size for the match is 21,019) viewers for the Wimbledon semi-final match between Agnieszka Radwanska and Anqelique Kerber. Switching Agnieszka Radwanska with Maria Sharapova would increase TV-viewership by 5,436 additional viewers, all else being equal.

Table 8: Robustness checks with subsample regressions separated by player gender.

Dependent variable: LN(TV)	**(1)** All players	**(2)** Female players	**(3)** Male players
SUMSYMMETRY	0.022***	0.015*	-0.007
	(0.006)	(0.006)	(0.009)
MALE	4.560**		
	(1.580)		
MALE X SUMSYMMETRY	-0.027**		
	(0.011)		
LN(SUMRANK)	-0.353***	-0.017	-0.683***
	(0.100)	(0.118)	(0.142)
LN(DELTARANK)	0.161*	0.056	0.293**
	(0.065)	(0.077)	(0.092)
SUMGS	0.002	0.010	-0.006
	(0.008)	(0.014)	(0.009)
NUMBEROFGAMES	0.022**	0.048***	0.016
	(0.007)	(0.010)	(0.009)
Constant	5.825***	5.338***	11.676***
	(0.932)	(0.994)	(1.416)
Observations	622	261	361
R^2	0.524	0.442	0.508
Adj. R^2	0.513	0.415	0.491
Controls	YES	YES	YES

Robust standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Table 9: Robustness checks with subsample regressions separated by player and viewer gender.

	(1)	(2)	(3)	(4)
Dependent variable:	♀ audience	♂ audience	♀ audience	♂ audience
LN(TV)	Female matches	Female matches	Male matches	Male matches
SUMSYMMETRY	0.018**	0.014*	-0.003	-0.009
	(0.007)	(0.007)	(0.009)	(0.009)
LN(SUMRANK)	0.080	-0.041	-0.681***	-0.622***
	(0.141)	(0.122)	(0.151)	(0.141)
LN(DELTARANK)	0.019	0.044	0.317**	0.297**
	(0.086)	(0.083)	(0.100)	(0.092)
SUMGS	0.003	0.012	-0.010	-0.004
	(0.018)	(0.013)	(0.012)	(0.009)
NUMBEROFGAMES	0.060***	0.046***	0.008	0.017*
	(0.013)	(0.010)	(0.006)	(0.009)
Constant	3.182*	5.182***	10.372***	11.076***
	(1.261)	(1.065)	(1.510)	(1.384)
Observations	260	261	359	361
R^2	0.454	0.404	0.470	0.490
Adj. R^2	0.428	0.375	0.451	0.473
Controls	YES	YES	YES	YES

Robust standard errors in parentheses *** p>0.001, ** p<0.01, * p<0.05

5. Conclusion

In this paper, we examine whether consumers reward a beauty premium for athletes when watching sports on TV. By analyzing 622 live tennis matches from Grand Slam tournaments and calculating facial symmetry scores of tennis players, we show that consumers demonstrate a beauty bias in that they prefer to watch games with attractive female tennis players more often. Facial attractiveness does not play any significant role for male tennis matches.

5.1 Contributions and implications

Our results have implications for researchers and managers alike. In contrast to previous researchers (Meier & Konjer, 2015) that did not find any positive relationship between attractiveness and TV-viewership in tennis, we show that a beauty bias in tennis TV-viewership exists, but it is only granted for female tennis players. We

thereby extend the literature in sports demand research by (a) applying new methods to calculate facial attractiveness and (b) providing new findings. Previous researchers in athlete brand building (Braunstein & Zhang, 2005; Carlson & Donavan, 2013) relied on surveys to show relationships between physical attractiveness and consumption. Our empirical results show a direct relation between facial attractiveness and TV-viewership.

The implications for managers are manifold. Given that we have analyzed Swiss TV-viewership data based on the national TV broadcaster SRG, the results need to be interpreted with caution. We believe that the national TV broadcaster SRG has a public service function and therefore is interested in broadcasting matches with Swiss players and of high quality. Exploiting consumer biases (taste-based discrimination) with regards to facial attractiveness poses the danger of reinforcing non-sports related taste-based discrimination types. The situation might be different for profit-maximizing broadcasters and advertising revenue-maximizing media organizations objectives. As we have seen in previous research (Fink, 2015; Frisby, 2017), sports media organizations as well as sports governing bodies clearly exploit these consumer biases. They are likely to factor in beauty perceptions as demand determinants and therefore calculate the additional revenue-generating potential. Female athletes' performances (Cunningham et al., 2008 call this expertise) usually played a secondary role behind their attractiveness and femininity. In doing so, it is very likely that non-sports related biases are reinforced. Our results and previous findings (Cunningham et al., 2008; Fink & Cunningham, 2004; Mutz & Meier, 2016) suggest that both athletes' performances and attractiveness play a significant positive role in consumer interest. In this sense, there is no reason for sports media organizations and governing bodies not to put athletes' performances first.

Marketers, advertisers, and brand managers have long recognized the potential effects of physical attractiveness for endorsement deals; our findings strengthen the empirical evidence in that they clearly show a relationship between facial attractiveness and increased TV-demand. Cunningham et al. (2008) showed that both

expertise and attractiveness are important factors for product-endorser fit (in the study the product was a sports event). This is supported by our findings because we show that the TV-audience prefers both performance (i.e., high-quality matches) and attractiveness. Hence, marketers that collaborate with attractive athletes for endorsement deals, are advised to ensure that the given athlete's performance is promoted.

5.2 Limitations and future research

Although we show that consumers prefer to watch attractive athletes on TV, some researchers suggested that better-looking athletes win more often (Bakkenbüll & Kiefer, 2015). If this were true, tennis players with increased productivity (winning probability) would have increased probabilities of being broadcast on TV. Similar to previous econometric studies (Hamermesh & Biddle, 1994), the causal mechanisms are not fully clear and future research might better isolate these effects. A new study with a larger sample size over several years and different tournaments could shed light on these specific effects. Moreover, the research on early selection effects of young and physically attractive sports talents (e.g., in sports clubs, tennis academies, and agencies.) is very limited in comparison to other fields. Researchers could focus on selection biases that affect young athletes before those athletes compete on a global level.

Our study is further limited in that we (a) rely only on Swiss TV-viewership data and (b) consider only facial attractiveness in our model. In that sense, our study demonstrates evidence from a case in Switzerland using facial symmetry as the only predictor for physical attractiveness. However, Switzerland provides a very interesting case to analyze consumption behaviors on TV because the country can be geographically, linguistically, and culturally divided into four regions (i.e., the German part in the northeast, the French part in the west, the Italian part in the southern canton of Ticino, and the Romansh parts in the southeastern trilingual canton of Grisons). Moreover, 25% of the local population consists of foreigners. Future researchers should consider analyzing broader regions and include additional

physical attractiveness measures. Adding further attractiveness measures (e.g., body shape, or BMI) together with facial attractiveness would give important insights about consumer preferences for different attractiveness factors. More importantly, this insight could help to further advance the literature on the sexualization of female athletes in the commercial sports-media complex.

We apply new methods to analyze physical attractiveness using software to calculate facial attractiveness scores. Most previous researchers have used surveys for attractiveness ratings. Future studies could advance the methods provided in this study. For instance, different software algorithms (e.g., Microsoft, Google, and Amazon provide application-programming interfaces to analyze faces) might be used to calculate facial symmetries. Some software algorithms already use artificial intelligence methods based on human ratings to derive attractiveness scores. This would test the facial symmetry and attractiveness scores for robustness. Moreover, a new study could show how software ratings perform against human ratings based on surveys.

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A.3

Are workers rewarded for inconsistent performance?

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Abstract

This paper examines whether workers are rewarded for inconsistent performances by salary premia. Some earlier research suggests that performance inconsistency leads to salary premia while other research finds premia for consistent performances. Using detailed salary and performance data, we find that inconsistency is rewarded for some dimensions of performance, specifically those where creativity is important and outcomes have higher variance. We find salary penalties for inconsistent performances in those dimensions that are basic requirements of successful team production.

JEL Classification: J31, M52, Z20
Keywords: salaries, performance, consistency

1. Introduction

Following Lazear (1998), a body of personnel economics literature has considered whether workers who demonstrate greater performance inconsistency than comparable workers of similar average productivity are rewarded more highly. Lazear conjectured that there would be an 'upside potential to risky workers' so inconsistent performers would be more highly rewarded in salary due to their capability of providing extraordinarily high productivity albeit on a few occasions. Firms would consider this unusually high performance to be an option value and would reward workers more highly to reflect this.

In some cases, principals prefer consistent performances to volatile ones by their agents (Bodvarsson & Brastow, 1998; Deutscher, Gürtler, Prinz, & Weimar, 2017; Dickinson & Oaxaca, 2014), in other cases, researchers suggest that principals prefer inconsistent agents to consistent ones (Bollinger & Hotchkiss, 2003; Deutscher & Büschemann, 2016). Although existing literature finds evidence for either case, the question under which conditions inconsistency is penalized or rewarded remains ambiguous, especially because the necessary conditions are not identified. Beyond the aforementioned studies, Andersson, Freedman, Haltiwanger, Lane, and Shaw (2009) show that software firms that are active in areas with highly skewed positive returns (e.g., video game developers) pay higher upfront salaries and offer higher compensation growth. The analysis, however, does not consider inconsistency and salary differences are explained by firms' product payoff dispersions.

To solve the puzzle, one could try to compare two industries, one in which inconsistency is punished and one in which it is rewarded, and then identify the determinants of the differences. However, such an analysis is very difficult because industries differ by many factors and it would be impossible to identify the relevant factors. Another strategy could be to analyze such differences within a single industry. This approach would require an industry in which performance inconsistency is measured very precisely and in which there are some tasks in which workers are penalized and some tasks in which workers are rewarded for performance

inconsistency. Empirical testing for the upside potential of risky workers is very difficult in most industries as individual workers' mean and variance of productivity cannot be cleanly derived (Ernst & Vitt, 2000; Garen, 1988). Self-reported survey data are unhelpful in this context and results from firm-specific data may not easily generalize (Barrett & O'Connell, 2001; Chapman & Southwick, 1991), because cross-firm comparisons are not possible. Instead, sports data offer good opportunities to study the relationship between worker salary and variations in productivity since we can extract performance data at individual worker (player) level for many different competing firms (clubs) over time (seasons) into a large data set. Kahn (2000) emphasizes that the sports industry presents a valuable laboratory setting to analyze labor markets. In recent years, many researchers have turned to sports data to analyze numerous research questions in management, economics, and other social science fields.

We exploit detailed European football performance data from the top division of one of the Top Five European football leagues, i.e., the Italian Serie A. We define performance inconsistency as performance variation and are particularly interested in the effects of performance variation on salary. Some players might be rewarded for consistency of performances (e.g., defenders) while others might be rewarded for performance variation as their roles require creativity which, in turn, generates inconsistency. Such features of heterogeneity may be important in a wider complex organizational setting. Especially in settings where creative workers combine with workers doing more mundane tasks in a repeated team production context, e.g., celebrity chefs and immediate co-workers in a restaurant, star actors and background artists in a theater production, or surgeons in the operating room and assisting nurses. Our data set facilitates testing of heterogeneous effects of performance on salary.

In contrast to Deutscher and Büschemann (2016), who use the same single performance proxy measure (journalist ratings for player performances) for all players regardless of field position in the team, we use actual salary data, which is clearly superior to market values and other proxies. Deutscher and Büschemann's (2016)

analysis of Bundesliga football lacks data on both direct salaries and player performances, so the authors use proxy measures. The salary proxy is a player valuation measure created by experts at Kicker sports magazine. The researchers argue that Kicker valuations are closely correlated with a subset of available salaries for Bundesliga players. The performance proxy is a set of subjective grade scores (journalists' ratings) recorded by Kicker ranging at match level from 1 (excellent) to 6 (very poor). Using market values as proxies for salary data (e.g., via Transfermarkt.de or Kicker ratings) raises several issues: (i) the algorithm to calculate market values is non-transparent, (ii) the algorithm does not update frequently, and (iii) crowd estimates cannot be verified or replicated (Müller, Simons, & Weinmann, 2017). Market values conflate transfer fees with salary payments. Thrane (2019) shows the limitations of market values as predictors of actual salary in Norwegian football.

Although expert ratings might have their merits, Gauriot and Page (2018) show that managers, journalists, and sports fans significantly overrate observed outcomes when they evaluate performance, i.e., they demonstrate outcome-bias. Specifically, journalists have a tendency to overrate players two-thirds of a standard deviation when a goal is scored compared to when no goal is scored (Gauriot & Page, 2018). Outcome bias occurs in settings where ex-post outcomes influence an individual's judgements of a given situation, although the ex ante information was identical (Baron & Hershey, 1988; Lefgren, Platt, & Price, 2015).

Going beyond previous research, we show that salary premia in our setting are only offered for particular dimensions of performance. To the best of our knowledge, this is the first paper to empirically show that inconsistency is rewarded for some dimensions of performances, while it is penalized in others. The existing literature on the effect of performance inconsistency on worker salaries does not differentiate between differences of tasks within a team and therefore cannot capture the insights generated by our study. In short, performance inconsistency in defensive tasks is penalized while performance inconsistency in attacking and goal scoring is rewarded. As in any other industry, workers need to provide various skillsets for different tasks.

Some tasks are more repetitive or administrative and others require more creative skills, where effort, productivity, and salary returns have disproportionate relationships to performance attributes.

The remainder of this paper is organized as follows: section 2 provides the necessary theoretical background, section 3 presents our data and empirical model. In section 4, we analyze empirical results, and we conclude the paper in section 5.

2. Background

A widely used regression model to explain earnings as a function of schooling and experience is Mincer's (1974) framework, a cornerstone of empirical labor economics, that has been replicated in many studies around the world (Ashenfelter & Alan, 1994; Bils & Klenow, 2000; Card & Krueger, 1992; Willis, 1987). More-educated workers earn higher salaries; additional years of work experience and age have a positive albeit diminishing effect on salaries (i.e., upward sloping and concave functional form). Within sports, researchers have focused largely on Mincer's wage equation to model salary outcomes, where age, experience, position, national team selection, team effects, country of origin, and performance have been used to determine salaries. Bryson, Frick, and Simmons (2013) find that age, height, goals per game, international appearances, and two-footedness increase salaries. In general, offensive players earn more (Lucifora & Simmons, 2003). Extraordinarily talented football players, i.e., superstars earn up to 34% more (Lucifora & Simmons, 2003) and according to Bryson, Rossi, and Simmons (2014), migrant players earn more than domestic ones, which is partly explained by superstar effects. Furthermore, evidence for superstar effects is offered by Carrieri, Principe, and Raitano (2018) using Google citations as a measure of player popularity.

Rosen's (1981) seminal paper formally analyzed the economics of superstars. He showed that marginal differences in talent can lead to huge differences in earnings. When talent is highly valued by consumers, the most talented individuals earn disproportionately high incomes due to economies of scale in audience consumption of the performer's talent. In modern European football, audience consumption refers

to global broadcast coverage of matches featuring superstar players. Even regular league games are broadcast worldwide live across all major continents.

Furthermore, Adler (1985) shows that equally talented individuals might have huge differences in earnings because consumers are more familiar with one talent compared than the other, suggesting that it might be an individual's celebrity status associated with accumulated reputation, rather than that individual's talent leading to higher earnings. Both Rosen's and Adler's explanations of superstar effects are complementary and not mutually exclusive: to qualify as a superstar, a player needs strong performances, high popularity, and the ability to reach a large audience (i.e., players like Messi and Ronaldo have all three attributes).

Superstar effects are most likely to occur in arts, entertainment, and sports but they are also observed in other fields. Researchers have focused on the earnings of CEOs (Malmendier & Tate, 2009), Wall Street analysts (Groysberg, Lee, & Nanda, 2008), scientists (Narin & Breitzman, 1995), actors (Ravid, 1999), and athletes (Carrieri et al., 2018; Lucifora & Simmons, 2003). Using several regression methods, including unconditional quantile regressions, and Italian salary data similar to ours, Carrieri et al. (2018) show that football players' popularity is the most important determinant of salary in the top decile of the player salary distribution, outweighing player performance and bargaining power, thereby supporting Adler's (1985) theory.

Some researchers have turned to sports data to find empirical evidence for Lazear's (1998) theory of upside potential of risky workers: Bodvarsson and Brastow (1998) show that managers prefer consistent over volatile performances by analyzing data from the National Basketball Association (NBA), i.e., inconsistent NBA players earn less because they need to be monitored, which is costly. Bollinger and Hotchkiss (2003) empirically test baseball player's salaries and performances and find that inconsistent baseball players earn a salary premium compared to their colleagues who have the same average performance but do not offer larger upside potential. Deutscher and Büschemann (2016) and Deutscher et al. (2017) study the relationship between player salaries and performance variation in the German Bundesliga and in the NBA,

respectively. For German football, the researchers offer evidence that players are more highly rewarded for more inconsistent performance. For the NBA, the results point in the opposite direction, where greater consistency is rewarded by a salary premium. Thus, these two papers deliver contradictory results from two different sports leagues.

Beyond sports industry related studies, Dickinson and Oaxaca (2014) use experimental settings to show that inconsistent workers are more likely to be hired but earn lower salaries. Andersson et al. (2009) argue that there is a strong connection between talent and product innovation in the software industry, a sector that has large economies of scale in production and is characterized by highly skewed payoffs for both firms and skilled workers. Indeed, some software products may generate extra-ordinary revenues while others might turn out to generate large losses. This is often a result of winner-take-all markets. The researchers define star employees as those project managers and engineers who have better abilities to pick projects with high positive returns. As such, they conjecture that star employees would increase project payoffs both in less risky industries and in high-risk industries. However, the project payoffs are much larger in markets that have high variance and high skewness. Using OLS and quantile regressions, the researchers show that firms with higher revenues pay higher salaries but they emphasize that product payoff dispersions have a significant positive effect on starting salaries and salary growth.

Similar to Andersson et al.'s (2009) arguments about the software industry, scoring and winning in European football are heavily dependent on athletes' talents. Here again, club managers need to pick the best talents that maximize their club's winning percentage, and therefore, revenues. European football is known as a low-scoring and low-numbers game. Given the nature of the game, the relationship between effort and payoffs (e.g., goals scored) can be highly skewed. Not only can an additional scored goal decide whether a team wins or loses, winning the league leads to extraordinary prize money for the winning club but also to enormous additional revenues in subsequent seasons because winners qualify for prestigious tournaments,

e.g., UEFA Champions League (UCL), with high prizes[1]. On the other hand, losing teams at the bottom of the league face relegation. An additional goal that is conceded might lead to an extraordinary loss of revenues (e.g., from TV-rights, stadium attendance, and merchandising, etc.) because there is a steep drop in revenues between top divisions and subsequent lower divisions. According to Dietl, Franck, and Lang (2008), clubs overinvest in talents because of these unequal industry payoff structures. The structure of rewards in football competitions points to potential large returns to teams and players from success generated by high levels of player performance. The question we pose is whether player salary returns are increased or decreased by higher performance variation.

3. Data and methods

In European football, two teams compete against each other with 11 players on each side; the team that scores more goals wins, hence, the objective team production function is to produce more goals. Players have different tasks, i.e., goal keepers guard the goal and are allowed to use their hands, defenders try to keep the ball as far away from their goals as possible, midfielders connect defense and attack (some have coordinating tasks, others have creative tasks), and strikers need to be creative to outplay the opponent's defenders in order to score goals. To oversimplify: attackers proactively seek to outplay defenders, while defenders react and try to minimize any mistakes.

To study the heterogeneous relationship between inconsistent worker performance and earnings, we require a detailed dataset with information on numerous performance metrics and earnings. For this, we use player performance data from eight seasons (2009/10 to 2016/17) of the Italian Serie A. Our choice of Italy

[1] Juventus, Roma, and Napoli qualified for the UCL after ranking 1st, 2nd, and 3rd respectively in the 2016/17 Serie A season. In the subsequent 2017/18 UCL season, these teams generated additional revenues between EUR 39m and EUR 83m. For a detailed list of UCL revenue distributions, see: https://www.uefa.com/MultimediaFiles/Download/competitions/General/02/57/82/51/2578251_DOWNLOAD.pdf

Serie A is motivated by availability of both player salary and player performance data. Italy is the only European country for which reliable and consistent football player salary data are published in a comprehensive manner over a long period (Bryson et al., 2014; Carrieri et al., 2018).

The rich player performance data set was purchased from Panini Digital, an official data provider for clubs of the Italian Serie A. In total, we count 84,499 player-match observations. The sample reduces to 78,302 player match observations because we exclude goalkeepers from our analysis. Assessing individual goalkeeper performances is very difficult compared to defenders, midfielders, and forwards. Our salary data come from the most popular sports newspaper La Gazzetta dello sport and are published in September of each year, since 2008. The salary data represent gross basic pay and exclude performance-related and other bonuses. In order to estimate salary models, we collapse our match-level performance statistics into season-level aggregates.

3.1 Performance measures

We measure individual player performances by numerous on-field metrics (e.g., balls played, successful passes, recovered balls, shots on target). Players are assigned different positions by the data provider (e.g., defender, midfielder, forward) which require different sets of skills. We take the position categories as given by the data providers. Although some players might be more versatile and therefore are assigned to different positions in different games by the managers, they are usually playing the same position in a given season.

Thousands of actions (events) are measured by Panini Digital, of which some are more important for team match outcomes than others. For this reason, we proceed as follows: First, we use a single composite performance index called IVG that is provided by Panini Digital. The measure is used by Italian Serie A clubs media outlets and researchers (Fumarco & Rossi, 2018; Montanari, Silvestri, & Bof, 2008) for player performance evaluation.

The IVG measure is an index that is calculated by an algorithm that includes more than thousand in-game actions. The measure has been developed by researchers at the Department of Statistical Sciences of the University of Bologna, together with a team of football experts that are all current or past football coaches (e.g., Sacchi, Lippi, Zeman, Lucescu, Ancelotti). This index covers several situations (e.g., player in possession, player dictating the pass, player recovering the ball) and compares each player to a historical average, i.e., a benchmark that is specific to that role (Fumarco & Rossi, 2018). The IVG can take values from 1 (minimum) to 30 (maximum) and has a sample mean around 17. The index may increase for defenders that are able to contribute to attack (e.g., shots) or decrease for attackers that are caught offside or lose the ball; there are penalties and extra points for each role. Scoring is highly rewarded with additional extra points, the extra points for goals decrease with every additional goal scored in a match (e.g., 4 points for the first goal, 3 points for the second goal, 2 points for the third goal, 1 point for any additional goal above 3).

Second, we apply factor analysis to reduce the number of performance metrics to arrive at a more representative and smaller number of performance variables that can summarize more accurately different skillsets for different players. A very similar multivariate technique for data reduction is called Principal Component Analysis (PCA) (Jackson, 1991). Both methods reduce the dimensionality of the data into a smaller number of unobserved variables expressed as linear combinations of observed variables. Other than factor analysis, however, PCA assumes that there is no unique variance of the observed variables and that the total variance is equal to the common variances.

Factor Analysis (and PCA) is used in many fields, including social sciences (Cattell, 1978; Gorsuch, 1983), economics (Bai & Wang, 2016; Bhatti, Al-Shanfari, & Hossain, 2006; Huang-Lachmann, Hannemann, & Guenther, 2018; Studer & Winkelmann, 2017), and biostatistics (Van Belle, Fisher, Haegerty, & Lumley, 2004).

We collected data for 26 on-field metrics (see Tables 1 and 2) to assess player performances. For example, a defender's performance is assessed by observing the

number of interceptions, blocked shots, tackles, etc. he had, while an attacker's performance is assessed by the number of shots on target, dribblings, assists, etc. Using factor analysis, we reduce these observable and measurable variables (e.g., shots on target, tackles) into a set of fewer underlying latent variables, i.e., factors that explain the interrelationships among observed variables. At the center of the analysis is the covariance among the observed variables: variables that are highly correlated will share a lot of variance. The assumption is that the observed variables are linear combinations of the underlying and unobserved factors. The procedure reduces dimensionality because the factors that share common variance (communality) can explain more of the variance of an individual observed variable (Bhatti et al., 2006; Mueller & Kim, 1978).

Other than PCA, factor analysis assumes that there are latent factors that better explain the relationship between correlating observed variables. This supports our decision to apply factor analysis instead of PCA: Even if we can measure the number of passes, shots, etc., we do not know how these variables relate to ability and effort. Ability itself can be individual (a player's own skillset) and peer-related, that is, the ability to interact in a team. These are intangible factors. Nonetheless, we have also tested our models using PCA with results available on request. The resulting tables (eigenvalues, explained variance, factor loadings) are different due to the different procedure; however, the patterns of the extracted components and the interpretations thereof are very similar. Thus, the regression results using the two methods are not remarkably different. Indeed, previous researchers have shown that PCA and factor analysis show very similar results (Velicer & Jackson, 1990).

Table 1: Definitions of observed variables for factor analysis.

Accurate crosses	Accurate passes from a wide position to a central attacking area.
Accurate long balls	Accurate passes of 22.83 meters or more.
Accurate through balls	Accurate passes between opposition players in their defensive line to find an onrushing teammate (running through on goal).
Aerial duels won	Winning a header in a direct contest with an opponent.
Anticipations	Preventing an opponent's pass from reaching their teammates.
Assists	Pass leading to scoring a goal.
Balls played	Total number of played balls.
Balls played in opp. half	Total number of played balls in the opposition half.
Blocked shot	An outfield player's prevention of an opponent's shot reaching the goal.
Clearances	Defending player that removes the attacking threat on their goal, effectively alleviating pressure on their goal.
Counterattack	An attack made in response to one by an opponent.
Fast breaks	Attempts to move the ball up the pitch and into scoring position as quickly as possible.
Goal chances	Players' opportunity to score a goal.
Goals	Scoring a goal.
Goals from inside goal area	Goal scored inside the box.
Interceptions	Preventing an opponent's pass from reaching their teammates leading to ball possession.
Recovered balls	Recovering the ball and keeping possession of the ball.
Recovered balls in def. area	Recovering the ball and keeping possession (defensive area).
Shots	Total number of player's shots.
Shots on target	Attempts to score which required intervention to stop it from resulting in a goal.
Successful passes	Passes from a player to a teammate.
Total tackles	Dispossessing an opponent, whether the tackling player comes away with the ball or not.
Useful dribbles	Dribbles that provide an advantage.
Useful plays	Plays that generate an advantage in favor of the team that possesses the ball.
Useful plays in opp.half	Plays that generate an advantage in favor of the team possessing of the ball (opposition's half).
Useful short passes in opp. half	Short passes that generate an advantage in favor of the team possessing the ball (opposition half).

Table 2: Descriptive statistics of on-field metrics (observed variables) used for factor analysis.

Variable	Obs.	Mean	SD	Min	Max
Balls played	78,302	40.572	22.428	0	196
Balls played in opp. half	78,302	19.634	14.603	0	131
Successful passes	78,302	25.844	17.405	0	176
Useful plays	78,302	6.830	5.723	0	76
Useful plays in opp. half	78,302	3.357	3.538	0	48
Recovered balls	78,302	10.446	7.627	0	50
Recovered balls in def. area	78,302	5.244	5.613	0	35
Anticipations	78,302	1.453	1.983	0	23
Counterattack	78,302	0.514	0.807	0	8
Fast breaks	78,302	1.933	1.944	0	18
Useful dribblings	78,302	0.595	1.029	0	14
Assists	78,302	0.644	0.979	0	10
Goal chances	78,302	0.350	0.714	0	8
Shots	78,302	0.973	1.328	0	13
Goal from inside goal area	78,302	0.019	0.138	0	3
Useful short passes in opp. half	78,302	0.927	2.002	0	39
Shots on target	78,302	0.343	0.687	0	8
Aerials won	78,302	0.993	1.412	0	15
Total tackles	78,302	1.553	1.658	0	16
Interceptions	78,302	1.299	1.569	0	13
Clearances	78,302	2.135	3.027	0	29
Blocked shots	78,302	0.241	0.563	0	7
Accurate crosses	78,302	0.381	0.820	0	11
Accurate long balls	78,302	2.033	2.634	0	29
Accurate through balls	78,302	0.094	0.345	0	6
Goals	78,302	0.091	0.318	0	5

Table 3: Factor Analysis.

Factor	Eigenvalue	Differences	Proportion	Cumulative
Factor1	6.06159	1.53575	0.4287	0.4287
Factor2	4.52584	2.54691	0.3201	0.7488
Factor3	1.97894	1.34984	0.14	0.8888
Factor4	0.62909	0.0682	0.0445	0.9332
Factor5	0.56089	0.18724	0.0397	0.9729
Factor6	0.37364	0.05432	0.0264	0.9993
Factor7	0.31932	0.07022	0.0226	1.0219
Factor8	0.2491	0.05942	0.0176	1.0395
Factor9	0.18968	0.03235	0.0134	1.053
Factor10	0.15733	0.0447	0.0111	1.0641
Factor11	0.11263	0.05272	0.008	1.072
Factor12	0.05991	0.03381	0.0042	1.0763
Factor13	0.0261	0.00964	0.0018	1.0781
Factor14	0.01646	0.02975	0.0012	1.0793
Factor15	-0.01329	0.01194	-0.0009	1.0784
Factor16	-0.02524	0.00395	-0.0018	1.0766
Factor17	-0.02918	0.0386	-0.0021	1.0745
Factor18	-0.06778	0.0122	-0.0048	1.0697
Factor19	-0.07998	0.00193	-0.0057	1.0641
Factor20	-0.08191	0.00491	-0.0058	1.0583
Factor21	-0.08682	0.00161	-0.0061	1.0521
Factor22	-0.08843	0.02903	-0.0063	1.0459
Factor23	-0.11745	0.03034	-0.0083	1.0376
Factor24	-0.1478	0.04177	-0.0105	1.0271
Factor25	-0.18957	0.00413	-0.0134	1.0137
Factor26	-0.1937	.	-0.0137	1

Number of observations: 78,302 Retained factors: 3

Usually, the procedure takes several steps. (1) The factor analysis is run on a set of observed variables, in our case 26 (see Table 2), and factors are extracted. Table 3 shows the eigenvalues (i.e., the variance) of the factors. Following Kaiser (1960), we drop all factors that have eigenvalues lower than unity. This leaves us with three factors. Although there are multiple approaches to select the number of factors to retain, the Kaiser rule is the most commonly used. (2) Factors are rotated to achieve a simple structure that allows us to more easily interpret the results. Without factor rotation, most of the observed variables are loaded on the first factor so that the first factor explains most variance. Achieving a simple structure is helpful because each

factor can define a distinct cluster of interrelated variables and the results are more easily interpretable (Cattell, 1978; Mueller & Kim, 1978). We use oblique rotation for our analysis because the factors are correlated (i.e., a player can have strong playmaking skills and striking skills). Note that the underlying data does not change here. Results of the rotated factor analysis are shown in Tables 4 and 5.

Table 4: Factor Analysis – Rotated Factors (oblique promax).

Factor	**Variance**	**Proportion**	Rotated factors are correlated
Factor1	5.33453	0.3773	
Factor2	5.06215	0.358	
Factor3	3.22875	0.2284	
Number of observations: 78,302		Retained factors: 3	

After rotating the factors, we focus on interpreting the results. The factor pattern matrix in Table 5 shows the partial standardized regression coefficients of each observed variable (rows) with a specific factor (columns). For instance, 0.772 is the effect of factor 1 on the observed variable balls played, controlling for factors 2 and 3; while 0.450 is the effect of factor 2 on balls played controlling for factors 1 and 2. Squaring the loadings, e.g., 0.7722 = 0.60, gives us factor 1's unique contribution of the variance in 'balls played', controlling for factors 2 and 3.

Table 5: Rotated (oblique promax) factor loadings and pattern matrix.

Variable	**Factor1** Playmaking	**Factor2** Defense	**Factor3** Striker	**Uniqueness**
Balls played	0.772	0.450	0.057	0.118
Balls played in opp. half	0.818	-0.242	0.179	0.213
Successful passes	0.741	0.404	-0.050	0.215
Useful plays	0.851	0.229	-0.080	0.184
Useful plays in opp. half	0.904	-0.236	0.017	0.170
Recov. balls	0.220	0.904	0.016	0.095
Recov. balls in def. area	-0.069	0.946	0.005	0.120
Anticipations	0.030	0.700	0.005	0.506
Counterattack	0.182	0.181	0.017	0.927
Fast breaks	0.528	0.392	-0.086	0.508
Useful dribblings	0.375	-0.162	0.171	0.781
Assists	0.520	-0.236	0.103	0.661
Goal chances	-0.006	0.026	0.834	0.318
Shots	0.198	-0.085	0.715	0.364
Goal from inside goal area	-0.101	0.106	0.425	0.841
Useful short passes in opp. half	0.494	-0.048	-0.063	0.767
Shots on target	0.020	0.021	0.828	0.318
Aerials duels won	-0.041	0.409	0.163	0.849
Total tackles	0.261	0.363	-0.047	0.770
Interceptions	0.124	0.578	-0.021	0.627
Clearances	-0.167	0.804	0.047	0.379
Blocked shots	-0.068	0.413	0.011	0.835
Accurate crosses	0.462	-0.204	-0.016	0.771
Accurate long balls	0.413	0.350	-0.062	0.666
Accurate through balls	0.265	-0.119	0.066	0.908
Goals	-0.096	0.112	0.726	0.524

The uniqueness column presents the portion of variance that is not explained by the three factors. To calculate the communality of each observed variable, we subtract each uniqueness value from 1. For instance, balls played has a communality of 0.88, meaning that 0.88 of the variance of balls played is accounted for by the three factors. Variables with higher uniqueness (lower communality) are not as well explained by the three retained factors as those variables with lower uniqueness.

A closer look on Table 5 helps us to interpret the specific skillsets for players. For instance, the factor loadings for balls played (0.772), balls played in opposition half (0.818), successful passes (0.741), useful plays (0.851), useful plays in opposition half

(0.904) are all very high for factor one: they describe playmaking skills. Players associated with high values of this factor have the ability to control and direct the ball. Moreover, they also contribute to creative attacking play, as the loadings for assists (0.520) and useful short passes in opposition half (0.494) indicate. It is not surprising that most midfielders score high on this factor. In contrast, factor two explains defensive skills, clearly visible by the high loadings of recovered balls (0.904), recovered balls in defensive area (0.946), anticipations (0.700), interceptions (0.578), and clearances (0.804). The third factor describes typical striker skills: loadings on shots (0.715), shots on target (0.828), goal chances (0.834), and goals (0.726) are all high. We can see that these three factors, i.e., skillsets, are well correlated with the player positions.

Having extracted the three factors (playmaking, defense, striker), we predict factor scores for every player-match observation to see how players have performed on a given skillset in a game. This step is important because include the predicted factor scores into our main regression analysis. Technically, statistical software packages use regression methods to predict factor scores. After predicting the factor score, we calculate the average factor score per season (e.g., average score over all matches in a given season) and the standard deviation of factor score per season to include these newly generated performance variables in our salary regressions.

3.2 Econometric strategy

Based on the Mincer wage equation and literature on salary determination in team sports (Bryson et al., 2014; Carrieri et al., 2018), we first model player salaries as a function of player productivity measures (mean and standard deviation of performance) and control covariates. This model facilitates testing of previous research findings on the effects of performance inconsistency on salaries. Because three teams are relegated from Serie A in each season and we do not observe Serie B earnings, some players in our unbalanced panel data set may appear in one season and disappear in the next. In addition, some players may move to other leagues or may retire. As

salaries are outcomes of performances, we cannot regress salaries and performances in the same year due to endogeneity concerns. Therefore, salary levels at time t are regressed on performance levels and associated coefficient of variation from season t-1, where these performances may come from a different club if the player has switched teams. We calculate average performance (MEAN IVG) per season for each player and the standard deviation of performance (SD IVG) per season for each player. Hence, performance variation refers to dispersion of performances within a given season rather than across seasons.

We control for player age, career games, and national team selection before the beginning of the season. In addition, we use dummies for non-European players, for positions (defender, midfield, forward), and for teams. Along the lines of numerous papers that have used the Mincer wage regression, we expect age and the number of career games to have a positive yet diminishing (i.e., concave) effect on salaries (Bryson et al., 2013). Appearance in the national team represents both a selection and signaling effect, which will also have a positive effect on salaries. While we expect foreign players (Bryson et al., 2014) to have higher salaries as well, reflecting unobserved ability and specialized skills. Moreover, we already see, from a descriptive analysis, that attacking players usually earn more than defending players, hence, midfielder and forward dummies should have a positive effect on salaries (Frick, 2007; Lucifora & Simmons, 2003).

$$LN(SALARY_t) = \alpha_0 + \alpha_1 MEAN\ IVG_{t-1} + \alpha_2 SD\ IVG_{t-1} + \alpha_3 AGE_t + \alpha_4 AGE_t^2 + \alpha_5 CAREER\ GAMES_t + \alpha_5 CAREER\ GAMES_t^2 + \alpha_6 NATIONALTEAM_t + \alpha_7 NONEU + Position + Team + \text{error} \quad (1)$$

Our focus is on the sign and size of $\alpha 2$. A negative sign shows that performance inconsistency, i.e., standard deviation of performance, reduces player salary. A zero coefficient shows no effects, indicating perhaps that team managers regard performance inconsistency as a consequence of luck and so should play no role in assessing salary in contract negotiations. A positive coefficient indicates support for Lazear's hypothesis of upside potential of risky workers.

Table 6: List of dependent and independent variables and their descriptions.

Variable	Description
LN(SALARY$_t$)	Natural logarithm of salary in season t.
MEAN IVG$_{t-1}$	Average performance in season t-1.
SD IVG $_{t-1}$	Standard deviation of performance in season t-1.
PLAYMAKING $_{t-1}$	Average playmaking skills in season t-1.
SD PLAYMAKING $_{t-1}$	Standard deviation of playmaking skills in season t-1.
DEFENSE $_{t-1}$	Average defensive skills in season t-1.
SD DEFENSE $_{t-1}$	Standard deviation of defensive skills in season t-1.
STRIKER $_{t-1}$	Average striking/scoring skills in season t-1.
SD STRIKER $_{t-1}$	Standard striking/scoring skills in season t-1.
AGE$_t$	Age of player in season t.
AGE$_t^2$	Age squared of player in season t.
CAREERGAMES$_t$	Cumulative number of career games in the Serie A in season t.
CAREERGAMES $_t^2$	Cumulative number of career games sq. in the Serie A in season t.
NATIONALTEAM$_t$	Dummy = 1 if appeared in the national team squad in season t.
DEFENDER$_t$	Dummy = 1 if player is a defender.
MIDFIELDER$_t$	Dummy = 1 if player is a midfielder.
FORWARD$_t$	Dummy = 1 if player is a forward.
NONEU	Dummy = 1 if player is a non-European player.
Team dummies	Dummy variable for team.
Season dummies	Dummy variable for season.

Table 7: Descriptive statistics of dependent and independent variables.

Variable	Obs.	Mean	SD	Min	Max
LN(SALARY$_t$)	2,049	7.308	0.808	4.094	9.616
MEAN IVG$_{t-1}$	2,049	17.744	1.523	11.733	23.323
SD IVG $_{t-1}$	2,049	2.761	0.689	0.212	6.241
PLAYMAKING $_{t-1}$	2,049	0.074	0.645	-1.228	3.831
SD PLAYMAKING $_{t-1}$	2,049	0.684	0.251	0.019	2.055
DEFENSE $_{t-1}$	2,049	0.096	0.819	-1.268	2.242
SD DEFENSE $_{t-1}$	2,049	0.503	0.230	0.043	1.300
SRIKER $_{t-1}$	2,049	-0.016	0.565	-0.801	3.320
SD STRIKER $_{t-1}$	2,049	0.631	0.390	0.010	2.241
AGE$_t$	2,049	28.128	4.147	17.000	40.800
AGE$_t^2$	2,049	808.372	236.167	289.000	1,664.640
CAREERGAMES$_t$	2,049	138.226	100.027	5.000	619.0
CAREERGAMES $_t^2$	2,049	29,106.9	42,486	25.0	383,161
NATIONALTEAM$_t$	2,049	0.540	0.499	0	1.000
DEFENDER$_t$	2,049	0.368	0.482	0	1.000
MIDFIELDER$_t$	2,049	0.429	0.495	0	1.000
FORWARD$_t$	2,049	0.203	0.402	0	1.000
NONEU	2,049	0.424	0.494	0	1.000

In our second and main model, we switch our productivity measure IVG with the three factors from our factor analysis that explain playmaking, defensive, and striker skills respectively. The control covariates do not change. Here, we are interested in the sign and sizes of $\alpha 2$, $\alpha 4$, and $\alpha 6$ to see if inconsistent performances for different skillsets have different effects on salaries.

$$\begin{aligned} LN(SALARY_t) = {} & \alpha_0 + \alpha_1 PLAYMAYKING_{t-1} + \alpha_2 SD\ PLAYMAKING_{t-1} + \\ & \alpha_3 DEFENSE_{t-1} + \alpha_4 SD\ DEFENSE_{t-1} + \alpha_5 STRIKER_{t-1} + \alpha_6 SD\ STRIKER_{t-1} + \\ & \alpha_7 AGE_t + \alpha_8 AGE_t^2 + \alpha_9 CAREER\ GAMES_t + \alpha_{10} CAREER\ GAMES_t^2 + \\ & \alpha_{11} NATIONALTEAM_t + \alpha_{12} NONEU + Position + Team + \text{error} \end{aligned} \quad (2)$$

4. Regression results

We run OLS regressions for 2,049 player observations over eight seasons. Our initial results (see Table 8, regressions 1 to 4) show that we can replicate previous findings from German football. Using more precise salary and performance measures (the IVG single composite measure), we find that inconsistent players earn more than consistent ones; similar to Deutscher and Büschemann (2016). The baseline regression (1) shows positive and significant coefficients of average performance (MEAN IVG) and performance inconsistency (SD IVG).

An increase of the average performance by one unit increases salaries by 7.4% while increasing the average performance by one standard deviation would raise salaries by 11.3% in the OLS regression. If performance inconsistency increases by one unit, salaries increase by 7.9%. Our control covariates perform as expected. Age has a positive, yet diminishing effect on salaries. The turning point where the positive age effect diminishes is roughly 30 years in the OLS regression. Similarly, tenured players with a larger number of career games are paid higher salaries. Moreover, players that were selected into the national team squad are also paid higher salaries. In regression (2), we add player fixed effects and see that the results on player inconsistency persist. Naturally, the coefficients are smaller than in the OLS regression but they are positive

and significant. Here, a one-unit increase of performance inconsistency would lead to a salary increase of 0.4%.

Table 8: Estimation results for OLS and FE regressions (IVG).

Dependent variable: LN(SALARY$_t$)	**OLS** **(1)**	**FE** **(2)**	**OLS (corr. IVG)** **(3)**	**FE (corr. IVG)** **(4)**
MEAN IVG$_{t-1}$	0.074***	0.005	0.080***	0.017
	(0.008)	(0.010)	(0.012)	(0.012)
SD IVG$_{t-1}$	0.079***	0.040***	0.131***	0.056***
	(0.016)	(0.015)	(0.016)	(0.016)
AGE$_t$	0.374***	0.410***	0.372***	0.398***
	(0.038)	(0.073)	(0.038)	(0.072)
AGE$_t^2$	-0.006***	-0.009***	-0.006***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
CAREERGAMES$_t$	0.002***	0.007***	0.002***	0.007***
	(0.000)	(0.001)	(0.000)	(0.001)
CAREERGAMES$_t^2$	-0.000**	-0.000***	-0.000**	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
NATIONALTEAM$_t$	0.115***		0.095***	
	(0.023)		(0.023)	
MIDFIELD$_t$	0.062***		0.025	
	(0.024)		(0.022)	
FORWARD$_t$	0.259***		0.246***	
	(0.033)		(0.031)	
NONEU	0.100***		0.095***	
	(0.023)		(0.023)	
Constant	-0.339	1.841	-0.446	1.816
	(0.554)	(1.335)	(0.564)	(1.339)
Observations	2,049	2,049	2,049	2,049
Number of Players		725		725
R^2	0.723	0.526	0.731	0.533
Adj. R^2	0.716	0.516	0.724	0.522
Season Dummies	YES	YES	YES	YES
Team Dummies	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

As a robustness check, we have used 78,302 player-match observations and corrected the productivity scores (IVG) by additionally controlling for the rank difference between home and away teams, derby matches, last eight matches of the season and the opposition team. Regressions (3) and (4) show the results of the

corrected productivity scores. The results persist: inconsistency is rewarded by a salary premium.

Using quantile regressions (Table 9), we test whether our results are consistent at different points in the conditional distribution of our dependent variable. OLS focuses on the average relationship between the dependent and independent variables; while quantile regressions test this relationship on assigned percentiles and median, using least absolute deviation of observations from fitted regression line and still using all observations for any given quantile estimate. The median regression is especially more robust to outliers in comparison to OLS. We regress salaries on our performance (MEAN IVG, SD IVG) and control variables to yield coefficient estimates at the 10th, 25th, 50th, 75th, and 90th percentiles (see Table 9). Intriguingly, while the average performance on different percentiles of salaries has similar effects, performance inconsistency at the 75th and 90th percentile have stronger effects, i.e., inconsistent players that are earning above median incomes earn much higher salary premia than below median.

Table 9: Estimation results for quantile regressions (IVG).

Dependent variable: LN(SALARY$_t$)	**(1)** 10th pctile	**(2)** 25th pctile	**(3)** Median	**(4)** 75th pctile	**(5)** 90th pctile
MEAN IVG$_{t-1}$	0.088***	0.066***	0.072***	0.066***	0.067***
	(0.013)	(0.010)	(0.009)	(0.010)	(0.013)
SD IVG$_{t-1}$	0.056**	0.059***	0.063***	0.106***	0.106***
	(0.024)	(0.020)	(0.018)	(0.020)	(0.025)
Constant	-3.886***	-1.431**	-0.237	2.078***	2.175***
	(0.705)	(0.565)	(0.525)	(0.567)	(0.732)
Observations	2,049	2,049	2,049	2,049	2,049
Pseudo R^2	0.420	0.469	0.507	0.537	0.537
Controls	YES	YES	YES	YES	YES
Season Dummies	YES	YES	YES	YES	YES
Team Dummies	YES	YES	YES	YES	YES

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

To this point, our regression results confirm earlier findings in European football (Deutscher & Büschemann, 2016) and basketball (Bodvarsson & Brastow,

1998). It seems that by using one single performance metric, inconsistent football players earn higher salaries than consistent ones. However, analyzing more detailed performance metrics, we show that inconsistency is not favored in all performance dimensions.

Table 10 shows the regression results using our three factors from the factor analysis. High scores of playmaking, defensive, and striking skills each lead to increased salaries in the OLS regression (model 1). Interestingly, however, we observe that an increase in the standard deviation of defensive skills significantly decreases salaries, while an increase in the standard deviation of striking skills raises salaries. It seems that the coefficient on standard deviation of playmaking skills is insignificant for salary determination. A one unit increase in standard deviation of defensive skills decreases salaries by 24.7%, while a one unit increase in standard deviation of striker skills increases salaries by 16.6%.

We can see that inconsistency is not rewarded in every dimension, and in the defensive case, inconsistency is penalized. When we add player fixed effects to the regressions (model 2), inconsistency in these three different skills no longer plays a significant role. This could be due to unobserved heterogeneity that is captured by the player fixed effects in a panel structure where the number of players per group is rather small (less than three on average). Because of this feature of our data set, we prefer the OLS estimates over the player fixed effects estimates.

The positive effect of performance coefficient variation on player salaries for strikers fits Lazear's notion of 'upside potential of risky workers' but in our setting it is the more creative and more productive workers who gain from higher performance variation. Strikers are hired specifically to score goals. However, strikers' own abilities may be thwarted by bad luck (Gauriot & Page, 2018) and the efforts of opposing defenders. Hence, the variation of striker performances within a given team-season can be substantial.

Table 10: Estimation results for OLS and FE regressions (FA).

Dependent variable: LN($SALARY_t$)	**OLS** **(1)**	**FE** **(2)**
$PLAYMAKING_{t-1}$	0.117***	0.083***
	(0.028)	(0.026)
SD $PLAYMAKING_{t-1}$	0.021	0.066
	(0.074)	(0.059)
$DEFENSE_{t-1}$	0.194***	-0.016
	(0.029)	(0.036)
SD $DEFENSE_{t-1}$	-0.247***	-0.045
	(0.087)	(0.068)
$STRIKER_{t-1}$	0.226***	0.060
	(0.049)	(0.054)
SD $STRIKER_{t-1}$	0.166***	0.069
	(0.059)	(0.052)
AGE_t	0.351***	0.389***
	(0.038)	(0.071)
AGE_t^2	-0.006***	-0.009***
	(0.001)	(0.001)
$CAREERGAMES_t$	0.002***	0.007***
	(0.000)	(0.001)
$CAREERGAMES_t^2$	-0.000	-0.000***
	(0.000)	(0.000)
$NATIONALTEAM_t$	0.080***	
	(0.023)	
$MIDFIELD_t$	0.084***	
	(0.031)	
$FORWARD_t$	0.266***	
	(0.053)	
NONEU	0.106***	
	(0.022)	
Constant	1.543***	2.265*
	(0.531)	(1.306)
Observations	2,049	2,049
R^2	0.739	0.538
Adj. R^2	0.732	0.526
Season Dummies	YES	YES
Team Dummies	YES	YES
Number of Players		725

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

In contrast, inconsistent performances by defenders will be viewed by team management as a threat to team wins. A given team's defense needs to work together

to prevent goals from being conceded to a team's opponent in a given match. Erratic performances by defenders in terms of our factor loadings may be compensated by other attributes so the player is still selected for the team (because mean performance is still viewed as reasonable). However, salary for an inconsistent defender will tend to be lower than for a more consistent defender, ceteris paribus, where that condition includes mean performance over the season.

Table 11: Estimation results for quantile regressions with factor scores.

Dependent variable: LN($SALARY_t$)	**(1)** 10^{th} pctile	**(2)** 25^{th} pctile	**(3)** Median	**(4)** 75^{th} pctile	**(5)** 90^{th} pctile
$PLAYMAKING_{t-1}$	0.114***	0.105***	0.142***	0.147***	0.132***
	(0.039)	(0.032)	(0.031)	(0.030)	(0.042)
SD $PLAYMAKING_{t-1}$	0.056	0.112	-0.077	-0.044	-0.075
	(0.098)	(0.080)	(0.078)	(0.076)	(0.104)
$DEFENSE_{t-1}$	0.180***	0.215***	0.177***	0.143***	0.135***
	(0.041)	(0.033)	(0.033)	(0.032)	(0.044)
SD $DEFENSE_{t-1}$	-0.178	-0.174*	-0.248***	-0.224**	-0.184
	(0.114)	(0.093)	(0.091)	(0.088)	(0.122)
$STRIKER_{t-1}$	0.178**	0.290***	0.295***	0.184***	0.166**
	(0.071)	(0.057)	(0.056)	(0.054)	(0.075)
SD $STRIKER_{t-1}$	0.220**	0.074	0.082	0.190***	0.221**
	(0.088)	(0.071)	(0.070)	(0.068)	(0.094)
Constant	-1.504**	0.946*	2.257***	3.532***	3.759***
	(0.649)	(0.526)	(0.514)	(0.501)	(0.690)
Observations	2,049	2,049	2,049	2,049	2,049
Pseudo R^2	0.434	0.486	0.527	0.555	0.550
Controls	YES	YES	YES	YES	YES
Season Dummies	YES	YES	YES	YES	YES
Team Dummies	YES	YES	YES	YES	YES

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

In the quantile regressions (Table 11), we test the three factors for robustness. Similar to our OLS regressions, we can see that the key results persist. Greater inconsistency in defensive skills leads to significantly lower salaries at the 25th, 50th, and 75th percentile of the salary distribution, while inconsistency in striking skills has a positive and significant effect, although for the 10th, 75th, and 90th percentile but not at the median.

The striker 'upside potential' wage premium is apparent at both extremes of the salary distribution. The strikers at the 10th percentile tend to be young and inexperienced players whose full potential has yet to be realized. These players fit the characterization of rookie players identified by Bollinger and Hotchkiss (2003) as new arrivals from the baseball draft in North America. Team managers welcome the future prospects of such emerging talent, recognizing that high mean performance comes with high inconsistency, partly due to inexperience.

The 90th percentile is occupied by proven stars whose performance record is already known. Players at this level also deliver 'upside potential' but more in terms of winning key games that help a team towards winning championships and other trophies. Higher performance inconsistency, for the same mean level, is accompanied by the capability to win important games by a small margin, quite likely a single goal. That special match-winning and championship-winning capability is rewarded by higher salary.

Overall, our results are intriguing because they show (1) that only inconsistency in those actions that increase the chances of scoring are positively rewarded and (2) that single performance indicators, such as IVG or Kicker grades are highly skewed because of these scoring effects – an outcome bias that has been empirically demonstrated by Gauriot and Page (2018). Attacking players need to be creative to improve their chances of scoring goals and this is what seems to be rewarded, both in mean and variance. In essence, similar to other industries with highly skewed positive returns (e.g., software), an additional goal scored (conceded) in one match can lead to extraordinary revenues (losses), i.e., returns of scoring are highly disproportional. This is one of the reasons offensive players that need to creatively outplay defenders to score goals are allowed to be inconsistent in comparison to defensive players.

For defensive players, being inconsistent might lead to goals conceded by the opponent team. Contrary to offensive players, inconsistency in defense is penalized in salary. Just as scoring generates disproportionate positive returns, so too do mistakes in defensive areas generate disproportionate risks of conceding goals, i.e., negative

returns. The results are in line with previous research in the software industry, where positive outcomes are highly skewed and software developers in these industries experience faster salary growth (Andersson et al., 2009).

Moreover, the results indicate that inconsistency is rewarded for creative skills that have a high positive impact. Just as workers have different types of tasks where, for some, consistency in execution is preferred over creativity (e.g., highly repetitive and administrative tasks), there are other types of tasks where creativity and problem solving are much more important and therefore inconsistency might be highly rewarded.

5. Discussion and conclusion

In this paper, we analyze whether inconsistent workers earn a salary premium. By analyzing 78,302 player-match observations over eight seasons (from 2009-10 to 2016-17) in the Italian Serie A, we show that inconsistent players earn a salary premium when only one performance indicator is used to assess overall match performance. Analyzing more detailed performance metrics from on-field actions of the same players, we show that inconsistency is only rewarded for some dimensions of performance, while it is penalized in others. That is, players that are inconsistent in defense are penalized, while offensive players earn a salary premium for being inconsistent.

We confirm earlier results that used European football data to test whether performance inconsistency is rewarded. In contrast to previous research (Deutscher & Büschemann, 2016) we show that using single performance indicators for overall performances (e.g., expert ratings, grades, or single performance indices) is not sufficient to test this relationship, especially because single performance indicators cannot capture the complexity of different skillsets that are needed for different job roles. Here, we go further; we apply factor analysis and introduce three factors that capture the different skillsets that are needed on the field. These three factors correspond closely to player positions on the field. Using our three components, we

show that greater inconsistency is rewarded in salary for players with high scores in attacking skillsets, but it is penalized in salary for defensive players. To the best of our knowledge, this is the first paper that can show these relationships in detail for subgroups of workers in team production. Our results suggest that a simple focus on performance variation in one metric is inadequate for consideration of salary determination.

Although we exploit a rich data set for our paper, there are also technical limitations regarding our performance metrics. Measuring individual performance in team competitions is not always conclusive. While an attacking player's performance can be measured in the number of dribbles, shots on target, assists, or goals, it is much more difficult to measure the individual performance of a defensive or midfield player. Because good defending is usually a team effort requiring considerable coordination among team members. Midfield players have both attacking and defensive responsibilities including regaining possession for their team and the effort provided in that task is hard to capture empirically.

Moreover, positional play in defense is an important skill that cannot be as easily measured compared to blocked shots or tackles. In some cases, a tackle might even be an outcome of bad positional play. In that sense, the action and event statistics that are gathered for defensive players might not fully cover their actual performances. A tackle that has occurred can be both an outcome of good defending or bad defending depending on the situation in a game. This is a common problem in football: data providers can gather events and measure what is happening on the field, while they cannot gather what is not happening, e.g., a lost attacking chance because the defending team had extraordinary positional play or because of poor decision-making by the attackers. As sports analytics develops further, we expect better metrics for all players to emerge with explicit consideration of the context for player actions. Such improved measures will greatly facilitate analysis of salary determination in team sports.

Notwithstanding issues with performance evaluation in football, our results point to an interesting and important separation of effects of performance inconsistency on salary. Creative and star performers appear to be rewarded for inconsistent outcomes. Workers who perform more mundane but essential tasks, who are not primarily responsible for spectacular payoffs for their employers, appear to be rewarded for consistent outcomes. That polarity in our results merits further research in other labor market settings.

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Curriculum vitae

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