IJSF

International Journal of Sport Finance

Volume 11 • Issue 3 • August 2016

ORIGINAL CONTRIBUTIONS

Official Journal of the ESEA European Sport Economics Association

International Journal of Sport Finance

Volume 11 • Number 3 • August 2016

Publisher: The *International Journal of Sport Finance* is published four times a year (February, May, August, and November) by FiT Publishing, a Division of the International Center for Performance Excellence, West Virginia University, 375 Birch St., PO Box 6116, Morgantown, WV 26506-6116.
Phone: 304.293.6888
Fax: 304.293.6658
Email: fitcustomerservice@mail.wvu.edu
Website: www.fitpublishing.com

The *International Journal of Sport Finance* is printed by The Sheridan Press, Hanover, PA.

The *International Journal of Sport Finance* is indexed in CSA, Current Contents/Social & Behavioral Sciences, EBSCO, Intute: Social Sciences, Leisure Recreation & Tourism Abstracts, Physical Education Index, Research Papers in Economics, SCOPUS, Social Sciences Citation Index, SPORTDiscus, SportSearch, Ulrich's, and WorldCat.

ISSN: 1558-6235 (Print)
1930-076X (On-line)

FiT

International Journal of Sport Finance

Volume 11 • Issue 3 • August 2016

Original Contributions

Professional Bulletin Board

August 31–September 2, 2016
ESEA 8th Conference on Sport Economics
Location: Groningen, Netherlands
Website: http://sporteconomics.eu/

September 7–10, 2016
EASM 24th Annual Conference
Location: Warsaw, Poland
Website: http://www.easm2016.com/

November 23–25, 2016
SMAANZ 22nd Annual Conference
Location: Aukland, New Zealand
Website: http://www.sprinz.aut.ac.nz/conferences/smaanz-2016

January 3–6, 2017
Western Economics Association International 13th International Conference
Location: Santiago, Chile
Website: http://www.weai.org/PR2017

March 14–18, 2017
SHAPE America National Convention & Expo
Location: Boston, Massachusetts
Website: http://www.shapeamerica.org/events/convention2017/convention2017.cfm

March 22–24, 2017
Sport Entertainment & Venues Tomorrow
Location: Columbia, South Carolina
Website: http://www.sevt.org/

May 8–11, 2017
17th Annual International Conference on Sports: Economics, Management, Marketing, and Social Aspects
Location: Athens, Greece
Website: http://www.atiner.gr/sports.htm

May 30–June 3, 2017
North American Society for Sport Management 2017 Conference
Location: Denver, Colorado
Website: http://www.nassm.org/NASSM2017/

June 25–29, 2017
Western Economics Association International 92nd Annual Conference
Location: San Diego, California
Website: http://www.weai.org/

International Journal of Sport Finance, 2016, **11**, 183-203, © 2016 West Virginia University

French 75% Tax Rate: An Opportunity to Optimize the Attractiveness of the French Soccer League

Mickael Terrien[1], Nicolas Scelles[2], and Christophe Durand[1]

[1] University of Caen Normandy

[2] University of Stirling

Mickael Terrien is a PhD student in management sciences. His research interests include sport economics, finance, and management.
Nicolas Scelles, PhD, is a lecturer in the Faculty of Health Sciences and Sport. His research interests include sport economics, finance, and management.
Christophe Durand, PhD, is a professor in the Faculty of Sports Sciences. His research interests include sport economics, finance, and management.

Abstract

This paper analyzes the impact of the French 75% income tax rate on the attractiveness of the French soccer league. The concerns are less about its financial implications for clubs than about the possible decrease in its attractiveness. A classical model of professional team sport leagues is employed to measure the Nash equilibrium competitive balance and the stock of talent to assess the effect of the new taxation. We then propose two hypotheses corresponding to specific situations in the French soccer league: "social and fiscal disparities between clubs" and "sugar daddy" behavior. The new model predicts a polarization of the league and an exodus of talent, which could be mitigated by revenue sharing.

Keywords: sport economics, professional team sports, competitive balance, taxation

Introduction

The European sovereign debt crisis has forced the French national government to find new funding sources; increasing the top marginal tax rate is a means of doing so. Consequently, and given the average salary of soccer players, taxation is an important contingent factor for teams in an international competitive environment. To such an extent that Arsène Wenger, manager of Arsenal FC, predicted that "with the new taxation system ... the domination of the Premier League will go, that is for sure" (*The Sunday Times*, April 25, 2009) when the British government decided to increase the top marginal tax rate from 40% to 50%.[1]

Why was the powerful Premier League so afraid of this marginal change? One reason is the "Bosman ruling" and the ensuing liberalization of the player market. The decision by the European Court of Justice to ban restrictions on foreign EU players has intensified the inter-league competition for players (Gouguet, 2004), especially for the superstars (Gouguet & Primault, 2003). In a market where the players have perfect mobility, taxation is a key criterion in their choice of location (Kleven, Landais, & Saez, 2013). Fluctuation in the top marginal tax rate then has a direct impact on the competitiveness of clubs and leagues.

The French 75% tax rate law, enforced since 2014, acts as a significant fluctuation. The new tax system implies that all incomes of over €1 million per year will be taxed at 75%, and then affects the French championship attractiveness, called Ligue 1 (L1), by changing the allocation of resources intra- and inter-leagues.

This paper is organized as follows. The following section presents the 75% tax rate mechanisms and its direct impact on L1 clubs. A model of sports leagues is used in the next section with revenue function depending on the relative and the aggregate quality of the teams. It allows measuring the Nash equilibrium competitive balance and the stock of talent to assess the effect of the new taxation on the league attractiveness.

Next, we adapt the model to specific situations. First, we analyze a case of social and fiscal imbalance in a national championship. This must reflect the situation of the AS Monaco in L1. Second, we formulate a hypothesis regarding the behavior of club owners: what happens when a club maximizes wins under exogenous soft budget constraint? Finally, we discuss the impact of revenue sharing on competitive balance in relation to the new taxation.

Mechanisms and Direct Impact of the 75% Tax Rate

It is important to first provide an overview of the existing research on tax system changes and regulation of professional leagues before discussing the mechanism of the French tax on high wages and its impact on L1.

Tax System and Professional Sports Leagues

On both sides of the Atlantic, 1995 was a key year in the regulation of professional sports leagues. On one side, the National Hockey League decided to help reduce the economic gap (exchange rate, taxation and social security system, and public assistance) between the Canadian and American franchises by creating two support funds to reduce the differences and keep franchises in Canada (Helleu & Durand, 2006). On the other side, the European Union (EU) implemented the Bosman ruling, which increased competition between clubs and leagues to attract the best players, with no restrictions on foreign EU members. Since 2003, players from countries who signed the Cotonou Treaty (with 79 African, Caribbean, and Pacific countries) and the Malaja ruling (involving countries associated with the EU) also have no restriction to play in Europe. Economists have paid great attention to the European Court of Justice's decision, particularly with regard to transfer fees (Tervio, 2006; Frick, 2007). Kleven et al.'s (2013) research study gives interesting insight into the topic of this paper. Indeed, the originality of their work lies in their focusing on the effects of income tax rates on the international migration of workers. For that purpose, they analyzed the soccer player market in Europe in two steps. First, they performed an analysis of special tax schemes offering preferential tax rates in specific countries (Spain, Denmark, Belgium, and Greece). Second, they presented a theoretical model showing the relation between taxation and migration for the 15 main European championships.

Since the European soccer player market was liberalized in 1995, there has been a positive and large correlation between tax rates and players' location decisions. Kleven and colleagues note that this effect is reinforced in the case of the most talented workers. This result supports the findings of Gouguet and Primault (2003) concerning the Bosman ruling. Based upon these results, we expect that the French 75% tax rate, which is unique in Europe, will lead to an exodus of the best players from L1 to rival leagues abroad. This is an important issue for L1 attractiveness as there is a growth of televised matches featuring foreign leagues (Solberg & Mehus, 2014), offering substitutes for fans with more aggregate talent.

The French 75% Tax Rate: Mechanisms

During the last presidential election campaign, François Hollande pledged to levy a 75% income tax rate, for a period of two years, on all annual income above €1 million. The proposal was motivated by the necessity to balance the public accounts and by a desire for social justice. However, the Constitutional council of the French Republic struck down this top income tax rate, ruling that it would be applied to individuals rather than households. Consequently, the French government amended the bill to shift the burden from individuals to employers. In other words, this measure increases the employers' contributions for salaries over €1 million per year and thus the total cost of talent for clubs.

The Constitutional council's decision has a threefold impact on French soccer. First, this measure has no direct consequence on players' salary. Second, the tax implies that French soccer clubs will have to pay a higher price in order to maintain the salary level of their players. Unlike Kleven et al. (2013), the adjustment variable in the labor market is no longer the supply (players basing their location decisions according to net earnings), but the player hiring by team owners who must take into account the new budgetary constraints. Third, the AS Monaco (ASM) now benefits from the fiscal arrangements between France and Monaco whereby companies located in the Principality of Monaco are exempt from French taxation laws, whereas French taxpayers are not. Had the Constitutional council not rejected the proposed tax rate, the French players of the ASM paid over €1 million per year would have been subject to the 75% tax rate. However, in order to reduce the financial pressure on French firms, the government decided that the total tax payout would be capped at 5% of a corporation's annual turnover. Despite this concession, the clubs' union has complained that the government has decided to tax businesses that have been in difficulty over the last seasons.[2] The tax system alone is not responsible for the financial difficulties of French clubs, since clubs and the league have long suffered from a weak governance structure (Andreff, 2007).

The French 75% Tax Rate in L1

There were 114 players from 14 L1 clubs that earned salaries of more than €1 million per year in 2013. Even though the bonuses are variable, the aggregate tax cost is estimated by the clubs themselves at €44 million per year. [3] This estimation is questioned by the government. Nevertheless, as there is no other available data, we shall use this estimate in our analysis of the effects of the French 75% tax rate, which it is not a problem as we focus on theoretical analysis.

According to club owners, this new tax could potentially threaten the viability of the clubs. Table 1 sums up the direct impact of the 75% tax rate for each club. From Table 1, it is possible to categorize the clubs according to the effects of the tax (Table 2). Five categories emerge (Terrien, Durand, Maltese, & Veran, 2014).

Clubs that are not impacted will be the main beneficiaries of the increase of the top marginal tax rate to 75%. As seen in Table 1, five clubs are not concerned by this tax rate as they do not pay any of their players' annual salaries of € 1 million or over. Furthermore, Monaco benefits from its registered office being located in the Principality. Moreover, four clubs benefit from a significant tax cost reduction thanks to the implementation of a measure capping the tax at 5% of the clubs' turnover even though those clubs are the most affected by the tax, along with Bordeaux and Rennes. The effect is uncertain for the remaining clubs. The new taxation appears to be an additional cost for clubs. Nevertheless, it could create new sporting opportunities for them thanks to the financial difficulties it will cause to rival clubs.

Table 1. Effect of the French 75% Tax Rate on Soccer Clubs in L1 (2013–2014)

Clubs	Turnover 2012–2013 (in K€)	Number of players	Tax without cap (in K€)	Relative impact of tax without cap (in K€)	Tax with cap (in K€)	Relative impact of tax with cap	Tax reduction with cap (in K€)
Paris	392,892	21	43,565	11,09 %	1,9645	5 %	23,920
Marseille	104,535	17	13,034	12,47 %	5,227	5 %	7,807
Lyon	99,083	14	11,545	11,65 %	4,954	5 %	6,591
Bordeaux	67,766	14	4,151	6,13 %	3,388	5 %	763
Lille	96,255	13	7,696	8,00 %	4,813	5 %	2,883
Saint-Etienne	49,951	9	896	1,79 %	896	1,79 %	0
Rennes	42,036	8	3,316	7,89 %	2,102	5 %	1,214
Toulouse	35,415	7	1,196	3,38 %	1,196	3,38 %	0
Montpellier	74,367	3	356	0,48 %	356	0,48 %	0
Valenciennes	30,257	3	206	0,68 %	206	0,68 %	0
Nice	33,815	2	1,076	3,18 %	1,076	3,18 %	0
Ajaccio	20,381	1	99	0,49 %	99	0,49 %	0
Bastia	24,708	1	178	0,72 %	178	0,72 %	0
Guingamp	22,000	1	9	0,04 %	9	0,04 %	0
Evian	32,300	0	0	0 %	0	0 %	0
Lorient	32,860	0	0	0 %	0	0 %	0
Monaco	130,000	0	0	0 %	0	0 %	0
Nantes	32,000	0	0	0 %	0	0 %	0
Reims	28,581	0	0	0 %	0	0 %	0
Sochaux	30,648	0	0	0 %	0	0 %	0
Sum	**1,379,850**	**114**	**87,323**		**44,145**		**43,178**

Table 2. Typology of French Soccer Clubs Related to 75% Tax Rate Effect

Clubs deeply impacted by the tax and the implementation of the cap		Clubs impacted by the tax (less than 5% of turnover)	
Significant tax reduction (more than 2 M€)	**Marginal tax reduction (less than 2 M€)**	**Significant impact (more than 1% of turnover)**	**Marginal impact (less than 1% of turnover)***
Paris	Bordeaux	Toulouse	Montpellier
Marseille	Rennes	Saint-Etienne	Guingamp
Lyon		Valenciennes	Ajaccio
Lille		Nice	Bastia

* Six clubs not impacted by the tax: Evian, Lorient, Monaco, Nantes, Reims, and Sochaux

The results shown in Table 1 are calculated for a given payroll. However, clubs have room to maneuver and will implement a strategic response to cope with this new constraint. To estimate the dynamic equilibrium of L1, we use the non-cooperative game theory in our competitive balance model.

Competitive Balance and the 75% Tax Rate

First, a short overview of the competitive balance concept is provided. We then specify our general model. We finally discuss the effect of the 75% tax rate and the consequences of capping the tax at 5% of the company's revenue.

Competitive Balance: What is it About?

There is a common understanding that a sporting competition is more successful when the degree of competitive balance among teams is high. Through the Louis-Schmelling paradox, Neale (1964) shows beyond doubt that competitive balance is essential to professional sports. Thus, much effort is expended to measure it, with a high heterogeneity in the measuring instruments used (Mourão & Cima, 2015). There are two approaches for understanding uncertainty of outcome: competitive intensity, which is related to sporting stakes, and competitive balance (Scelles, Durand, Bonnal, Goyeau, & Andreff, 2013; Terrien, Scelles, & Durand, 2015). Focusing on the latter, three time scales can be considered: a game, a season, or several seasons (Szymanski & Kuypers, 1999). Here, we replicate the model of a league with two clubs inspired by that of El-Hodiri and Quirk (1971). El-Hodiri and Quirk's model provides the first formalization of competitive balance. It is useful for testing the "invariance principle" introduced by Rottenberg (1956) following a Walrasian approach to general equilibrium. This principle states that the elimination of the reserve clause in professional baseball will not cause competitive imbalance in Major League Baseball (MLB). Other policy tools have been tested (e.g., gate revenue sharing, the draft system) and no significant effect on outcome uncertainty has been found (Scully, 1995; Vrooman, 1995). Salary restrictions should theoretically improve competitive balance, even if a non-optimal situation is produced (Késenne, 2000, 2007).

However, the "invariance principle" is situated within the specific context of North American major leagues, which differs from that of European leagues. The former are closed leagues with a limited number of franchises whose objective is to maximize profit. European soccer leagues are open; the promotion and relegation system structures the championships, which impacts owners' behavior. The goal of club owners seems to be more oriented toward win maximization within budget constraints (Davenport, 1969; Sloane, 1971). Indeed, 63% of European soccer clubs in 2011 reported losses (UEFA, 2011), which provides evidence that the majority of the owners are not oriented toward profit. Unlike the North American cooperative franchises, European soccer teams are rivals; the talent supply is no longer exogenously determined but is variable (Andreff, 2009). This leads to a non-cooperative Nash equilibrium model (Szymanski & Késenne 2004).[4]

The General Model

Let us consider a league with only two clubs ($i = 1, 2$) with different revenue functions. We assume this function to be dependent upon the local economic potential, which can be approximated by an exogenous variable: the market size m_i. Here, Team 1 benefits from an asymmetric revenue advantage $m_1 > m_2$. Revenue is also affected by a club's winning percentage w_i. According to the fan preference for competitive balance, reflected by β, the part of the revenue functions depending on relative talent R_i is strictly concave:[5]

$$R_i(w_i) = m_i . w_i - \left(m_i . \frac{w_i^2}{\beta}\right) \tag{1}$$

It is common in the literature to assume that revenues depend only on relative talent. However, consumers' valuation and then teams' incomes may suffer from the new taxation if it implies an exodus of talent, even if the competitive balance improves. Following Madden (2011), we assume that the revenue function $P_i(w_i,T)$ depends also on aggregate talent T with $T = T_i + T_j$. The revenue function is assumed to be homogeneous of degree $\sigma \in [0;1]$ with σ measuring the constant elasticity of revenue with respect to changes in the aggregate team quality. Then, the revenue function depending on relative and absolute talent is:

$$P_i(w_i, T) = T^\sigma P_i(w_i, 1) = T^\sigma R_i(w_i) = T^\sigma [m_i w_i - m_i \frac{w_i^2}{\beta}] \tag{2}$$

We assume that playing talent is perfectly divisible and available on the professional players' labor market at a constant marginal cost of c. An exogenous cost pertains to a flexible talent supply (Szymanski, 2004) and implies that clubs are wage takers. This hypothesis is generally accepted even though clubs may exercise enough market power to affect the price levels (Cavagnac & Gouguet, 2008; Madden, 2011).

As the payroll does not differentiate between units of playing talent, the tax burden cannot be applied only on the basis of individual salaries of over €1 million. We therefore assume that the cost will be borne by all individuals on the payroll.[6] Let $d > 0$ be the marginal tax burden added to the constant marginal cost of talent c. As Table 1 highlights, weak payrolls are not concerned with the new tax system. Therefore, the parameter d is applied from the threshold L such that $cT_i > L$. Moreover, the tax burden of team i will increase with its payroll T_i until the cap becomes effective, with the threshold given by $dT_i > (1-x)P_i$: The existence of fiscal cap at $(1-x)$ % of the turnover of Club i means that the tax burden is no longer graduated on T_i, but only depends on P_i. This cap allows reducing the tax cost for Club i. Therefore, after the application of the tax, Club i keeps x% of its turnover P_i.

The expenditure on playing talent is the only club cost and clubs' objective is to maximize wins w_i under a strict seasonal budget constraint that does not allow for losses. The profit functions of teams after the implementation of the new taxation system change according to the value taken by t_i. Then three profit functions are described:

$$\pi_i = P_i - cT_i = 0 \quad \text{if } cT_i \le L \tag{3A}$$

$$\pi_i = P_i - (c+d)T_i = 0 \quad \text{if } cT_i > L \text{ and } dT_i \le (1-x)P_i \tag{3B}$$

$$\pi_i = xP_i - cT_i = 0 \quad \text{if } cT_i > L \text{ and } dT_i > (1-x)P_i \tag{3C}$$

A contest success function depends both on the number of talent units T_i and also on the number of talent units T_j of the competing club. The contest success function is given by:

$$w_i = \frac{T_i}{T_i + T_j} = \frac{T_i}{T} \tag{4}$$

According to this contest success function, the acquisition of an additional unit of playing talent has an external effect on the other club. The teams find themselves in a non-cooperative Nash equilibrium. Simultaneous win maximization (mutual best response with $\pi_i = 0$) for both teams yields the reaction functions. As we use different profit functions (3A, 3B, 3C), we obtain three reaction functions expressed in terms of the aggregate quality of teams as $T = \frac{T_i}{w_i}$:

$$T^B = \left[\frac{m_i - (m_i w_i)/\beta}{c}\right]^{\frac{1}{1-\sigma}} \tag{5A}$$

$$T^C = \left[\frac{m_i - (m_i w_i)/\beta}{c+d}\right]^{\frac{1}{1-\sigma}} \tag{5B}$$

$$T^A = \left[\frac{x[m_i - (m_i w_i)/\beta]}{c}\right]^{\frac{1}{1-\sigma}} \tag{5C}$$

Competitive Balance and Exodus of Talent

Let Club 2 have no player paid over €1 million per year ($ct_2 \le L$) and Club 1, operating in the largest market, be subject to the 75% tax plus cap regime [$ct_1 > L$ and $dt_1 > (1-x)P_1$]. To assess the effect of introducing a tax and the advisability of its cap on the league attractiveness, we proposed three equilibria. First, we define competitive balance before the implementation of the tax (A). Assuming the profit function of teams 1 and 2 are respectively (3C) if $x = 1$ (or (3B) if $d = 0$) and (3A) provide the equilibrium B by equalizing the related reaction functions (5C) with $x = 1$ and (5A):

$$w_1^A = \frac{\beta m_1 - (\beta - 1)m_2}{m_1 + m_2} \quad with\ w_1^A \ge w_2^A \ if m_1 \ge m_2 \tag{6A}$$

In the initial situation, the league is naturally imbalanced and outcome uncertainty is not guaranteed. Second, we assess the only tax regime (B): the threshold $dt_1 \leq (1-x)P_1$ in (3B) is removed. Without the governmental concession to cap the tax, this equilibrium C would have prevailed in L1. Profit functions of team 1 and 2 are (3B) and (3A), respectively. By equalizing the reaction functions (5A) and (5B), the only tax regime equilibrium is:

$$w_1^B = \frac{\beta c m_1 - (\beta - 1)(c+d)m_2}{cm_1 + (c+d)m_2} \; with \; w_1^B \geq w_2^B \; if \; \frac{m_1}{m_2} \geq \frac{c+d}{c} \tag{6B}$$

Third, we define competitive balance in the tax plus cap regime (C). This configuration is the theoretical one prevailing in L1 (with $x = 0.95$). Profit functions of team 1 and 2 are (3C) and (3A), respectively. By equalizing the related reaction functions (5C and 5A), we obtain the following equilibrium:

$$w_1^C = \frac{\beta x m_1 - (\beta - 1)m_2}{xm_1 + m_2} \; with \; w_1^C \geq w_2^C \; if \; \frac{m_1}{m_2} \geq \frac{1}{x} \tag{6C}$$

Those win percentages are not sensitive to the elasticity of revenue with respect to changes in the aggregate team quality. Assuming that the revenue function only depends on relative talent is inconsequential on competitive balance, but not for the stock of talent. It increases when the revenue advantage of team 1 is moderated. From (5C) and (6C) for the tax plus cap equilibrium prevailing in L1:

$$\frac{\delta T^C}{\delta \sigma} > 0 \text{ if } m_2 \leq m_1 \leq \frac{c\beta m_2}{2\beta x m_2 - m_2 x - \beta c x}.$$

The evolution of the attractiveness degree of the league could be assessed thanks to those three equilibria. Notice that $\frac{\delta w_1^B}{\delta d} < 0$ (with $1 \leq \beta \leq 2$) and $w_1^A = w_1^B$ when $d = 0$. Then, the only tax regime that improves the competitive balance compared to the initial configuration is: $w_1^A \geq w_1^B$ if $d \in [0;1]$. Since the league attractiveness also depends on aggregate talent, a comparison between the several levels of talent is necessary. By substituting the win percentage (6B) in the aggregate quality function (5A), the drain grows as d increases since $\frac{\delta T^B}{\delta d}$ has the sign of $\frac{\delta w^B}{\delta d}$. Thanks to $T^A = T^B$ when $d = 0$, $T^A \geq T^B$ for $d \in [0;1]$.

$\frac{\delta w_1^C}{\delta x} > 0$ (with $1 \leq \beta \leq 2$), $w_1^A = w_1^C$ when $x = 1$. The introduction of the prevailing tax system also improves the competitive balance: $w_1^A \geq w_1^C$ if $x \in [0;1]$. Slackening the cap (increasing x) qualifies this beneficial effect. To assess the league attractiveness, T^A must be compared to T^C. By substituting the win percentage (6C) in the aggregate quality function (5A), we deduce $\frac{\delta T^C}{\delta x}$ has the sign of $\frac{\delta w_1^C}{\delta x}$. As when $x = 1$, the implementation of the tax leads to an exodus of talent: $T^A \geq T^C$ with $x \in [0;1]$. Reducing the tax payable (increasing x) helps limit this migration.

The new tax rate (tax only or tax plus cap regime) helps improve competitive balance of L1 and has the same effect as a salary cap. This is not surprising if we consider Scully's argument (1995) that a salary cap can act as a tax on superstar salaries. The question remains if it was wise to implement a tax cap by comparing equilibria B and C:

$$w_1^B < w_1^C \text{ if } \frac{c}{c+d} > x \quad \text{for } (1-x)P_1 > dT_1 \tag{7}$$

Despite the new tax that allows reducing the wins gap between the two teams related to the initial equilibrium $(w_1^A > w_1^C)$, the implementation of the cap limits this improvement $(w_1^B < w_1^C)$. As the winning percentage is inelastic to σ, we conclude that whatever σ∈[0;1], $w_1^B < w_1^C < w_1^A$ if $cT_1 > L$, $dT_1 > (1-x)P_1$ and $cT_2 \leq L$. The uncertainty of outcome of L1 is damaged by the implementation of the tax cap. This is the argument used by Frédéric Thiriez, president of the French Professional Soccer League (LFP), to challenge the advisability of the cap: "I am not saying that the outcome is worse than the initial system, but it is really unfair. The reality is that the biggest clubs will benefit from the tax cap. That is to say Paris-SG basically, and to some extent Marseille, Lyon or Lille."[7] Nevertheless, the tax cap has an interest to limit the exodus of talent. From (5A), (6B), and (6C), aggregate quality of teams increases since $T^B \leq T^C$ if $w_1^B \leq w_1^C$. As $T^A \geq T^B$ and $T^A \geq T^C$, the transitive relation $T^B \leq T^C \leq T^A$ is observed, whatever σ∈[0;1].

The competition organizer has to solve the dilemma between competitive balance and aggregate quality of teams, as Figure 1 and Table 3 illustrate. The initial situation (equilibrium A) prevails whenever $d = 0$ or $x = 1$. The competitive balance [given by (6A)] and the aggregate talent [given by (6A) and (5A)] are invariable. When $d > 0$ and $x = 1$, only tax regime (B) prevails, leading to an improvement of the competitive balance and an exodus of talent. In Figure 1, lets define points *I, II,* and *III*, with *d* positive and constant. In *I*, *x = 0*, whereas *x = c / (c + d)* in *II*, and *x = 1* in *III*. From *I* towards *II* in the diagram, nothing changes in terms of competitive balance and stock of talent, as the tax burden of Club 1 is still below the cap. In other words, Club 1 still uses the (3B) profit function (tax only regime). Instead, moving above *II* towards *III* means that Club 1 now benefits from the tax plus cap regime. Equilibrium C now prevails and the aggregate stock of talent is given by (6C) and (5C). As *x* increases, com-

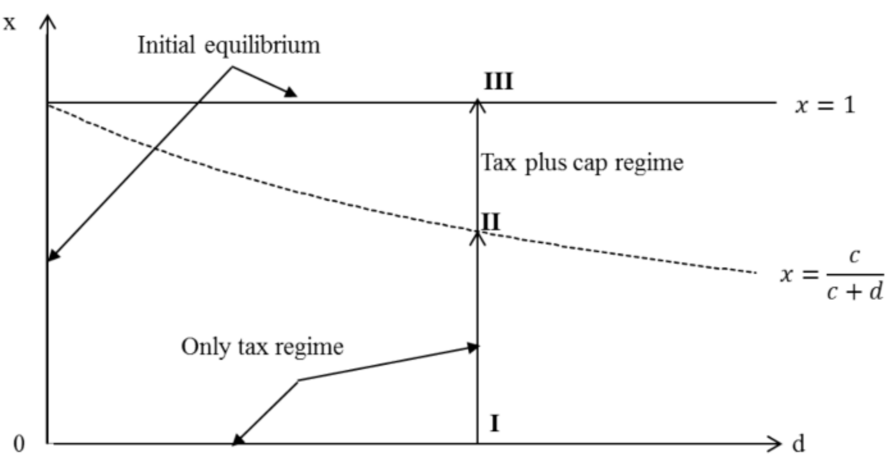

Figure 1. Tax plus cap regime, tax only regime, and initial equilibria.

Table 3. Tax Plus Cap Regime, Tax Only Regime, and Initial Equilibria

		Initial regime	Tax only regime	Tax plus cap regime
General model	Equilibrium	A	B	C
	Transitivity	$w_1^B \leq w_1^C \leq w_1^A$ and $T^B \leq T^C \leq T^A$		
Distortion model	Equilibrium	D	E	F
	Transitivity	$w_1^D \leq w_1^F \leq w_1^E$ and $T^E \leq T^F \leq T^D$		
Sugar Daddy model	Equilibrium	G	H	I
	Transitivity	$w_1^G \leq w_1^I \leq w_1^H$ and $T^H \leq T^I \leq T^G$		

petitive balance is worsened and an influx of talent is observed until $x = 1$, where T and w_1 return to their initial value given by equilibrium A.

The case of French L1 lies between *II* and *III* ($x = 0.95$); *d* was determined by the French government, and the competition organizer has no say on the matter. However, the tax cap was added to mitigate the contestation of the clubs' union. Assuming the total amount of tax revenue collected is deemed sufficient to the French government, this actual equilibrium is optimal only if the primary aim of the league was to maximize the aggregate quality of teams.

Otherwise, as Frédéric Thiriez argued, the system would be suboptimal. This leads us to believe that this intermediary situation could be optimized.

Extension of the Model and Policy Regulation

In this section, both clubs are now assumed to be subject to the 75% tax rate ($cT_i \geq L$). We relax some of the model's hypotheses in reaction functions to be in line with the stylized facts of L1. This suggests that we reverse our argument about the cap advisability.

Social and Fiscal Distortions in a Professional Sports League

The increase of the top marginal tax rate in France has also highlighted the comparative advantage enjoyed by the ASM. As explained previously, due to the terms of the Franco-Monegasque tax convention, Monaco levies no income tax on individuals, the only exception being that French nationals must pay French income tax. As a result, ASM benefits from social and fiscal distortions, compared with other L1 clubs. Given the club's payroll, this advantage is estimated at €70 million per year, divided between social (€50 million for foreign players) and fiscal (€20 million, related to the 75% tax rate) distortions.[8] We assume club 1 to be located in such an area. Its social advantage implies a lower constant marginal cost (c - e) with $e > 0$ leading to a cheaper acquisition of unit of playing talent for team 1 than for team 2. The fiscal distortion implies that the new taxation system does not apply to team 1 whatever T_1 is. Whatever the tax regime is (related to stock of talent T_1), the profit function for team 1 is: $\pi_1 = P_1 - (c - e)T_1 = 0 \text{ for } e > 0 \quad (\mathbf{2D})$, leading to the reaction function 5D:

$$T = \left[\frac{m_1 - (m_1 w_1)/\beta}{c - e}\right]^{\frac{1}{1-\sigma}} \tag{5D}$$

Club 2 does not benefit from such an advantage. According to T2, the profit functions (2A), (2B), and (2C) are still applied, with the respective function reactions (5A), (5B), and (5C).

We now apply the theoretical framework presented in the previous section to this context to describe three additional equilibria. First, we define the initial situation (D) when club 2 does not suffer from the new tax rate thanks to the reaction functions (5D) and (5A):

$$w_1^D = \frac{\beta c m_1 - (\beta - 1)(c-e)m_2}{cm_1 + (c-e)m_2} \; with \; w_1^D \geq w_2^D \, if \; \frac{m_1}{m_2} \geq \frac{c-e}{c} \tag{6D}$$

e = *0* means a lack of social dumping from club 1, leading to $w_1^A = w_1^D$. Notice $\frac{\delta w_1^D}{\delta e} > 0$ showing that the competitive balance worsens as the social distortions grow: ${w_1}^D \geq {w_1}^A$. We then determine the only tax (equilibrium E) and the tax plus cap (equilibrium F) equilibria from the equalization of the reaction functions (5B) and (5D), and (5C) and (5D):

$$w_1^E = \frac{\beta(c+d)m_1 - (\beta-1)(c-e)m_2}{(c+d)m_1 + (c-e)m_2} \; with \; w_1^E \geq w_2^E \; if \; \frac{m_1}{m_2} \geq \frac{c-e}{c+d} \tag{6E}$$

$$w_1^F = \frac{\beta c m_1 - x(\beta-1)(c-e)m_2}{cm_1 + x(c-e)m_2} \; with \; w_1^F \geq w_2^F \; if \; \frac{m_1}{m_2} \geq \frac{x(c-e)}{c} \tag{6F}$$

$w_1^D = w_1^E$ for $d = 0$, $\frac{\delta w_1^E}{\delta d} > 0$ and $\frac{\delta T^E}{\delta d}$ has the sign of $\frac{-\delta w_1^E}{\delta d}$. Thus $w_1^D \leq w_1^E$ and $T^D \geq T^E$ if $d \leq 0$. For $x = 1$, $w_1^D = w_1^F$. $\frac{\delta w_1}{\delta x} > 0$ and $\frac{\delta T^F}{\delta x}$ has the sign of $\frac{-\delta w_1^F}{\delta x}$ therefore $w_1^D \leq w_1^F$ and $T^D \geq T^F$ if $x \epsilon [0; 1]$. Then the competitive balance and the aggregate quality of teams worsen due to the new taxation.

Nevertheless, the implementation of the cap allows reducing the competitive imbalance and the exodus of talent, which follow the introduction of the 75% tax rate: whatever $x \epsilon \left[\frac{c}{c+d}; 1\right]$, $w_1^E \geq w_1^F$ and $T^E \leq T^F$. Slackening the cap leads to more outcome uncertainty as the introduction of the tax enhanced the competitive advantage of the ASM head office location. Thus, the French Football Federation (FFF) wanted to introduce a new rule making it a requirement for all L1 clubs to have their head office in France. ASM came to an "illegal" agreement (according to the State Council) with the LFP that guarantees the club's participation in the French championship while maintaining its head office within the Principality. In return, ASM agreed to pay the LFP a single contribution of €50 million.[9]

On the other hand, this distortion turns out to be an opportunity for the league to attract more talent since $\frac{\delta T^F}{\delta e}$ has the sign of $\frac{\delta w_1^F}{\delta e}$: $T^F \geq T^C$. It allows limiting the exodus of talent implied by the introduction of a tax.

It must also be noted that the degree of imbalance should increase when distortion is combined with an asymmetry of resources. Paris and Monaco together account for 43% of the aggregate income excluding trading of L1 for the 2013–2014 season (DNCG, 2014). This asymmetry calls into question the premise of strict budgetary constraints.

Soft Budget Constraint, 'Sugar Daddies,' and Competitive Imbalance

Private owners do not always seek to achieve a break-even position and can "behave as non-profit-seeking investors, patrons, or tycoons" (Andreff, 2007, p. 6). The concept of soft budget constraints (SBC) pioneered by Kornai (1980) to study socialist economies provides another rational explanation of recurring deficits in the soccer industry. The concept is best understood when contrasted with its counterpart (Storm & Nielsen, 2012). The hard budget constraint, the dominating form of budget constraint in capitalist economies, could be defined as a situation in which "proceeds from sales and costs of input are a question of life and death for the firm" (Kornai, 1980, p. 303).

The SBC syndrome can appear in the context of professional soccer.[10] Soccer teams may benefit from local governments (subsidy, rent facilities at subsidized prices, etc.) or shareholders bail them out. Teams can also influence the tax rules: the Salva Calcio in 2002 (Hamil, Morrow, Idle, Rossi, & Faccendini, 2010), the agreement between Lazio and the Italian government in 2005 (Morrow, 2006), the debt reduction in 1985 and 1992 for Spanish clubs (Barajas & Rodriguez, 2010), or the implementation of a tax cap at 5% of the total revenue. Thus, European professional soccer clubs "operate chronically on the edge of financial collapse" without going out of business (Storm & Nielsen, 2012, p. 183).

However, the limited SBC syndrome is too common a situation to be applied to the particular cases of PSG and ASM. Both clubs have much looser budget constraints than their opponents, which enables them to over-invest in players. We assume that PSG and ASM are not oriented toward win-maximization under strict seasonal budget constraints or limited SBC, but under inelastic SBC. They both want to build competitive teams at the European level in order to perform well in the UEFA Champions League. For this purpose, "sugar daddies" will invest in recruiting as many top players as possible, even if this leads to significant budgetary deficits. Then, team 1 owned by a sugar daddy will invest up to a certain limit to achieve an exogenous stock of talent, noted as $\overline{T}$ whatever the cost is. This stock enables the owner to reach its European sporting goals. The budgetary constraint of the sugar daddy is now endogenous: $SBC(\bar{T}, \pi_1)$. The reaction function of the sugar daddy, whatever the tax regime, is:

$$T = \frac{T}{w_1} \tag{5E}$$

By contrast, team 2 is not allowed to generate a deficit.[11] As the sugar daddy investment ensures a sufficient degree of aggregate quality of teams, we assume σ=*0* to focus on relative talent. Equalizing (5A) and (5E) provide the initial equilibrium G:

$$w_1^G = \frac{(1-\beta)m_2 + \sqrt{(\beta m_2 - m_2)^2 + 4\beta c \bar{T} m_2}}{2m_2} \text{ with } w_1^G \geq w_2^G \text{ if } \bar{T} \geq \frac{m_2}{4\beta c} \tag{6G}$$

Equilibrium H assesses the tax only regime, which allows testing the relevance of the decision to add a cap to the tax system: the threshold $dt_i \leq (1\text{-}x)P_i$ in (3B) is removed. By equalizing the reaction functions (5B) and (5E):

$$w_1^H = \frac{(1-\beta)m_2 + \sqrt{(\beta m_2 - m_2)^2 + 4\beta(c+d)\bar{T}m_2}}{2m_2}$$

$$with\ w_1^H \geq w_2^H\ {}_1^I\ if\ \bar{T} \geq \frac{m_2}{4\beta(c+d)} \quad \text{(6H)}$$

Equalizing (5C) and (5E) provides the tax plus cap regime equilibrium I:

$$w_1^I = \frac{(1-\beta)xm_2 + \sqrt{[xm_2\beta - xm_2]^2 + 4\beta c\bar{T}xm_2}}{2xm_2}\ with\ w_1^I \geq w_2^I\ if\ \bar{T} \geq \frac{xm_2}{4\beta c} \quad \text{(6I)}$$

Competitive balance and exodus of talent worsen with the new taxation in the tax only and the tax plus cap regimes compared to the initial equilibrium: $\frac{\delta w_1^H}{\delta d} > 0$ and $\frac{\delta T^H}{\delta d} < 0$ as it takes the opposite sign of $\frac{\delta w_1^H}{\delta d}$, with $w_1^G = w_1^H$ when d=0, then $w_1^G <= w_1^H$ and $T^G \geq T^H$; $\frac{\delta w_1^I}{\delta x} < 0$, $\frac{\delta T^I}{\delta x}$ takes the sign of $\frac{-\delta w_1^I}{\delta x}$ with $w_1^G = w_1^I$ when x=1, then $w_1^G \leq w_1^I$ and $T^G \geq T^I$. And when comparing (6H) and (6I), $w_1^H \geq w_1^I$ and $T^H \leq T^I$ whatever $x \epsilon \left[\frac{c}{c+d}; 1\right]$. The implementation of the cap allows limiting the exodus of talent and the harm of the competitive balance implied by the introduction of a tax.

The competitive balance also worsens when gap between owners' behavior ($\bar{T}$) increases: $\frac{\delta w_1^I}{\delta \bar{T}} > 0$. $\frac{\delta T^I}{\delta \bar{T}}$ takes the sign of $\frac{\delta w_1^I}{\delta \bar{T}}$, therefore increasing the sugar daddy investment or slackening the cap; both lead to an influx of talent in the league. Imposing the new tax system implies that the uncertainty of outcome will worsen, already threatened by the sugar daddy behavior.

With the social and fiscal distortions, and the sugar daddy behavior assumptions, the conclusions of the previous section are reversed. In Figure 1 and Table 3, we show that the initial situation was the optimal situation. The only tax regime provides the most imbalanced league with the less aggregate team quality. According to these new hypotheses, the decision to add a cap to the tax increases the uncertainty of outcome. As the cap also slows down the exodus of talent, its introduction seems wise.

From those three models, the 75% tax rate reinforces the polarization of the L1 between two dominant clubs funded by sugar daddies on the one hand, and the other clubs struggling to remain solvent. The general model indicates that the 75% tax rate reduces the effect of the revenue advantage of the big clubs in return of an exodus of talent. Capping the tax levy somewhat reduces those effects. However, if we relax two basic hypotheses to obtain more realistic forecasts, two clubs enhance their hegemonic positions in the league. Therefore we recommend income redistribution between teams.

Table 4. Effect of the French 75% Tax Rate in L1 with Revenue Sharing (in K€)

Clubs	Initial situation	Tax plus cap regime		Only tax regime		Only tax regime with revenue sharing	
	Payroll	75% tax rate capped	Residual payroll	75% tax rate without cap	Residual payroll	Revenue sharing	Residual payroll
Paris	239773	19645	220128	43565	196208	2323	198531
Monaco	94581	0	94581	0	94581	0	94581
Marseille	85112	5227	79885	13034	72078	2323	74401
Lyon	82354	4954	77400	11545	70809	2323	73132
Lille	62190	4813	57377	7696	54494	2323	56817
Montpellier	33434	356	33078	356	33078	2323	35401
Bordeaux	55961	3388	52573	4151	51810	2323	54133
Saint-Etienne	40603	896	39707	896	39707	2323	42030
Rennes	41172	2102	39070	3316	37856	2323	40179
Toulouse	29735	1196	28539	1196	28539	2323	30862
Lorient	25898	0	25898	0	25898	2323	28221
Nice	25394	1076	24318	1076	24318	2323	26641
Evian	17901	0	17901	0	17901	2323	20224
Nantes	18706	0	18706	0	18706	2323	21029
Sochaux	21226	0	21226	0	21226	2323	23549
Valenciennes	20275	206	20069	206	20069	2323	22392
Reims	19004	0	19004	0	19004	2323	21327
Bastia	20581	178	20403	178	20403	2323	22726
Guingamp	18609	9	18600	9	18600	2323	20923
Ajaccio	14405	99	14306	99	14306	2323	16629
Standard-Deviation	**50124**		**46033**		**41021**		**40881**
Variation coefficient	**5.18%**		**4.99%**		**4.66%**		**4.43%**
Skewness	**2.99**		**2.92**		**2.79**		**2.81**

For Revenue Sharing

Competitive balance can be seen as a public good (Daly & Moore, 1981). Even if all the members of the league benefit from a well-balanced competition, every club behaves as a free-rider. Therefore an external regulation is necessary to guarantee an optimal solution, and the combination of several regulatory tools is effective (Dietl, Lang, & Rathke, 2011).

The primary objective of the 75% tax rate is to bring down the public deficit and to act as a symbol of solidarity. We assume that the total amount of tax revenue collected in tax plus cap regime is deemed sufficient by the French government. Based on this basic premise, could the new taxation system help improve the attractiveness of L1?

As mentioned previously, Frédéric Thiriez has argued that the system was unfair. The tax cost reduction associated with the implementation of the cap mostly benefits

PSG; 55% of the total savings profit the richest club, which alone represents 31.7% of the aggregate income excluding trading of L1 for the 2013–2014 season. Though the cap was implemented to reduce the budgetary pressure on French clubs, it appears to have a "dead-weight effect for sugar daddy." Instead of creating a cap, we recommend implementing revenue sharing funded by the difference between the total amount of tax revenue collected in the tax plus cap regime and what would have been collected in the only tax regime. This revenue sharing should improve the attractiveness of L1 by maintaining competitive balance and be inconsequential in terms of stock of talent as clubs maximize wins. The revenue sharing must concern all L1 clubs whose head office is located in France. In other words, ASM will not benefit from this measure. In order to ensure that this tax exemption is neutral with regard to the public budget, the total amount of the revenue shared must be equal to the amount of additional tax collected thanks to the removal of the cap on the 75% tax rate (x=1 and d>0). In order to take into account the rent-seeking game played by clubs, this amount will have to be determined once the 75% tax has been collected. The impact of this policy tool with a static payroll is given in Table 4.

We use the coefficient of variation to proxy competitive balance (Daly & Moore, 1981). *In fine*, the variation coefficient between payrolls decreases from 5.18% to 4.43%. The competitive balance is significantly improved at each step of the regulation. Like the implementation of the revenue sharing, the introduction of the 75% tax rate helps optimize outcome uncertainty, but the most important improvement stems from removing the 5% cap on the 75% tax. Using the third statistical moment allows highlighting the polarization of the league. The positive skewness of the payroll distribution points out that the competitive balance is worsened due to a few extremely good teams (Lee, Jang, & Hwang, 2014). As the skewness decreases with the policy tool (from 2.99 to 2.81), the only tax regime with revenue sharing holds back the polarization of L1. The primary aim of the revenue sharing would be to convince the clubs' union, UCPF, to accept the removal of the cap in return for this new tax rebate. Those regulation tools help optimize the attractiveness of L1.

Discussion, Implications, and Avenues

Discussion

As European soccer teams are involved in a competitive environment, talent supply is variable. The welfare of players is not impacted by a change in tax rates as net salary is assumed to be maintained at the same level (c is constant). If French soccer teams are no more able to offer a certain level of salary, players will leave the country to keep the same level of net salary. Regarding club owners, they are assumed to be oriented toward win maximization. The new tax rate has no effect at an aggregated level, as the sum of winning percentages must equal 1. Only the sugar daddy utility may decrease as the introduction of a new tax raises his endogenous SBC. As the new tax rate has no effect on players and clubs (at the league level), social welfare only varies according to fan utility, which is assumed to depend on their preference for outcome uncertainty and the aggregate quality of teams.

The fan preference for competitive balance could be challenged. Borland and MacDonald (2003) list 15 studies dealing with the correlation between competitive balance and attendance. Only seven among them conclude that competitive balance has, indeed, a positive effect. Yet, if we question the concavity of the revenue function, the general model yields different results (Cavagnac & Gouguet, 2008). Competitive balance appears to be only one of the determinants of a team's revenue function. According to the Yankee/Manchester United paradox (Szymanski, 2001), an unbalanced league could be attractive if teams with the larger fan bases were better than the others. Do those considerations call into question the validity of the results regarding the relevance of the 75% tax rate mechanism?

According to Dietl, Lang, and Werner (2009), a degree of imbalance is necessary to maximize the welfare of sports leagues. Yet, which teams will be the main beneficiaries of the 75% tax rate? The answer is ASM and to a lesser extent PSG. The Principality team does not have the most devoted fan base and has the worst attendance in L1.[12] If PSG is popular, other clubs with large fan bases (e.g., Marseille, Saint-Etienne, Lyon) appear to be the main losers of the new taxation.

Moreover, sugar daddy behavior can be perceived as "financial doping" and harms leagues' attractiveness. "Many fans complain that it is unfair that wealthy owners are able to 'buy' a championship simply by using their financial muscle" (Peeters & Szymanski, 2014, p. 355).

The behavioral asymmetry and the social and fiscal distortions as well as the 75% tax rate widen the gap between PSG and ASM on the one hand and the other clubs on the other. Two teams will be in contention for the title and the other 18 teams will take part in another championship in the league. This "leftward shift of the Diracized subset," since it moves the block of competitively balanced teams toward the bottom, is non-optimal for the attractiveness of the league (Gayant & Le Pape, 2013). This explains why the 75% tax rate causes a non-optimal level of imbalance, and revenue sharing seems necessary.

Another argument challenges this analysis: beyond the dilemma between competitive balance and aggregate quality of teams, competition organizers should help the emergence of domestic elite perform well in European competitions. The stakes are twofold. First, country coefficient rankings are based on the results of each domestic club in the five previous UEFA Champions League and UEFA Europa League seasons. The rankings determine the number of places allotted to a country in forthcoming competitions. Second, the revenue function also depends on a club's performance in the UEFA club championship. Qualifying for European Cup competitions generates prize money estimated to amount to an average of 11% of revenue (UEFA, 2011). On the one hand, LFP wants to maintain competitive balance to increase the attractiveness of L1. On the other hand, the French league needs teams to perform well in European competitions. Thus, French broadcasting rights are shared unequally, in favor of the biggest clubs. LFP should clarify its position. The broadcasting rights sharing suggests that the league wishes to promote the emergence of an elite team. However, Frédéric Thiriez's statement leads us to believe the opposite.

Implications

Contrary to the dominant view, the main threat associated with the 75% tax rate, for the French soccer championship, is not the risk of bankruptcy. It certainly implies a new constraint. However, despite earning high revenues, European soccer clubs experience financial problems. If enormous revenues are not enough (Solberg & Haugen, 2010), then the nature of the problem must be structural. Several explanations can be advanced. Andreff (2007) blames the problem on a lack of governance, Solberg and Haugen (2010) use a game-theory model in the race for talent, and Szymanski (2012) explains it by negative shocks (productivity and/or demand).

So where does the trouble come from? According to our study, which takes into account situations that are specific to L1 (social and fiscal distortions, and behavior asymmetry), a 75% tax rate harms competitive balance, leads to an exodus of talent, and reinforces L1 polarization. LFP has failed to improve the competitive position of French clubs in the UEFA ranking (sixth, after the Portugal championship). Nevertheless, thanks to the two sugar daddies in L1, the performance of French soccer clubs in European competitions should improve. Moreover, we have explained that the actual degree of imbalance is not optimal. That is why LFP should no longer promote the emergence of an elite, as by doing so, they risk polarizing L1. Nöel Le Graët, chairman of the FFF, underlines this when he stated, "Clubs can see that PSG and Monaco hold the first two places in the championship. Stadiums are being built all over France, but that's to play for the third place, at best. This is cause for concern and questioning."[13] The revenue sharing (and the regularization of the ASM head office location) should help maintain competitive balance.

At present, only the top two teams in L1 are ensured qualification for the lucrative Champions League. This implies that the actual heterogeneity of resources could worsen competitive balance through a cumulative effect.[14] Apart from this "snowball effect," the UEFA Financial Fair Play regulations (FFP) will also ossify the actual hierarchy (Franck, 2014; Sass, 2016). The clubs' payroll will have to be entirely financed by revenues generated by soccer, and injections of "external" money will be forbidden. FFP will act as a barrier to entry and it will become increasingly difficult for a challenger to fill the gap between the best clubs and itself. Even if the 75% tax rate is a temporary measure (by assuming no hysteresis effect), its impact could be sustainable. L1 could be durably polarized and the attractiveness of the French championship diminished.

Avenues

The literature in the economics of sports generally deals with the measure of competitive balance. The non-cooperative model fits well with the theoretical debate. It helps understand the impact of fiscal measures in terms of outcome uncertainty and exodus of talent. However, this model does not take into account specific situations such as fiscal and social distortions or sugar daddy behavior. It therefore seems necessary to use it gingerly because results are hypothesis dependent. An interesting avenue for further research in this area is to challenge the basic premises about a club's revenue function or the behavior of their owners (Cavagnac & Gouguet, 2008). Despite the fact that the general model includes the effect of aggregate talent to the revenue function, the revenue function could also include a trading variable. A club located in a less favorable area may benefit from player transfer fees paid by a richer club. If the new taxation damages the recruitment opportunities of the clubs operating in the bigger markets, this will have negative spillovers on the other club. The impact on competitive balance would then be reduced to some extent and the exodus of the best players would be reinforced.

Moreover, this model does not specify the clubs' adjustment mechanism. We assume the talent supply variable (price) is exogenous. Then the available talent stock T is the adjustment variable. But no more information is given about it. Is it a qualitative (more or less skilled players) or quantitative (size of the squad) adjustment? Kleven et al. (2013) point out that the number of players is not correlated to taxation. This absence of correlation implies a qualitative adjustment, which could impact the attractiveness of L1. This raises another question: Are the best or the weakest players departing from the league (and are substituted by lower-ability players)? Even if the players are the decision-makers for Kleven et al., their results help anticipate the adjustment; the tax rate is negatively correlated to the presence of the best players, but positively to the low-ability players.

If the 75% tax rate leads to an exodus of the superstars, fan interest could decrease exponentially. Indeed, the team attendance and revenue functions of a team could be correlated to the presence of a superstar on the team (Hausman & Leonard, 1997). The net-salary differences with the rival leagues are the main determinant of the exodus of the best French players. The new taxation strengthens those differences while the Premier League's TV deal for 2016–2019 already threatens the attractiveness of the L1 and could raise the marginal cost of talent, which is assumed to be constant in the general model.

The question of the utility function of sugar daddies could be challenged; is the new taxation system disincentive enough for them to give up their investments? The evaluation of the new tax system could also be improved by a three-club model and a clearer definition of the league's priority objective. Much still has to be done about the socially desirable level of imbalance and the specification of the model to come closer to reality.

References

Andreff, W. (2007). French football: A financial crisis rooted in weak governance. *Journal of Sports Economics, 8*, 652–661.

Andreff, W. (2009). Equilibre compétitif et contrainte budgétaire dans une ligue de sport professionnel. *Revue Economique, 60*, 591–633.

Barajas, Á., & Rodríguez, P. (2010). Spanish football clubs' finances: Crisis and player salaries. *International Journal of Sport Finance*, *5*, 52–66.

Borland, J., & MacDonald, R. (2003). Demand for sport. *Oxford Review of Economic Policy, 19*, 478–502.

Cavagnac, M., & Gouguet, J.-J. (2008). Droits de retransmission, équilibre compétitif et profits des clubs. *Revue d'Economie Politique, 118*, 229–253.

Daly, G., & Moore, W. J. (1981). Externalities, property rights and the allocation of resources in Major League Baseball. *Economic Inquiry, 19*, 77–95.

Davenport, D. (1969), Collusive competition in Major League Baseball: Its theory and institutional development, *American Economist*, *13*, 6–30.

Dietl, H. M., Lang, M., & Rathke, A. (2011). The combined effect of salary restrictions and revenue sharing in sports leagues. *Economic Inquiry, 49*, 447–463.

Dietl, H. M., Lang, M., & Werner, S. (2009). Social welfare in sports leagues with profit-maximizing and/or win-maximizing clubs. *Southern Economic Journal, 76*, 375–396.

DNCG. (2014). Rapport annuel de la saison 2013–2014, Commission de contrôle des clubs professionnels, Rapport d'activite, Compte des clubs professionnels.

El-Hodiri, M., & Quirk, J. (1971). An economic model of a professional sports league. *The Journal of Political Economy, 79*, 1302–1319.

Franck, E. (2014). Financial fair play in European club football: What is it about? *International Journal of Sport Finance*, *9*, 193–217.

Frick, B. (2007). The football players' labor market: Empirical evidence from the major European leagues. *Scottish Journal of Political Economy, 54*, 422–446.

Gayant, J.-P., & Le Pape, N. (2013) Measuring competitive imbalance in team sports: Toward an axiomatic approach. Working paper.

Gouguet, J.-J., & Primault, D. (2003). Formation des joueurs professionnels et équilibre compétitif : L'exemple du football. *Revue Juridique et Economique du Sport, 68*, 7–34.

Gouguet, J.-J. (2004). *Le sport professionnel après l'arrêt Bosman: Une analyse économique internationale. [Actes du colloque organisé les 1er et 2 juillet 1999 à Limoges par le centre de droit et d'économie du sport, CDES].* Limoges, France: Presses Univ. Limoges.

Helleu, B., & Durand, C. (2006). Sport collectif et compétitions internationales entre clubs: Le cas des équipes canadiennes en Amérique du Nord. *Revue Européenne de Management du Sport, 15*, 11–29.

Hamil, S., Morrow, S., Idle, C., Rossi, G., & Faccendini, S. (2010). The governance and regulation of Italian football. *Soccer & Society, 11*, 373–413.

Hausman, J. A., & Leonard, G. K. (1997). Superstars in the National Basketball Association: Economic value and policy. *Journal of Labor Economics*, *15*, 586–624.

Késenne, S. (2000). Revenue sharing and competitive balance in professional team sports. *Journal of Sports Economics, 1*, 56–65.

Késenne, S. (2007). *The economic theory of professional team sports: An analytical treatment.* Cheltenham, UK: Edward Elgar Publishing.

Kleven, H., Landais, C., & Saez, E. (2013). Taxation and international migration of superstars: Evidence from the European football market. *American Economic Review, 103*, 1892–1924.

Kornai, J. (1980). *Economics of shortage: Volumes A and B.* Amsertdam, The Netherlands: North Holland.

Lee, Y. H., Jang, H., & Hwang, S. H. (2014). Market competition and threshold efficiency in the sports industry. *Journal of Sports Economics*, *16*, 853–870.

Madden, P. (2011). Game theoretic analysis of basic team sports leagues. *Journal of Sports Economics*, *12*, 407–431.

Madden, P. (2015). "Walrasian fixed supply conjecture" versus "contest-Nash" solutions to sports league models: Game over? *Journal of Sports Economics*, *16*, 540–551.

Mourão, P. R., & Cima, C. (2015). Studying the golden generations' effects and the changes in the competitive balance of the Portuguese soccer league. *International Journal of Sport Finance*, *10*, 42–61.

Morrow, S. (2006). Impression management in football club financial reporting. *International Journal of Sport Finance*,v*1*, 96–108.

Neale, W. C. (1964). The peculiar economics of professional sports. *The Quarterly Journal of Economics, 78*, 1–14.

Pawlowski, T., Breuer, C., & Hovemann, A. (2010). Top clubs' performance and the competitive situation in European domestic football competitions. *Journal of Sports Economics*, *11*, 186–202.

Peeters, T., & Szymanski, S. (2014). Financial fair play in European football. *Economic Policy*, *29*, 343–390.

Quirk, J. P. (1997). *Pay dirt: The business of professional team sports.* Princeton, NJ: Princeton University Press.

Rottenberg, S. (1956). The baseball players' labor market. *The Journal of Political Economy, 64*, 242–258.

Sass, M. (2016). Glory hunters, sugar daddies, and long-term competitive balance under UEFA financial fair play. *Journal of Sports Economics, 17*, 148–158.

Scelles, N., Durand, C., Bonnal, L., Goyeau, D., & Andreff, W. (2013). My team is in contention? Nice, I go to the stadium! Competitive intensity in the French football Ligue 1. *Economics Bulletin*, *33*, 2365–2378.

Scully, G. W. (1995). *The market structure of sports.* Chicago, IL: University of Chicago Press.

Sloane, P. J. (1971). The economics of professional football: The football club as a utility maximiser. *Scottish Journal of Political Economy, 18*, 121–146.

Solberg, H. A., & Haugen, K. K. (2010). European club football: Why enormous revenues are not enough? *Sport in Society*, *13*, 329–343.

Solberg, H. A., & Mehus, I. (2014). The challenge of attracting football fans to stadia? *International Journal of Sport Finance*, *9*, 3–19.

Storm, R. K., & Nielsen, K. (2012). Soft budget constraints in professional football. *European Sport Management Quarterly*, *12*, 183–201.

Szymanski, S. (2001). Income inequality, competitive balance and the attractiveness of team sports: Some evidence and a natural experiment from English soccer. *The Economic Journal*, *111*, 69–84.

Szymanski, S. (2012). Insolvency in English professional football: Irrational exuberance or negative shocks. Working paper No. 1202.

Szymanski, S., & Késenne, S. (2004). Competitive balance and gate revenue sharing in team sports. *The Journal of Industrial Economics, 52*, 165–177.

Szymanski, S., & Kuypers, T. (1999). *Winners and losers: The business strategy of football.* London, UK: Viking Press.

Terrien, M., Durand, C., Maltese, L., & Veran, L. (2014). Taxe à 75%: Un salary cap en ligue 1? *Jurisport: Revue Juridique et Economique du Sport*, 42–45.

Terrien, M., Scelles, N., & Durand, C (2015). L'ouverture de la Ligue Nationale de Rugby: le French flair d'une instance récente. In P. Chaix (Dir.), *Le nouveau visage du rugby professionnel français* (pp. 55–74). Paris, France: L'Harmattan.

Terviö, M. (2006). Transfer fee regulations and player development. *Journal of the European Economic Association, 4*, 957–987.

UEFA. (2011). *The European club licensing benchmarking report: Financial year 2011*. Retreived from http://www.uefa.org/MultimediaFiles/Download/Tech/uefaorg/General/01/91/61/84/1916184_DOWNLOAD.pdf

Vrooman, J. (1995). A general theory of professional sports leagues. *Southern Economic Journal*, *61*, 971–990.

Vrooman, J. (2009). Theory of the perfect game: Competitive balance in monopoly sports leagues. *Review of Industrial Organization, 34*, 5–44.

Winfree, J. A. (2015). This game is being played under protest. *International Journal of Sport Finance*, *10*, 88–100.

Winfree, J., & Fort, R. (2012). Nash conjectures and talent supply in sports league modeling: A comment on current modeling disagreements. *Journal of Sports Economics*, *13*, 306–313.

Endnotes

[1] The highest British income tax rate is currently 45%. It could explain why the Premier League is still able to recruit the best players in the world.

[2] Aggregate net income is negative in L1 since 2007–2008 (DNCG, 2014).

[3] See http://www.franceinfo.fr/sports/football/article/pourquoi-les-clubs-de-foot-protestent-ils-contre-la-taxe-75-293245. To prove how this new tax rate may threaten the viability of the French championship, clubs made public the data, thanks to the media.

[4] Nash equilibrium could also be applied to closed leagues. For further discussion on this topic, see Madden (2011, 2015), Winfree and Fort (2012), and Winfree (2015).
[5] A strictly concave revenue function implies a quadratic function of wins percentage and to limit β between 1 and 2 because:

$$\frac{\partial R_i}{\partial w_i} > 0 \; for \; \beta > 2w_i; \; \frac{\partial R_i}{\partial w_i} = 0 \; for \; \beta = 2w_i; \; \frac{\partial R_i}{\partial w_i} < 0 \; for \; \beta < 2w_i;$$

(Sass, 2016).
[6] This hypothesis seems coherent with the L1 stylized facts as a significant linear correlation appears between payroll and the amount of tax payable (in only tax regime) by the clubs subject to 75% tax rate ($R^2 = 0.92$). From the 14 clubs suffering from the new tax system, we excluded PSG from the sample, considering it as an outlier for its very high payroll.
[7] See http://www.slate.fr/story/78358/plafonnement-taxe-75-bouclier-fiscal-psg-grands-clubs
[8] See http://www.lemonde.fr/sport/article/2013/09/30/regis-juanico-l-as-monaco-a-un-enorme-avantage-fiscal_3486973_3242.html. Data is from a governmental source. To put this amount in perspective, note that it represents the sixth budget of L1.
[9] See http://uk.eurosport.yahoo.com/news/football-monaco-pay-league-68-million-keep-tax-180646621—sow.html. Seven clubs have contested this agreement in the courts, leading to the cancellation of this "illegal" agreement by the French State Council. Since the court decision, no new measures were taken about the ASM head office location.
[10] Limited SBC means an exogenous tolerance for deficit. We assume that owner step as rescuers by paying the open bills to keep π=0. Adding the SBC in the revenue functions does not alter the equilibria defined above, if we assume owners of team 1 and 2 have the same loss tolerance. It only implies more aggregate talent as SBC increases, but the transitivity of $T^C \leq T^A \leq T^B$ and $T^F \leq T^D \leq T^E$ are respected.
[11] As explained previously, assuming a limited SBC does not alter the results.
[12] At the end of the 2013–2014 season; see http://www.lfp.fr/ligue1/affluences/journee
[13] See http://www.lequipe.fr/Football/Actualites/Le-graet-un-accord-un-peu-leger/441057
[14] See Sass (2016) for a dynamic equilibrium of the general model. Pawlowski, Breuer, and Hovemann, (2010) also highlight a significant worsening in competitive balance after the modification of the Champions League payout.

Authors' Note

The authors are grateful to the numerous DESport seminar participants for helpful comments and discussion.

International Journal of Sport Finance, 2016, **11**, 204-220, © 2016 West Virginia University

Human Capital, Formal Qualifications, and Income of Elite Sport Coaches

Pamela Wicker[1], Johannes Orlowski[1], and Christoph Breuer[1]

[1] German Sport University Cologne

Pamela Wicker, PhD, is a senior lecturer in the Department of Sport Economics and Sport Management. Her research interests include labor economics, non-profit economics, economics of physical activity, health economics, and economics of sport consumption.

Johannes Orlowski, MSc, is a research associate and PhD student in the Department of Sport Economics and Sport Management. His research interests include labor economics, economics of physical activity, health economics, and monetary valuation of intangibles.

Christoph Breuer is a professor of sport management in the Department of Sport Economics and Sport Management. His research interests include labor economics, non-profit economics, economics of physical activity, and sport sponsorship.

Abstract

This study examines the effect of various formal qualifications on the income of elite sport coaches in less commercialized sports. Elite sport coaches (i.e., coaches who are at least partially funded by the federal government) were surveyed online (n=186). Altogether, they reported 65 different formal qualifications that could be summarized into eleven categories. The regression results show that only a university degree in sport sciences has a significant positive effect on monthly net income, while various coaching licenses, diplomas, certificates, and formations are insignificant. From the perspective of human capital theory, the findings indicate that schooling and learning on the job are more relevant than further activities that increase the knowledge base. Coaches seeking higher income should invest in a university degree in sport sciences. Sport officials and policy makers should reconsider why the various formal qualifications provided, promoted, and requested by sport associations are not reflected in coaching salaries.

Keywords: human capital theory, coaching salary, coach education, labor market, high performance sport

Introduction

The development of elite sport is a key policy concern in many Western countries including the United Kingdom (Green, 2004), Australia, Canada (Green, 2007), and Germany (German Federal Government, 2014). Consequently, governments allocate large amounts of public funds to elite sport development (Green, 2007; Grix &

Carmichael, 2012). For example, the German government has provided approximately €1 billion for the promotion of sport between 2010 and 2013 with a large part of the money being attributed to the promotion of elite sport (German Federal Government, 2014).

Within elite sport systems coaches are situated at critical positions because they represent the link between government policies and investments, respectively, and elite sport achievements (Liston, Gregg, & Lowther, 2013). In addition to coaches, there are more critical factors because elite sport success is a combination of several factors as conceptualized in the SPLISS model (i.e., sports policy factors leading to international sporting success) by De Bosscher, De Knop, Van Bottenburg, and Shibli (2006). This model states that nine factors influence international sporting success. These pillars are: financial support; governance, organization, and structure of sport policies; foundation and participation (e.g., in clubs and schools); performance (e.g., talent identification and development); excellence (e.g., athletic career support); training facilities; (inter)national competition; scientific research and innovation; and coaching provision and coach development (De Bosscher et al., 2006).

The focus of this study is on the second facet of the last pillar (coach development) and more specifically, coach education and the returns to education. Generally speaking, coach education is a complex topic because the job of a coach is characterized by various roles and responsibilities. For example, in addition to the organization of the actual sport practice, coaches are responsible for selecting talent (Inoue, Plehn-Dujowich, Kent, & Swanson, 2012), have administrative (Laios, 1995) and managerial responsibilities (Inoue et al., 2012), fulfil parental roles (Burke & Johnson, 1992), need pedagogical skills (Jones, 2007), and serve as psychologists and mental coaches (Gucciardi, Gordon, Dimmock, & Mallet, 2009). These skills should also be reflected in coach education; yet, given the variety of coaches' responsibilities, there is no specific type of coach education or degree that covers all these skills.

In an effort to acquire the relevant skills mentioned, many coaches now hold various qualifications such as academic degrees, coaching licenses offered by (inter)national sport associations, and various types of additional coaching formations and certificates. However, it is questionable if all of the available qualifications are equally significant in terms of obtaining the relevant coaching knowledge and generating income. While the content of coach education has already been examined in previous research (e.g., Piggott, 2012, 2015), the effect of different formal coaching qualifications on income has been largely neglected. Since the working conditions of many elite sport coaches are characterized by high weekly workloads and relatively low income (Digel, Thiel, Schreiner, & Waigel, 2010), the question of what coaching qualifications pay off is a relevant one.

The purpose of this study is to examine the relationship between different formal coaching qualifications and income of elite sport coaches in less commercialized sports. Previous research almost exclusively looked at intercollegiate athletics when examining the determinants of coaching salaries (e.g., Byrd, Mixon, & Wright, 2013; Grant, Leadley, & Zygmont, 2013), probably because information about coaching salaries in other sports are hardly publicly available. Therefore, primary data were collected using an online survey of elite sport coaches (n=186). Coaches were asked to state all the formal qualifications they have, allowing a detailed analysis of the role of qualifications. This study contributes to the body of knowledge on coaching salaries and labor market research in elite sport.

Research Context

The research context of this study is Germany, where the working conditions and specifically the salaries of elite sport coaches in less commercialized sports are on the political agenda (German Parliament, 2014). This study uses the definition of elite sport suggested by Hong (2011): "Elite sport can be defined … as a competition in sport at the highest international level with a priority put on sports in the Olympic Games programme, and on those sports with regular world championships" (p. 977). In Germany, elite sport is funded by the federal government, while community sport is mainly supported by state and local governments. This is why the federal government and the German Parliament discuss and set the regulatory frame and financial means of elite sport coaches in less commercialized sports. In these sports, elite sport coaches are financially supported by the government; coaching salaries are only partially determined by the market. Having said that, this study excludes more commercialized sports like football, tennis, and boxing.

Since coaches in less commercialized sports have complained about their salaries for several years (Süddeutsche Zeitung, 2013) and coaching migration is a concern (Gienger, 2008), the federal government took measures to improve the financial compensation of elite sport coaches. Generally speaking, there is a directive that people employed in publicly funded jobs are not allowed to earn more than other employees in the public sector in comparable jobs (Federal Office of Administration, 2014). Since elite sport coaches are also publicly financed, this regulation would also be applicable to them. However, it was decided that elite sport coaches are excluded from this regulation to ensure the competitiveness of German elite sport. Up to €104,000 in funding is available for the yearly gross salary of national coaches (Federal Ministry of the Interior, 2015). Yet, the decision about the salary level is at the discretion of the national sport association. Thus, national coaches do not automatically receive this gross salary because the association can decide to pay a coach less or use this money to hire several coaches.

Theoretical Framework

The relationship between coach qualifications and income is rooted in the theory of human capital (e.g., Becker, 1962; Mincer, 1974; Schulz, 1960). Following Becker (1962), "activities that influence future real income through the embedding of resources in people … is called investing in human capital" (p. 9). The focus here is not on physical resources, but on less tangible (i.e., intangible) resources like knowledge. Investment in human capital includes, for example, schooling and on-the-job training (Becker, 1962) and is associated with gains in information, knowledge, skills, capabilities, and competencies (Becker, 1962; James, 2000; Schulz, 1960). In addition to schooling and on-the-job training, there are further activities that "raise real income primarily by increasing the knowledge at a person's command" (Becker, 1962, p. 26). Investments in human capital can lead to a competitive advantage when the individual's competitors have not made such investments (James, 2000).

The human capital theory assumes that an individual's level of human capital is positively associated with income (Becker, 1962; Mincer, 1974). However, the amount of resources invested and the monetary returns differ between the different ways of investing in human capital (Becker, 1962). Notably, investment in human capital is associated with costs; foregone earnings are costs of human capital as well as resources that are invested in training rather than in producing current output (Becker, 1962; Schulz, 1960). Thus, the typical relationship between age and earnings (i.e., earnings increase with age at a decreasing rate) can also be explained with human capital theory; earnings are lower during the investment period and greater afterwards (Becker, 1962).

Applying the concept of human capital to this study, on-the-job training is reflected by the number of years a person has worked as a coach and gained coaching experience. The formal qualifications that are available to elite sport coaches reflect different types of investment in human capital; while academic degrees reflect schooling (i.e., an investment in human capital made in an institution that specializes in teaching; Becker, 1962), the various coaching licenses and certificates can be considered further activities that increase the coaches' (sport-specific) knowledge base.

Human capital theory is often discussed together with social capital theory (e.g., Barros & Barros, 2005; Sagas & Cunningham, 2005). Following Lin (2001), social capital "consists of resources embedded in social relations and social structure" (p. 24). From a professional perspective, it includes an individual's social network and relationships with peers, colleagues, subordinates, and superiors (James, 2000). Research has shown that both human capital (e.g., education, experience) and social capital (e.g., network, weak, and other ties) have a positive effect on the earnings of sport administrators (Barros & Barros, 2005). For coaches, social networks were found to be especially relevant to the reception of job offers (Taylor, 2010). While it may be interesting to examine the role of social capital in coaching income, the focus of this research is on human capital.

Literature Review

The majority of studies examining the effect of human capital on coaching salaries were conducted in intercollegiate athletics, particularly in college football (Byrd et al., 2013; Fogarty, Soebbing, & Agyemang, 2015; Grant et al., 2013; Humphreys, Soebbing, & Watanabe, 2011; Soebbing, Wicker, & Watanabe, 2016) and basketball (Brewer, McEvoy, & Popp, 2015; Humphreys, 2000). A few studies looked at coaches in professional team sports (e.g., Kahn, 2006). The main reason for this research focus is the availability of salary data, which can be retrieved from public data bases (e.g., Fogarty et al., 2015; Humphreys et al., 2011; Soebbing et al., 2016).

Within these previous studies, a coach's human capital has been measured with age (Fogarty et al., 2015; Kahn, 2006), number of years on the job reflecting experience (Byrd et al., 2013; Grant et al., 2013; Kahn, 2006), and number of years employed in the organization reflecting tenure (Fogarty et al., 2015). Yet, in most previous studies human capital was only used as a control variable, since the focus was more on on-field and off-field performance (Byrd et al., 2013; Fogarty et al., 2015; Grant et al., 2013). A set of formal qualifications (i.e., undergraduate varsity athletic status, type of undergraduate institution, major in physical education, and years of higher education) was only considered by Knoppers, Bedker Meyer, Ewing, and Forrest (1989). Since intercollegiate athletics head coaches in revenue-generating sports share the job characteristics of chief executive officers and command relatively high salaries (Soebbing & Washington, 2011), their salary determinants may be less comparable to those of elite sport coaches in less commercialized sports.

At least two shortcomings can be observed when looking at the body of research examining the relationship between human capital and coaching income. First, research has focused on intercollegiate athletics and—to a smaller extent—on professional team sports, while less commercialized sports including various sports that are at the core of Olympic Summer and Winter Games have not yet been examined. Second, the existing studies predominantly measured human capital with age, experience, and tenure (Byrd et al., 2013; Grant et al., 2013) with one exception (Knoppers et al., 1989), while formal qualifications have been largely neglected. The present study attempts to increase the knowledge base by taking these shortcomings into account.

Methods

Data Collection

Since data on coaching salaries in elite sports are not publicly available—unlike in intercollegiate athletics—primary data had to be collected. An online survey was used for the data collection, which was online from July 17 to August 17, 2015. Since the support of elite sport is taken care of at the federal level in Germany, all elite sport coaches are at least partially funded by the federal government (i.e., national coaches, federal state coaches, and coaches at Olympic training bases). Formal ethics approval for this study was obtained by the university's ethics committee (approval number: 96/2015). This research is part of a larger study examining the location factors of elite sport coaches in Germany.

Due to data privacy issues, emails of coaches could not be made available. Thus, coaches had to be invited by umbrella organizations to complete the survey. An invitation email including a description of the project, the guarantee of anonymity, and the link to the online questionnaire was sent to the Professional Association of Coaches in German Sport (BVTDS) and the German Olympic Sports Confederation (DOSB)—the head organization for organized sport in Germany. While the BVTDS forwarded the invitation email directly to coaches, the DOSB sent an email to the sporting directors of the national sport associations and the directors of the Olympic training bases, who then forwarded the invitation email to the respective coaches within their organization. This sampling procedure ensured that coaches from a variety of sports, regions, and affiliations were invited.

Given the high workloads and relatively low salaries of elite sport coaches (Digel et al., 2010) an incentive of €50 was provided for taking the time to complete the survey. In light of the incentive, it seemed acceptable to program the survey in a way that respondents were forced to answer all questions, allowing a complete case analysis. Information about income is usually sensitive and, therefore, less likely to be declared; yet, this information is required for the current analysis. Altogether, 233 elite sport coaches participated in the survey. For the empirical analysis, 47 cases had to be removed because of incomplete responses resulting in a final sample size of 186.

Given the sampling procedure where coaches were (had to be) invited via various sport organizations rather than by the university leading this research project, we do not know how many coaches received an invitation email to the survey and, thus, it is difficult to report a response rate. As noted previously, elite sport coaches in Germany are at least partially funded by the federal government and the Federal Ministry of the Interior (BMI), respectively. According to the Federal Office of Administration (2015), a total of 687 elite sport coaches received a (full or partial) salary from the BMI in 2014—this figure represents the total population of elite sport coaches in Germany. This information allows us to report that 33.9% of these 687 coaches clicked on the link and started the survey and 27.0% completed the survey. The completion rate of 79.8% is relatively high, indicating that most coaches who started the survey also finished it.

The number of coaches in this sample is similar to previous studies examining the determinants of coaching salaries (*n*=185 coaches in Byrd et al., 2013; *n*=172 in Fogarty et al., 2015; *n*=184 in Inoue et al., 2012). Yet, previous studies were able to collect panel data because salary data of college football coaches are publicly available. This study shares the challenges of other survey-based studies facing a trade-off between guaranteeing anonymity to the survey respondents and collecting panel data. The latter requires surveying individuals more than once and matching the data sets using a key variable (e.g., name) that allows for identifying the respondents. This key variable requires personal information that would compromise the coach's anonymity. In the present study, collecting panel data was not possible because questions about income are highly sensitive and must guarantee anonymity to the survey respondents.

Measures and Variables

An overview of the variables used in this study is provided in Table 1. In line with previous research (Fogarty et al., 2015; Inoue et al., 2012), it is assumed that the income of coaches is determined by human capital, performance, and organizational characteristics. In the survey, the coaches' personal monthly net income was assessed. As can be seen in Figure 1, the income distribution is highly skewed. Therefore, it is common

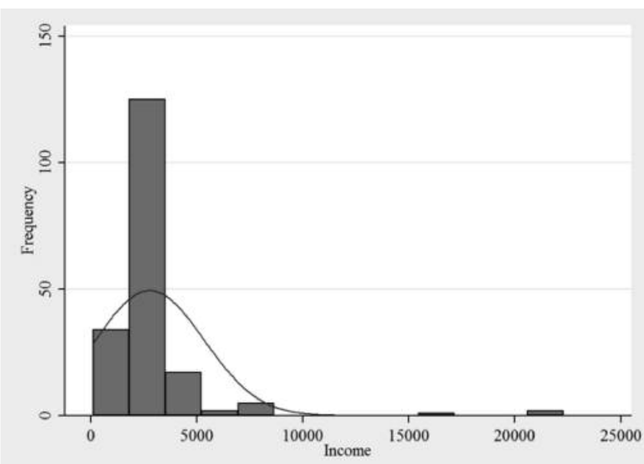

Figure 1. Distribution of income.

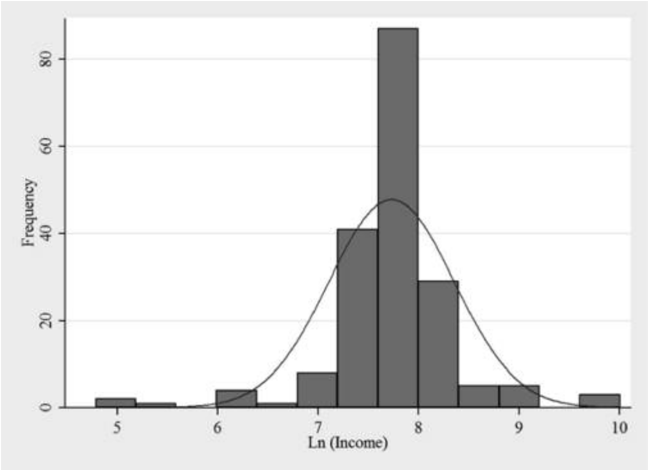

Figure 2. Distribution of Ln (Income).

to use the natural logarithm of income [*Ln(Income)*], shown in Figure 2, which is closer to the normal distribution (Mincer, 1974).

The coaches were asked to list all the formal coaching qualifications they have. Given the variety of existing coaching qualifications, an open question format was used and space was provided for eight different qualifications (only needed by one respondent). On average, coaches claimed 2.3 formal qualifications. Altogether, coaches reported 65 different types of formal qualifications, which could be summarized into the following 11 categories.

The coaching *A-License*, *B-License*, and *C-License* are the standard licenses for coaches in Germany, which are provided by the sport associations (A is higher than B; B is higher than C). Usually, holding a C-License is a requirement for participating in a training course for a B-License, and holding a B-License is a precondition for being eligible to participate in an A-License training course. However, not every coach has the opportunity to enroll in a training course for a B- or A-License; some sport associations not only require coaches to possess the respective lower license, but also to have other requirements related to, for example, years of coaching experience, performance level of coached athletes, etc. Moreover, the number of participants at a training course is limited. Given the limitations in terms of eligibility and limited participant numbers of training courses, particularly the higher licenses can become bottle necks for coaching jobs at sport associations. Typically, specific licenses are required for specific coaching jobs.

Nevertheless, there are exceptions to these rules, which are at the discretion of each sport association. For example, former elite athletes do not necessarily have to obtain all licenses from the bottom up (i.e., first obtaining a C-License, then a B-License, and then an A-License). Individual arrangements are made that allow reducing the period needed to obtain the necessary qualifications, resulting in a "fast track coach qualification for former athletes" (De Bosscher, Shibli, Westerbeek, & van Bottenburg, 2015, p. 295). Consequently, research shows that higher-level coaches are more likely to have international experience as an athlete rather than having completed a higher-level coaching qualification (De Bosscher et al., 2015).

The category *Fed_license* includes all other licenses that are provided by national sport associations (e.g., skiing coach, tennis coach). *Int_License* summarizes all coaching licenses issued by international sport associations. At the Coaching Academy of the DOSB, a specific coaching diploma can be obtained (*DOSB_Diploma*). It represents a job-integrated degree that, however, is not yet considered equivalent to a university degree. All other coaching-related licenses issued by the DOSB are summarized under *DOSB_License* (e.g., instructor, physical fitness, trainer certificate).

SportSci_Degree measures whether the coach has a university degree in sport sciences. It includes different types of degrees in sport sciences such as undergraduate, postgraduate, PhD, and the previous diploma degree (i.e., a recognized four-year degree before bachelor and master programs were established in Germany). A more detailed examination of these qualifications would be interesting because they differ in terms of the time spent at a university. However, such a distinction is not possible because in the open question many respondents did not specify what type of degree they have; they simply wrote "university degree in sport sciences."

Other_Degree summarizes stated university degrees in other subjects (e.g., medicine, psychology, pedagogy, biochemistry, molecular biology). While the various coaching licenses are qualifications that are only valid in the sport field, university degrees (including those in sport sciences) are also recognized in other fields.

The variable *Certificate* captures the various types of coaching-related certificates, formations, and vocational trainings that are provided by other organizations (e.g., certified performance specialist, mental coach, barbell coach, life kinetics, neuro-linguistic programming coach, systemic coach, wing wave coach, back therapy training, functional training).

The various non-coaching related formal qualifications are included in the category *Other_Qual* (e.g., club manager, sport marketing manager, fully qualified groom, referee, nutrition consultant, sport organization manager, educator). In this context, "non-coaching related" means that the reported qualifications are not directly related to sport practice and talent development, but may nevertheless be relevant to the job of a coach as explained earlier (Inoue et al., 2012; Laios, 1995; Martens, 1990). All qualification variables are dummy variables since one coach typically possesses more than one qualification.

In previous research on college football and basketball (Fogarty et al., 2015; Humphreys, 2000; Kahn, 2006; Soebbing, Tutka, & Seifried, 2015), performance was typically measured by career winning percentage. Since the present study includes various types of sports and not only team sports (e.g., alpine skiing, judo, track and field, biathlon, rowing, cycling, handball, basketball, swimming), performance is measured by whether the coach's athletes or teams belong to the *Top5*, *Top10*, or *Top15* in the world. These categories are mutually exclusive: *Top15* means that the athletes are among the top 15, but not among the top 10 or top 5 in the world; *Top10* means that the coach's athletes are among the top 10, but not among the top 5 in the world.

This study also includes age (*Age*) and the number of years working as a coach (*Exp*) as well as their squared terms (*Age_sq, Exp_sq*) to control for non-linear relationships. Having previously migrated to another country (*Migration*) may also be a form of experience and, thus, adds to a coach's stock of human capital. Moreover, this study includes the number of years in the current position, reflecting organization-specific

Table 1. Overview of Variables

Name	Description
Income	Individual monthly net income (in €)
Ln (Income)	Natural log of income
A-License	Coaching A-License (1=yes)
B-License	Coaching B-License (1=yes)
C-License	Coaching C-License (1=yes)
Fed_License	Coaching license issued by a national sport association (1=yes)
Int_License	Coaching license issued by an international sport association (1=yes)
DOSB_Diploma	Coaching diploma issued by the DOSB (1=yes)
DOSB_License	Other coaching license issued by the DOSB (1=yes)
Certificate	Coaching-related certificate/formation (1=yes)
SportSci_Degree	University degree in sports sciences (1=yes)
Other_Degree	University degree in another subject (1=yes)
Other_Qual	Non-training related formal qualification (1=yes)
Age	Age
Age_sq	Age squared
Exp	Number of years employed as a coach
Exp_sq	Experience squared
Migration	Coach has previously worked in another country (1=yes)
German	Nationality (1=German; 0=other nationality)
Male	Gender (1=male)
Years_pos	Number of years in current position
Top5	Coach's athletes are among the top 5 in the world (1=yes)
Top10	Coach's athletes are among the top 10 in the world, but not among the top 5 (1=yes)
Top15	Coach's athletes are among the top 15 in the world, but not among the top 10 or top 5 (1=yes)
Work_hours	Number of working hours per week
Married	Marital status (1=married; 0=other marital status)
Children	Coach has at least one child (1=yes)

human capital (*Years_pos*), nationality (*German*), and gender (*Male*). Weekly working time (*Work_hours*) can also affect income; some coaches in the sample do not work full-time. To better reflect the coaching reality, the actual weekly working time was assessed rather than the working hours specified in the contract. We also control for marital status (*Married*) and the presence of children (*Children*) because we examine net income, and people who are married and/or have children pay fewer taxes.

Descriptive Statistics

The summary statistics (see Table 2) show 79.0% of the surveyed coaches are males, reflecting the common gender distribution among elite sport coaches (Greenhill, Auld, Cuskelly, & Hooper, 2009). On average, coaches were 43.0 years old and have worked as a coach for 17.3 years, including 8.0 years with their current organization. Most of the surveyed coaches are German (95.7%) and 12.9% have already worked as a coach

Table 2. Summary Statistics (*n*=186)

Variable	Mean	SD	Min	Max
Income	2,786	2,557	120	22,299
Ln (Income)	7.733	0.624	4.787	10.01
A-License	0.763	0.426	0	1
B-License	0.247	0.433	0	1
C-License	0.134	0.342	0	1
Fed_License	0.043	0.203	0	1
Int_License	0.065	0.246	0	1
DOSB_Diploma	0.306	0.462	0	1
DOSB_License	0.048	0.215	0	1
Certificate	0.075	0.265	0	1
SportSci_Degree	0.419	0.495	0	1
Other_Degree	0.038	0.191	0	1
Other_Qual	0.065	0.246	0	1
Age	43.01	10.63	18	65
Age_sq	1,962	943.0	324	4,225
Exp	17.27	10.06	2	43
Exp_sq	398.9	420.6	4	1,849
Migration	0.129	0.336	0	1
German	0.957	0.203	0	1
Male	0.790	0.408	0	1
Years_pos	8.040	7.578	0.5	42
Top5	0.570	0.496	0	1
Top10	0.237	0.426	0	1
Top15	0.193	0.396	0	1
Work_hours	48.88	14.48	4	80
Married	0.833	0.374	0	1
Children	0.565	0.497	0	1

in another country. Altogether, 83.3% of the coaches are married and 56.5% have at least one child. The high weekly workloads of 48.9 hours on average are similar to previous research (Digel et al., 2010). On average, coaches have a monthly net income of €2,786. The relatively high standard deviation (*SD*=2,557) and the median of €2,200 indicate that the mean value is biased by some outliers who earn substantially higher incomes (see Figure 1).

With respect to formal qualifications, the results show that 76.3% of the respondents hold an A-License, 24.7% a B-License, and 13.4% a C-License. Typically, coaches only report their highest license. For example, when a coach has an A-License, he would not say that he also holds a B- and a C-License. And, as described earlier, holding a higher license does not necessarily mean that the training courses for all lower-level licenses have been completed. Moreover, it is likely that some elite sport coaches possess licenses from several sports. For example, a triathlon coach can also hold a coaching license in swimming or cycling. This possibility also explains why the proportions of coaches reporting these three licenses exceed 100%.

Fewer coaches have another license provided by a national (4.3%) or international sport association (6.5%). Approximately one third of the coaches possess a coaching diploma (30.6%) issued by the Coaching Academy of the DOSB; fewer coaches hold another coaching-related license (4.8%) issued by the DOSB or have completed other types of certificates, formations, and vocational trainings (7.5%). Altogether, 41.9% of the respondents have a university degree in sport sciences, while 3.8% hold a university degree in another subject. Formal qualifications not directly related to training practice are held by 6.5% of the coaches.

Empirical Analysis

Regression analysis is used to examine the effect of formal qualifications on coaching income while controlling for other potential influencing factors. Regression diagnostics were performed before the analysis. First, the model was checked for the presence of heteroscedasticity by plotting a residual-versus-fitted plot as well as by applying a Breusch-Pagan test. Neither the plot nor the Breusch-Pagan test (χ^2=2.05; p=0.153) showed evidence of heteroscedasticity. Second, the regression model was checked for multicollinearity using variance inflation factors (VIFs) and correlation analyses. The highest VIF was 2.34 and all correlation coefficients were below 0.6 (with the exception of *Age, Age_sq, Exp,* and *Exp_sq*, which naturally show high correlations). Following Hair, Black, Babin, and Anderson (2010), multicollinearity should not be an issue when correlation coefficients are below 0.7 and VIFs below 10.

Altogether, three log-linear models were estimated using ordinary least squares (OLS) with *Ln (Income)* as the dependent variable. In Model 1, the remaining variables from Table 1 were entered as independent variables. Models 2 and 3 take into account that income levels may differ among sports and associations, respectively. The sample includes coaches from 45 different sports that belong to 36 different national sport associations (e.g., alpine skiing, cross-country skiing, ski jumping, and biathlon belong to the German Skiing Association). To consider sport-specific differences, sport association dummies were included in Model 2. Since the ratio between the number of observations and the number of independent variables must be taken into account in regression analysis (Hair et al., 2006), standard errors were clustered by sport association in Model 3.

Results and Discussion

Table 3 displays the results of the regression analyses. Models 1 and 3 explain 46% of the variation in the dependent variable, while Model 2 explains 56%, supporting the fact that some variation in income can be attributed to the type of sports and sport association, respectively. Overall, the results can be considered relatively robust in the sense that the signs on the coefficients and significant effects are similar across models. The number of weekly working hours has a positive effect on income. The effect of nationality (*German*) is insignificant—similar to insignificant effects of race and visible minority in previous research (Fogerty et al., 2015; Kahn, 2006). Contrary to previous research reporting an earnings gap between males and females in intercollegiate athletics (Humphreys, 2000; Knoppers et al., 1989), the gender effect is insignificant in this study. Age has a positive effect and age squared a negative effect. Thus, the typical

Table 3. Summary of Regression Results for Ln (Income)

Variables	Model 1 Coef.	Model 1 Std. Err.	Model 2 Coef.	Model 2 Std. Err.	Model 3 Coef.	Model 3 Std. Err.
A-License	0.088	0.103	0.105	0.112	0.088	0.103
B-License	-0.206*	0.122	-0.084	0.139	-0.206*	0.119
C-License	0.114	0.155	0.019	0.172	0.114	0.196
Fed_License	0.268	0.189	0.181	0.223	0.268	0.158
Int_License	0.067	0.177	0.331	0.242	0.067	0.142
DOSB_Diploma	-0.047	0.088	0.035	0.100	-0.047	0.073
DOSB_License	-0.025	0.186	-0.115	0.219	-0.025	0.179
Certificate	-0.057	0.150	-0.070	0.161	-0.057	0.101
SportSci_Degree	0.171**	0.082	0.256***	0.096	0.171*	0.100
Other_Degree	-0.042	0.211	-0.246	0.256	-0.042	0.153
Other_Qual	0.124	0.166	0.217	0.177	0.124	0.126
Age	0.162***	0.038	0.158***	0.041	0.162**	0.062
Age_sq	-0.002***	0.000	-0.002***	0.000	-0.002**	0.001
Exp	-0.074***	0.020	-0.078***	0.022	-0.074**	0.029
Exp_sq	0.002***	0.000	0.002***	0.001	0.002**	0.001
Migration	-0.040	0.131	0.023	0.145	-0.040	0.118
German	-0.026	0.209	0.170	0.250	-0.026	0.147
Male	0.086	0.105	0.149	0.120	0.086	0.132
Years_pos	0.009	0.007	0.013	0.008	0.009	0.008
Top5	0.145	0.108	0.142	0.122	0.145	0.101
Top10	0.019	0.119	0.058	0.123	0.019	0.093
Top15	REF		REF		REF	
Work_hours	0.015***	0.003	0.013***	0.003	0.015***	0.004
Married	0.156	0.110	0.051	0.126	0.156	0.108
Children	0.005	0.088	0.073	0.096	0.005	0.109
Constant	3.542***	0.762	4.027***	0.866	3.542***	1.206
Sport association dummies included	No		Yes		No	
Std. Err. clustered by sport association	No		No		Yes	
n	186		186		186	
R^2	0.463		0.558		0.463	
R^2_{adj}	0.384		0.390		0.384	
F	5.795***		3.316***		141.1***	

Note: ***$p<0.01$; **$p<0.05$; *$p<0.1$; reference category for sport association is German Canoe Association.

relationship that earnings increase with age at a decreasing rate (Becker, 1962) was also found for elite sport coaches in less commercialized sports.

With respect to formal qualifications, the results reveal that only a university degree in sport sciences has a statistically significant and positive effect on income. The effects of all other formal qualifications such as the coaching diploma and licenses issued by the DOSB; other certificates, formations, and vocational trainings; other university degrees; and all coaching licenses issued by international and national sport associations are insignificant (with the exception of a B-License, which has a significant negative effect in two out of three models).

The negative effect of the B-License may be explained by the bottle neck phenomenon noted earlier. The B-License is the second highest formal coaching license issued by the national sport associations. However, this license may not be sufficient because for some higher-level coaching jobs such as national coaches (which are also associated with higher salaries) an A-License may be required. It is likely that coaches pursue obtaining the higher license, but may be hindered by the limitations in terms of eligibility and participant numbers at training courses.

Several explanations can be advanced for the positive effect of the sport sciences degree and the insignificant effects of most other formal qualifications. First, a university degree is a general qualification that is also valid and recognized in other fields, while coaching licenses, diplomas, and certificates are only valid in the sport field. Possessing a degree in sport sciences may provide coaches with a competitive advantage. Second, coaches who are busy collecting certificates may have less time for their athletes since investments in human capital also require time and energy in addition to monetary resources.

Third, it is likely that the various certificates, licenses, and diplomas are not expected to improve the coaching performance and are, therefore, not reflected in coaching income. Previous research outside of the sporting industry has also documented weak returns to certificates and diplomas (Liu, Belfield, & Trimble, 2015). Thus, the value of these qualifications may be relatively low. Fourth, other university degrees as well as other certificates, formations, and vocational training might indicate that the person is a career changer and has less experience as a coach, which is reflected in the insignificance of these qualifications.

The negative experience effect and the positive effect of the squared term indicate that a coach needs a certain level of experience before experience pays off and gains in income can be expected. This effect may be explained by investments in human capital and associated costs and foregone earnings, respectively. At the beginning of their career coaches may accept lower-level coaching jobs with lower pay to gain experience and invest in their human capital. This may especially apply to career changers who must gain coaching experience at the beginning of their coaching career and may accept a lower income. For example, experience could be gained in assistant coaching jobs through on-the-job training and learning from more experienced head coaches. In line with human capital theory, an investment period with lower earnings is followed by a period with higher earnings.

The experience effect could also be explained by the need of a track record that can reduce uncertainty for potential employers. Elite sport coaches have to prove their coaching abilities through successful athletes. At the beginning of their career, coaches typically train younger or grassroots athletes rather than top international athletes. Such an investment in a track record is necessary to reduce uncertainty for potential employers. While formal qualifications reflect stated coaching knowledge, a track record may be a better signal because it reflects revealed coaching quality. Moreover, the better the track record and reputation of the coach, the higher may be his bargaining power over employers.

Conclusion

This study examined the effect of various formal qualifications on the income of elite sport coaches in less commercialized sports. The results provide evidence that only a university degree in sport sciences has a positive effect on monthly net income, while other formal qualifications including various coaching licenses, diplomas, and certificates issued by national and international sport associations and other organizations have no significant effect. The findings indicate that schooling (i.e., degree in sport sciences) and learning on the job (i.e., experience) are more relevant than further activities that increase the knowledge base (i.e., certificates, diplomas, formations, vocational trainings). The contribution of this study lies in a detailed analysis of formal qualifications and their relationship with coaching income, which has not yet been examined in previous research.

This research has implications for (prospective) coaches. In light of these findings, coaches should invest in a university degree in sport sciences if they want to earn a higher income. The variety of formal qualifications reported in this study indicates that elite sport coaches have invested in different types of licenses, formations, vocational trainings, and certificates that are available; however, they do not pay off and, therefore, it cannot be recommended to obtain these various qualifications if they are not required by the coaching position.

The findings also have policy implications in the sense that sport officials and policy makers should reconsider why various formal qualifications provided, promoted, and requested by sport associations are not reflected in coaching salaries. Given the diversity of skills needed for high performance coaching and the critical role of elite sport coaches for the achievement of international sporting success and related policy goals, the compensation of coaches should reflect their investment in human capital to a greater extent, particularly when some qualifications are necessary for specific positions.

This study has some limitations that can guide future research. First, it is only based on cross-sectional data. Future research should try collecting panel data that allow tracking the development of coaching salaries and their determinants. Second, the present research design should be extended taking the inherent limitations into account. In future research, data allowing a more detailed examination of sport-specific differences that goes beyond the inclusion of sports dummies in regression models should be collected. It would be interesting to see if the determinants of coaching income differ between sports. Moreover, a more detailed analysis of the role of different degrees in sport sciences (i.e., undergraduate, postgraduate, PhD, etc.), which was not possible in this study, should be conducted in future studies. Furthermore, the relationship between social capital and coaching income should be examined for elite sport coaches in less commercialized sports. Third, the present research design should be applied to other labor markets within the sport sector such as personal coaches who can also have various formal qualifications, but also other coaching purposes such as health or weight management.

References

Barros, P. C., & Barros, C. (2005). The role of human and social capital in the earnings of sports administrators: a case study of Madeira Island. *European Sport Management Quarterly, 5*, 47–62.

Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of Political Economy, 70*, 9–49.

Brewer, R. M., McEvoy, C. D., & Popp, N. (2015). Predicting intrinsic value of NCAA Division I men's basketball coaching salaries. *Journal of Issues in Intercollegiate Athletics, 8*, 74–91.

Burke, K. L., & Johnson, J. J. (1992). The sport psychologist-coach dual role position: A rebuttal to Ellickson and Brown (1990). *Journal of Applied Sport Psychology, 4*, 51–55.

Byrd, W. J., Mixon, P. A., & Wright, A. (2013). Compensation of college football's head coaches: A case study in firm size's effects on pay. *International Journal of Sport Finance, 8*, 224–235.

De Bosscher, V., De Knop, P., Van Bottenburg, M., & Shibli, S. (2006). A conceptual framework for analysing sports policy factors leading to international sporting success. *European Sport Management Quarterly, 6*, 185–215.

De Bosscher, V., Shibli, S., Westerbeek, H., & van Bottenburg, M. (2015). *Successful elite sport policies*. Maidenhead, UK: Meyer & Meyer Sport.

Digel, H., Thiel, A., Schreiner, R., & Waigel, S. (2010). *Berufsfeld Trainer im Spitzensport [The profession of a coach in elite sports]*. Schorndorf, Germany: Hofmann.

Federal Ministry of the Interior. (2015). *Richtlinien des Bundesministeriums des Innern über die Gewährung von Zuwendungen zur Förderung von Bundessportfachverbänden [Guidelines of the Federal Ministry of the Interior for granting benefits for the support of national sport associations].* Retrieved from http://www.bmi.bund.de/SharedDocs/Downloads/DE/Themen/Gesellschaft-Verfassung/Sport/foerderrichtline_novellierung.html

Federal Office of Administration. (2014). *Allgemeine Nebenbestimmungen für Zuwendungen zur Projektförderung [General rider for granting benefits for project support]*. Retrieved from http://www.bva.bund.de/SharedDocs/Downloads/DE/BVA/Zuwendungen/ANBest-P.html

Federal Office of Administration. (2015). *Übersicht bundesfinanzierter Stellen für Trainerinnen und Trainer bei den Bundessportfachverbänden mit olympischen Sommersportarten, Wintersportarten und nichtolympischen Sportarten [Overview of federally funded female and male coaching positions in national sport associations]*. File provided upon request by the Federal Office of Administration.

Fogarty, K., Soebbing, B. P., & Agyemang, K. J. A. (2015). NCAA Division I-FBS salary determinants: A look at new and amended contracts. *Journal of Issues in Intercollegiate Athletics, 8*, 123–138.

German Federal Government. (2014). *13. Sportbericht der Bundesregierung [13th sport report of the federal government]*. Retrieved from http://www.bmi.bund.de/SharedDocs/Downloads/DE/Broschueren/2014/13_sportbericht.pdf?__blob=publicationFile

German Parliament. (2014). *Förderung des Leistungssportpersonals – Situation der Trainerinnen und Trainer [Support of the elite sport personnel – situation of female and male coaches]*. Retrieved from http://dip21.bundestag.de/dip21/btd/18/033/1803394.pdf

Grant, R. R., Leadley, J. C., & Zygmont, Z. X. (2013). Just win baby? Determinants of NCAA Football Bowl Subdivision coaching compensation. *International Journal of Sport Finance, 8*, 61–74.

Green, M. (2004). Changing policy priorities for sport in England: The emergence of elite sport development as a key policy concern. *Leisure Studies, 23*, 365–385.

Green, M. (2007). Olympic glory or grassroots development? Sport policy priorities in Australia, Canada and the United Kingdom, 1960–2006. *The International Journal of the History of Sport, 24*, 921–953.

Greenhill, J., Auld, C., Cuskelly, G., & Hooper, S. (2009). The impact of organisational factors on career pathways for female coaches. *Sport Management Review, 12*, 229–240.

Gienger, E. (2008). Zur Zukunftsfähigkeit der Spitzensportförderung in Deutschland [The sustainability of elite sport funding in Germany]. *Leistungssport,* 7(3), 5–12.

Grix, J., & Carmichael, F. (2012). Why do governments invest in elite sport? A polemic. *International Journal of Sport Policy and Politics, 4*, 73–90.

Gucciardi, D. F., Gordon, S., Dimmock, J. A., & Mallet, C. J. (2009). Understanding the coach's role in the development of mental toughness: Perspectives of elite Australian football coaches. *Journal of Sports Sciences, 27*, 1483–1496.

Hair, J., Black, W., Babin, B., & Anderson, R. E. (2010). *Multivariate data analysis.* (7^{th} ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Hong, E. (2011). Elite sport and nation-building in South Korea: South Korea as the dark horse in global elite sport. *The International Journal of the History of Sport, 28*, 977–989.

Humphreys, B. R. (2000). Equal pay on the hardwood: The earnings gap between male and female NCAA Division I basketball coaches. *Journal of Sports Economics, 1*, 299-307.

Humphreys, B. R., Soebbing, B. P., & Watanabe, N. M. (2011). Determinants of FBS head coaches' salaries: An economic perspective. In M. Leach & F. Guven (Eds.), *Sports for dorks college football* (pp. 145–167). Houston, TX: Sports for Dorks CFB LLC.

Inoue, Y., Plehn-Dujowich, J. M., Kent, A., & Swanson, S. (2012). Roles of performance and human capital in college football coaches' compensation. *Journal of Sport Management, 26,* 73–83.

James, E. H. (2000). Race-related differences in promotions and support: Underlying effects of human and social capital. *Organization Science, 11*, 493–508.

Jones, R. (2007). Coaching redefined: An everyday pedagogical endeavour. *Sport, Education and Society, 12*, 159–173.

Kahn, L. M. (2006). Race, performance, pay, and retention among National Basketball Association head coaches. *Journal of Sports Economics, 7*, 119–149.

Knoppers, A., Bedker Meyer, B., Ewing, M., & Forrest, L. (1989). Gender and the salaries of coaches. *Sociology of Sport Journal, 6*, 348–361.

Laios, A. (1995). Administrative responsibilities of the coach. *International Journal of Educational Management, 9*, 10–12.

Lin, N. (2001). *Social capital. A theory of social structure and action.* Cambridge, UK: Cambridge University Press.

Liston, K., Gregg, R., & Lowther, J. (2013). Elite sports policy and coaching at the coalface. *International Journal of Sport Policy and Politics, 5*, 341–362.

Liu, V. Y. T., Belfield, C. R., & Trimble, M. J. (2015). The medium-term labor market returns to community college awards: Evidence from North Carolina. *Economics of Education Review, 44*, 42–55.

Martens, R. (1990). *Successful coaching.* Champaign, IL: Leisure Press.

Mincer, J. (1974). *Schooling, experience, and earnings.* New York, NY: Columbia University Press.

Pigott, D. (2012). Coaches' experiences of formal coach education: A critical sociological investigation. *Sport, Education and Society, 17*, 535–554.

Pigott, D. (2015). The Open Society and coach education: A philosophical agenda for policy reform and future sociological research. *Physical Education and Sport Pedagogy, 20*, 283–298.

Sagas, M., & Cunningham, G. B. (2005). Racial differences in the career success of assistant football coaches: The role of discrimination, human capital, and social capital. *Journal of Applied Social Psychology, 35*, 773–797.

Schulz, T. W. (1960). Capital formation by education. *Scottish Journal of Political Economy, 68*, 571–583.

Soebbing, B. P., Tutka, P., & Seifried, C. S. (2015). The effect of sanctions on external job promotions of NCAA Division I-FBS college football head coaches. *International Journal of Sport Finance, 10*, 375–388.

Soebbing, B. P., & Washington, M. (2011). Leadership succession and organizational performance: Football coaches and organizational issues. *Journal of Sport Management, 25*, 550–561.

Soebbing, B. P., Wicker, P., & Watanabe, N. M. (2016). The effect of performance expectations on total compensation of Division I-FBS head coaches. *Journal of Sport Management, 30*, 70–81.

Süddeutsche Zeitung. (2013). *Deutsche Trainer fordern mehr Gehalt und Anerkennung [German coaches want higher salaries and more recognition].* Retrieved from http://www.sueddeutsche.de/sport/sportfoerderung-deutsche-trainer-fordern-mehr-gehalt-und-anerkennung-1.1819684

Taylor, M. (2010). Football's engineers? British football coaches, migration and intercultural transfer, c. 1910–c. 1950s. *Sport in History, 30*, 138–163.

Authors' Note

This research was funded by the German Federal Ministry of the Interior following a decision by the German Bundestag (grant number: IIA-071805/14-16).

The 2011 NFL Collective Bargaining Agreement and Drafted Player Compensation

Quinn A. W. Keefer[1]

[1] California State University San Marcos

Quinn A. W. Keefer, PhD, is an assistant professor in the Department of Economics. His research focuses on the behavioral economics and labor economics of professional sports, primarily the National Football League.

Abstract

We examine the effect of the 2011 collective bargaining agreement (CBA) between the National Football League owners and the Players Association on drafted player compensation. The 2011 CBA made two major changes to the rules governing drafted player compensation. First, a rookie wage scale, based on selection number and round, was introduced. Second, there was a limit placed on compensation growth of 25% of year-one salary. We find the rookie wage scale actually increased the compensation of players selected in the first two rounds of the draft. However, the limit on compensation growth decreased compensation in later years. The overall effect is a significant decrease in the compensation of first-round selections, considering both year-one and year-two salaries.

Keywords: collective bargaining agreement, NFL draft, rookie contracts, compensation

Introduction

In 1993, the National Football League (NFL) owners and the NFL Players Association (NFLPA) signed a collective bargaining agreement (CBA) that granted NFL players the right to free agency. Players with three years of experience were granted restricted free agency and players with four or more years of experience were granted unrestricted free agency.[1] However, the right to free agency was accepted by the owners in exchange for a cap on players' salaries; the salary cap was calculated as a percentage of league revenues. The NFL salary cap is a hard cap, unlike the National Basketball Association (NBA); teams may not exceed the cap.[2] The 1993 CBA was extended several times, lasting through 2010. In 2008, the owners opted out of the agreement, which made 2010 the final season under these guidelines; however, 2010 was played without a salary cap. One of the major reasons for the owner opt-out, and subsequent lockout, was a desire to reduce drafted rookie compensation.

The NFL and NFLPA signed a new CBA on August 4, 2011 (National Football League, 2011). The new CBA maintained free agency and the salary cap. However, there was a major change to rookie players' compensation. Under the 1993 CBA, rookie players were free to negotiate their compensation with teams, subject to a rookie salary cap. In response to growing rookie compensation, the new CBA made several changes to the rules regarding drafted rookie compensation. First, all rookie contracts are now for a specific length of time, four years with a team option for a fifth for first-round selections, four years for selections in rounds two through seven, and three years for undrafted players. Second, drafted rookie contracts may not be renegotiated until after a player's third season. Third, all compensation counts toward rookie salary cap value. Rookie contracts may include incentive bonuses, but all incentive bonuses count toward rookie cap value. The 1993 CBA only counted bonuses that were deemed easily attainable. The 2011 CBA deems all incentives easily attainable for rookies. Finally, and most importantly, drafted rookies' compensation is now governed by a wage scale, similar to the NBA. For each drafted rookie there is a year-one minimum allotment, which is a player's minimum percentage of the total rookie compensation pool. The minimum allotment is based on round and selection number in the draft; however, the exact calculation is kept secret to the NFL and NFLPA. Therefore, each drafted rookie's compensation is predetermined based on his selection number in the draft. Furthermore, the new CBA limits the growth in rookie compensation to 25% of year-one salary.

Using data on players drafted under the 1993 CBA and the new CBA, we examine the effects of the new CBA on drafted player compensation. Drafted player compensation is important in the NFL for several reasons. First, due to the short career lengths of players in the NFL, rookie contracts make up a significant portion of total earnings. Second, there has been important research on the productivity of drafted players and how it relates to compensation (Hendricks et al., 2003; Keefer, 2015; Massey & Thaler, 2013). For example, Massey and Thaler (2013) found that early first-round selections are far overvalued, in part because they are extremely expensive. Thus, changes in compensation for drafted players, especially for early selections, are important, as they affect the value provided by these selections.

Method

Since the new CBA was an attempt to control the compensation of highly drafted players, we focus on players selected in the first two rounds of the NFL draft. Furthermore, the majority of variation in compensation for drafted players occurs in the first two rounds; the salary distribution is relatively flat in later rounds.[3] Due to the changes introduced in 2011, there is potential heterogeneity in the effect of the new CBA. Introducing a wage scale and limiting compensation growth may affect players differently depending on their selection number in the draft. As a result, we allow for the effect of the 2011 CBA to vary depending on selection number and round. More specifically, there may a differential impact depending on selection number and the impact for different selections may vary between rounds. The possible heterogeneity leads us to the following regression equation for players selected in the first two rounds:

$$\ln w_i = \sigma_0 + \sigma_1 CBA_i + \sigma_2 R_i + \sigma_3 CBA_i \times R_i + \sum_{j=1}^{2}\left[\beta_j s_i^j + \alpha_j\left(CBA_i \times s_i^j\right) + \pi_j\left(R_i \times s_i^j\right) + \theta_j\left(CBA_i \times R_i \times s_i^j\right)\right] + X_i\lambda + \epsilon_i$$

where w is player i's real salary, CBA is a binary variable for the new CBA, R is a binary variable for second-round selections, s is selection number, X is a vector of control variables, and ϵ is the stochastic error term. The vector of control variables includes a cubic time trend and binary variables for within-team selection number, position, and drafting team.[4,5]

Given our estimation equation, the effect of the new CBA is

$$E(\ln w \mid CBA = 1, s, R) - E(\ln w \mid CBA = 0, s, R) = \widehat{\sigma_1} + \widehat{\sigma_3}R + \sum_{j=1}^{2}\left[\widehat{\alpha}_j s^j + \widehat{\theta}_j\left(R \times s^j\right)\right]$$

We estimate the effect for each selection number, which allows us to make conclusions about the impact of the new CBA throughout the distribution of selections.

Since there are two main changes to rookie contracts under the new CBA—the rookie wage scale and the limit on compensation growth—we use two measures of rookie compensation. First, to test the effect of the rookie wage scale we use year-one real salary as our dependent variable; any change due to the new wage scale will be evident in year-one pay. Second, to test the effect of the limit on compensation growth, we use year-two real salary. Ideally, we would estimate the effect of the new CBA on drafted player compensation until they reach free agency. However, in the NFL, unrestricted free agency is not granted until a player has played four seasons. Since the new CBA took effect in 2011, only one cohort of drafted players has reached unrestricted free agency.

Data and Descriptive Statistics

The data contain all players selected in the first two rounds of the NFL Draft from 2002 to 2015. We used 2002 as our starting point because it was the first year the NFL had its current 32 teams; the Houston Texans began play in the 2002 season. Therefore, our data contains nine years of observations under the previous CBA and five years under the current CBA. We use salary cap value as the measure of compensation, which is widely regarded as the appropriate measure of player compensation in a given year (Berri & Simmons, 2009). Salary cap value data come from two sources. Compensation data from 2002 to 2009 come from *USA Today's* database of professional athletes' salaries. Data from 2010 to 2015 come from Spotrac.com. We use multiple sources since *USA Today*'s data end in 2009. We convert salary cap value into real salary, in 2002 dollars, using the growth in the overall NFL salary cap. Since 2010 did not have a salary cap, we use the average of the 2009 and 2011 salary caps. Other variables were collected from Pro Football Reference, including selection number, round, within-team selection number, position, and team.

We begin with a simple descriptive analysis of the data. Table 1 presents descriptive statistics for year-one and year-two real salary. Prior to the new CBA, the average year-one real salary for players selected in the first two rounds was $831,370 and was $1,186,526 for first-round selections. It seems odd that owners would be contentious to paying these average salaries for their high draft picks. Figure 1 shows the year-one real salary for players chosen in the first two rounds from 2002 to 2015. It seems that the new CBA has not had a very large impact on rookie compensation. The new CBA has reduced the variance in compensation, but the average compensations seem to be

Table 1. Descriptive Statistics

	Real Salary	
	Year 1	Year 2
Full Sample	$821,204	$1,117632
	(556,641)	(963,040)
Round 1 & Previous CBA	$1,186,526	$1,820,899
	(649,268)	(1,214,301)
Round 2 & Previous CBA	$476,045	$548,081
	(114,541)	(193,156)
Round 1 & New CBA	$1,153,728	$1,344,583
	(487,033)	(579,513)
Round 2 & New CBA	$443,104	$535,442
	(74,733)	(102,189)

Note: Mean values reported. Standard deviations in parentheses.

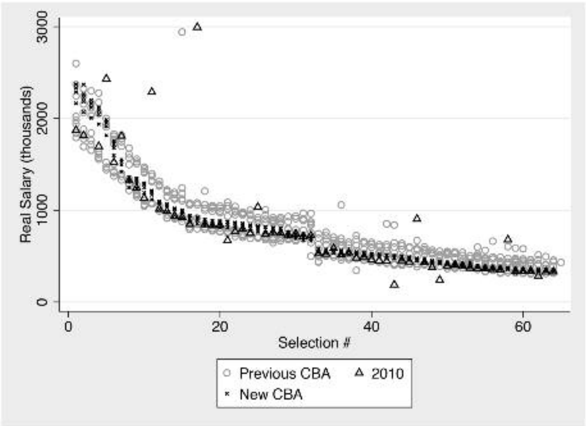

Figure 1. Year-one real salary 2002–2015.

Note: Figure 1 does not show one outlier, 2010 third overall selection Gerald McCoy.

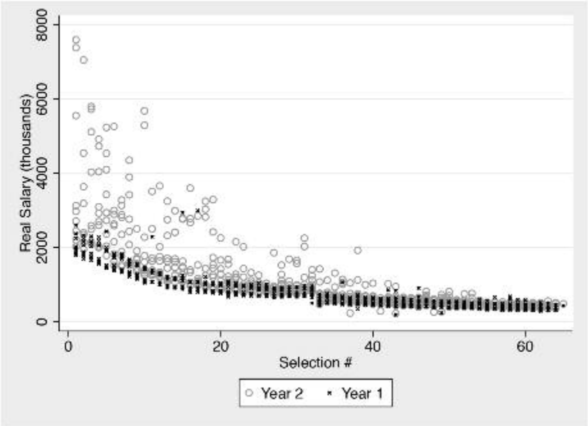

Figure 2. Year-one and year-two real salary 2002–2010.

Note: Figure 2 does not show one outlier, 2010 third overall selection Gerald McCoy.

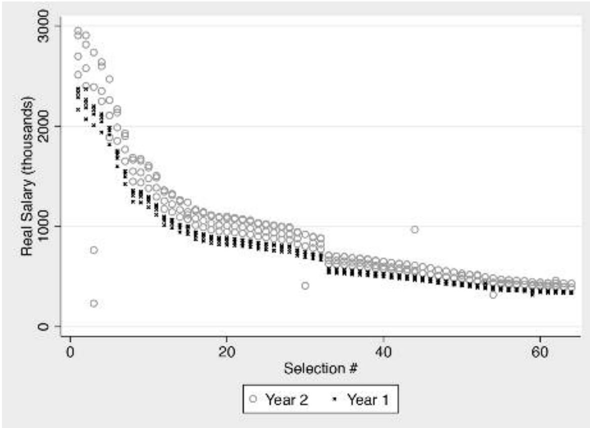

Figure 3. Year-one and year-two real salary 2011–2015.

very close. Figure 1 does not point to the new CBA having the intended effect on rookie compensation.

However, analyzing year-one salary may not tell the entire story. A player's salary cap value prorates his signing bonus, but also includes any easily attainable incentive bonuses. The key is that incentive bonuses are not prorated; therefore, an easily attainable, perhaps guaranteed, incentive bonus in a player's second year is not reflected in his year-one compensation. Prior to the new CBA, since there was no limit on compensation growth, many teams would delay the rookie wages of highly drafted players by including very large and easily attainable incentive bonuses in later years. For example, Matthew Stafford, the first overall selection in 2009, had a rookie cap value of \$3,100,000. However, he received a second-year roster bonus of \$9,105,000, inflating his second year salary cap value to \$12,980,000. Therefore, it is clear that we must analyze compensation beyond the rookie season to assess the effect of the new CBA on rookie wages.

Figure 2 shows the year-one and year-two salary cap values for players selected under the previous CBA. It is clear that players selected early in the first round experienced an explosion in compensation during their second year. Thus, the effect of the new CBA on rookie wages may take effect in a player's second year, or beyond. Figure 3 displays the year-one and year-two salary cap values for players selected under the new CBA. It is clear the new CBA has eliminated the explosive salary growth from year one to year two for early selections. To show by how much the new CBA has reduced second-year compensation, Figure 4 displays the year-two real salary of players selected under the different rules. The new CBA seems to have had a substantial effect on year-two compensation by eliminating the bonuses that are not reflected in year-one compensation.

Results

Our econometric results are reported in Table 2. Column 1 displays year-one compensation results. Since we allow for the effect of the new CBA to vary by selection number and round, our results are best shown graphically. Figure 5 displays the effect of the new CBA by selection number with the 95% confidence interval. It is clear that the

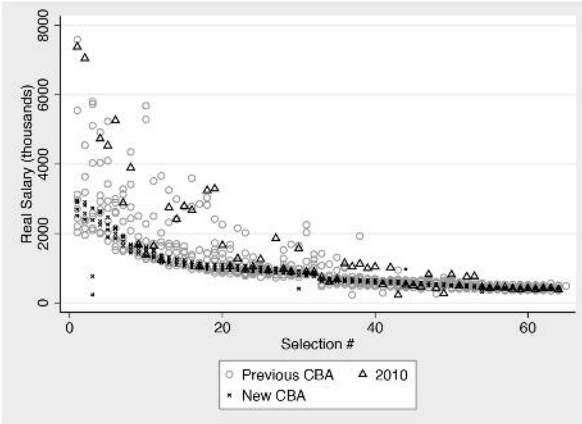

Figure 4. Year-two real salary 2002–2015.

new CBA actually increases rookie compensation for a significant portion of the first two rounds. For the majority of selections, the new CBA increases year-one compensation by approximately 9%. The rookie wage scale actually increases rookie compensation by a significant amount.

It may seem, at this point, that the new CBA was unsuccessful in limiting rookie compensation. However, from our descriptive analysis we suspect there is a large negative effect in subsequent seasons. Column 2 reports our estimation using year-two compensation as the dependent variable. Figure 6 shows the effect of the new CBA by selection number. It is clear that first-round selections experience a large and significant reduction in their second-year compensation as a result of the new CBA. Furthermore, the decrease in year-two compensation is much greater than the increase in year-one salary cap value. Figure 7 displays the effects of the new CBA on year-one and year-two compensation for comparison.

To determine the overall effect of the new CBA on compensation earned in the first two years, we use the total salary from a player's first two seasons as our dependent variable. Column 3 reports these results. Figure 8 displays our results for total compensation in the first two seasons. The overall effect of the new CBA is a significant reduction in compensation for first-round selections. Also, the effect on compensation decreases in selection number; the effect is larger for early first-round selections.

Interestingly, the decrease in compensation affects those selections that were previously shown to be overvalued. Massey and Thaler (2013) showed that surplus value—the difference between performance value and actual compensation received—increases with respect to selection number in the first round. Here we have shown the new CBA reduces compensation for first-round picks, and the effect size is decreasing in selection number. As a result, other factors equal, the new CBA has increased the surplus value of first-round selections, especially those taken early in the first round.

The effect of the new CBA on rookie wages can be summed up with a simple example. As previously mentioned, Stafford had a year-one compensation of $3,100,000 and a year-two compensation of $12,980,000—$1,791,976 and $7,595,811 in real terms, respectively. Only two years later, Cam Newton, another quarterback, was

Table 2. Estimation Results

	Dependent Variable = LN(Real Salary)		
VARIABLES	**Year 1**	**Year 2**	**Year 1 + Year 2**
CBA	0.206***	-0.512***	-0.215***
	(0.0645)	(0.144)	(0.0757)
Round 2	-0.919***	-0.308	-0.525*
	(0.273)	(0.441)	(0.307)
CBA×Round 2	-0.115	-0.219	-0.287
	(0.322)	(0.597)	(0.380)
Selection	-0.0760***	-0.0789***	-0.0771***
	(0.00572)	(0.0101)	(0.00710)
Selection^2	0.00125***	0.00107***	0.00110***
	(0.000157)	(0.000290)	(0.000202)
CBA×Selection	-0.0113*	0.0133	-0.00281
	(0.00640)	(0.0173)	(0.00871)
$\text{CBA}\times\text{Selection}^2$	0.000239	-8.03e-05	0.000224
	(0.000178)	(0.000457)	(0.000244)
Round 2×Selection	0.0576***	0.0250	0.0362**
	(0.0131)	(0.0205)	(0.0146)
$\text{Round 2}\times\text{Selection}^2$	-0.00120***	-0.000701**	-0.000856***
	(0.000206)	(0.000342)	(0.000242)
CBA×Round 2×Selection	0.0151	0.0143	0.0231
	(0.0156)	(0.0308)	(0.0182)
CBA×Round $2\times\text{Selection}^2$	-0.000326	-0.000208	-0.000448
	(0.000240)	(0.000541)	(0.000299)
t	-0.0870***	-0.223***	-0.133***
	(0.0114)	(0.0318)	(0.0153)
$t^2\times\text{Selection}^2$	0.00896***	0.0384***	0.0253***
	(0.00257)	(0.00541)	(0.00327)
$t^2\times\text{Selection}^3$	-0.000332***	-0.00176***	-0.00128***
	(0.000123)	(0.000244)	(0.000164)
Within-Team Selections	Yes	Yes	Yes
Position	Yes	Yes	Yes
Team	Yes	Yes	Yes
Constant	14.83***	15.33***	15.76***
	(0.0697)	(0.125)	(0.0858)
Observations	886	814	813
R-squared	0.941	0.855	0.922
Adjusted R-squared	0.937	0.844	0.916

Note: Robust standard errors in parentheses. ***Significant at 1%. **Significant at 5%. *Significant at 10%.

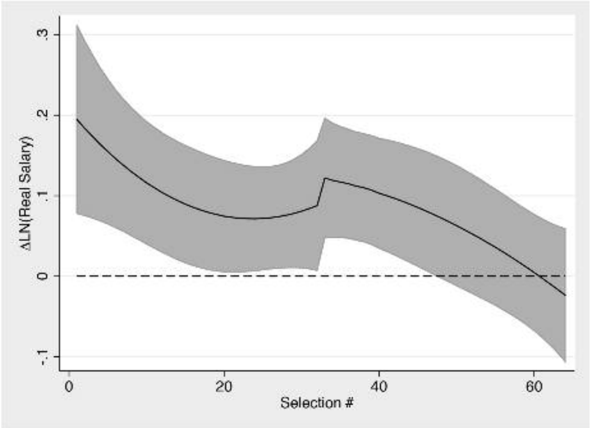

Figure 5. Effect of new CBA on year-one real salary.

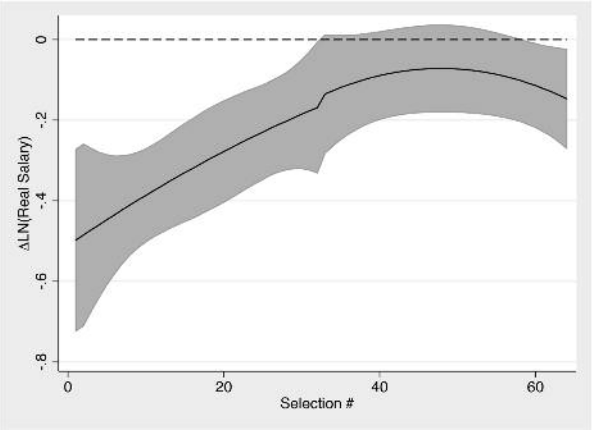

Figure 6. Effect of new CBA on year-two real salary.

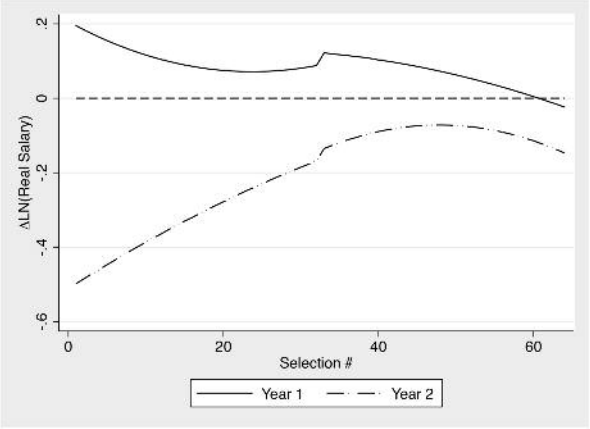

Figure 7. Effect of new CBA on year-one and year-two real salary.

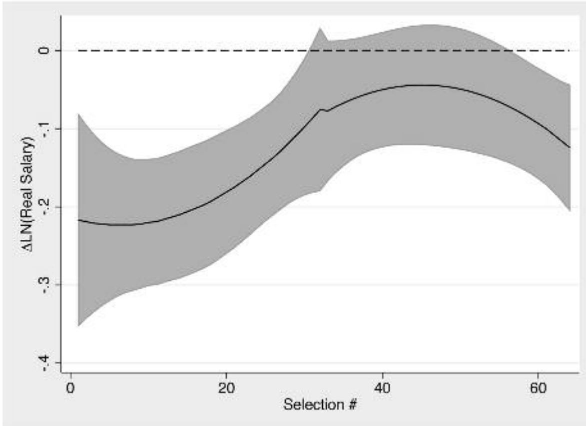

Figure 8. Effect of new CBA on total salary in first two years.

selected first overall, and first under the new CBA. Newton's year-one salary was \$4,004,636 and his year-two salary was \$5,005,795—\$2,372,780 and \$2,951,219 in real terms, respectively. The new CBA significantly increased year-one salary, but greatly reduced year-two salary.

Another interesting feature of rookie compensation prior to the new CBA was the existence of very large round effects, discontinuities is compensation uniquely at the round cutoffs (Keefer, 2014, 2015). Regression discontinuity estimates showed first-round selections received a \$240,000 or 36% to 38% premium compared to second-round selections (Keefer, 2014, 2015). Figure 1 clearly shows the discontinuity is compensation at the round cutoff for both the previous and new CBAs. Also, Figure 3 shows the discontinuity exists in year-two salary with the new CBA, which is expected due to the restrictions on compensation growth.

The discontinuity between rounds can be calculated from our econometric estimations. In general terms, the effect of being a second-round selection is

$$E(\ln w\,|CBA, s, R = 1) - E(\ln w\,|CBA, s, R = 0) = \widehat{\sigma_2} + \widehat{\sigma_3}CBA + \sum_{j=1}^{2}\left[\widehat{\pi}_j s^j + \widehat{\theta}_j\left(CBA \times s^j\right)\right]$$

To evaluate the discontinuity, we evaluate the second-round effect at the cutoff, selection number 33. Thus, the discontinuity is

$$\widehat{\sigma_2} + \widehat{\sigma_3}CBA + \sum_{j=1}^{2}\left\{\widehat{\pi}_j(33)^j + \widehat{\theta}_j\left[CBA \times (33)^j\right]\right\}$$

Using our estimation results, the discontinuity in year-one compensation prior to the new CBA is 39%, a log-difference of 0.33, which is consistent with the results from Keefer (2014, 2015) and significant at the 1% level. The discontinuity with the new CBA is estimated to be 35%, a log-difference of 0.30, and is also significant at the 1% level. Furthermore, we can determine if the new CBA significantly changed the discontinuity in rookie compensation between rounds, $\widehat{\sigma_3} + \sum_{j=1}^{2}\left\{\widehat{\theta}_j(33)^j\right\}$. The new CBA decreased the round discontinuity by 3%, a log-difference of 0.029, which is not statistically significant. The discontinuity in year-two salary is 28% prior to the new CBA and 25% with the new CBA, both of which are significant at the 1% level. The new CBA maintained the round discontinuity.

Conclusion

We show the two major changes to the rules governing rookie contracts from the 2011 CBA have different impacts on drafted player compensation. Our econometric results, which allow for heterogeneity based on selection and round, suggest the introduction of the year-one allotment has significantly increased compensation throughout the first round and much of the second round. The increase in year-one salary does vary by selection number, but is around 9% on average. On the other hand, the introduction of the limit on compensation growth has had a large negative effect on drafted player compensation. Year-two compensation for first-round selections is much lower under the 2011 CBA. The effect of the limit on compensation growth is largest for the overall number one selection and steadily decreases until the end of the first round. Considering the effects of the wage scale and limit on salary growth together, the new CBA has a significantly negative effect on the compensation of first-round selections. The limit on salary growth has a larger effect than the new rookie wage scale.

Our results suggest several avenues for future research. First, analyzing the effects of the new CBA on player compensation until they reach free agency is very important. As previously mentioned, this line of inquiry cannot be undertaken for several years, as it requires draft cohorts to reach the minimum amount of experience to become free agents. Also, the change in drafted player compensation resulting from the new CBA may have further implications. For example, by reducing the compensation of first-round selections, especially those selected early in the first round, the new CBA has made these selections more valuable. The change in value for early selections may have implications in the market for selections, the market in which teams trade selections for current or future year selections or current players.

References

Berri, D. J., & Simmons, R. (2009). Race and evaluation of signal callers in the National Football League. *Journal of Sports Economics*, *10*, 23–43.

Hendricks, W., DeBrock, L., & Koenker, R. (2003). Uncertainty, hiring, and subsequent performance: The NFL Draft. *Journal of Labor Economics*, *21*, 857–886.

Keefer, Q. A. W. (2014). Rank-based groupings and decision making: A regression discontinuity analysis of the NFL Draft rounds and rookie compensation. *Journal of Sports Economics*, forthcoming.

Keefer, Q. A. W. (2015). The sunk-cost fallacy in the National Football League: Salary cap value and playing time. *Journal of Sports Economics*, forthcoming.

Krautmann, A. C., von Allmen, P., & Berri, D. J. (2009). The underpayment of restricted players in North American sports leagues. *International Journal of Sport Finance*, *4*, 161–175.

Leeds, M. A., & Kowalewski, S. (2001). Winner take all in the NFL: The effect of salary cap and free agency on the compensation of skilled position players. *Journal of Sports Economics*, *2*, 244–256.

Massey, C., & Thaler, R. H. (2013). The loser's curse: Decision making and market efficiency in the National Football League Draft. *Management Science*, *59*, 1479–1495.

National Football League. (2011). Collective bargaining agreement. Retrieved from https://nfllabor.files.wordpress.com/2010/01/collective-bargaining-agreement-2011-2020.pdf

Pro Football Reference. (n.d.). NFL Draft history and AFL Drafts. Retrieved from http://www.pro-football-reference.com/draft/

Simmons, R., & Berri, D. J. (2009). Gains from specialization and free agency: The story from the gridiron. *Review of Industrial Organization*, *34*, 81–98.

Spotrac.com. (n.d.). NFL team contracts and payrolls. Retrieved from http://www.spotrac.com/nfl/

USA Today (n.d.). *USA Today* salaries database: National Football League salaries. Retrieved from http://content.usatoday.com/sportsdata/football/nfl/salaries/team?loc=interstitialskip

Vrooman, J. (2012). The economic structure of the NFL. In K. G. Quinn (Ed.), *The economics of the National Football League: The state of the art* (pp. 7–31). New York, NY: Springer.

Endnotes

[1] See Krautmann et al. (2009), Leeds and Kowalewski (2001), and Vrooman (2012) for more detailed discussion of free agency and its effects.

[2] In the NBA, teams may exceed salary cap and pay a luxury tax for doing so.

[3] See Massey and Thaler (2013) for a graphical presentation of compensation throughout the entire draft.

[4] The presence of revenue sharing and the NFL salary cap mitigate, or even eliminate, factors, such as market size, that may be important in other professional sports (Simmons & Berri, 2009).

[5] Estimation of earnings typically includes year fixed effects. Since we are estimating the effect of the new CBA, we cannot estimate year fixed effects. Thus, we use a flexible time trend to control for changes over time.

International Journal of Sport Finance, 2016, **11**, 232-246, © 2016 West Virginia University

The Pitfalls of Econometric Tests of the Uncertainty of Outcome Hypothesis: Interdependence of Variables, Imperfect Proxies, and Unstable Parabols

Łukasz Skrok[1]

[1] SGH Warsaw School of Economics

Łukasz Skrok is a PhD candidate in the Department of Economics II, Collegium of World Economy. His research interests include analysis of attendance demand and economics of professional sports leagues.

Abstract

A substantial number of empirical analyses of attendance at team sports events have been devoted to testing the uncertainty of outcome hypothesis, according to which the interest of fans is positively influenced by the degree of uncertainty of an outcome. The results, however, have turned out to be inconclusive. This article examines a possible explanation based on the flaws of the testing method. I show that results consistent with the uncertainty of outcome hypothesis can be obtained even when attendance is solely determined by the quality of the competing teams. The reason for this is the direct relationship between team quality and outcome probabilities. Moreover, while controlling for the quality of teams would solve this problem, one can only use imperfect approximations of unobservable variables. This might lead to results consistent with either the uncertainty of outcome hypothesis or the loss aversion hypothesis, regardless of the true nature of attendance demand.

Keywords: uncertainty of outcome hypothesis, attendance analysis, loss aversion

Introduction

The uncertainty of outcome hypothesis (UOH) has long been a mainstay of the economic theory of sport. Ever since Rottenberg's seminal paper (1956), it has been cited as one of the peculiar characteristics of the sport industry, necessitating the existence of a specific branch of economics. Its impact has been at least threefold: its validity has been assumed within theoretical analyses, its indispensability has been acknowledged by policymakers, and tests of its consistency using observed data have been the main theme of empiric (mainly econometric) studies on team sports. It is this area of research that is being discussed in this article.

In many cases econometric results have proven surprisingly inconsistent with the uncertainty of outcome hypothesis. The short-term measure in use—the quadratic function of the win probability of the home team—has rarely provided evidence for

UOH. In many cases, the coefficients did not significantly differ from zero. Even worse, numerous studies led to statistically significant but contradictory estimates of the quadratic function's coefficients. In other words, in contradiction to UOH, the relation between the probability of a home team win and match attendance should not be described by an inverse U-shaped curve, but by a U-shaped curve with a minimum.

To explain the frequently observed U-shaped relationship, Coates, Humphreys, and Zhou (2014) proposed a hypothesis based on the concept of loss aversion. The loss aversion hypothesis (LAH), in the context of team sports, states that the loss of utility from unexpected losses by a favorite (home) team is so strong that only in case of near-certain wins would the expected gain from winning outweigh it. On the other hand, the prospect of an upset (i.e., an unexpected win by the home team) makes those matches in which the visiting team is the strong favorite particularly interesting ones. Therefore, all else being equal, the most balanced matches are the least interesting. Humphreys and Zhou (2015) investigate this idea further and propose an empirical procedure to test which effect (UOH, LAH, or preference for a home win) is the strongest. In order to explain attendance at the MLB matches on which their data is based, they use, along with variables describing variability in league standings and measures of quality for both teams, a quadratic function of residuals from regressing home win probabilities based on betting odds against variables approximating the quality of both teams.[1] Their interpretation of the obtained results suggests that LAH is dominant, since the relationship between the logarithm of attendance and the part of the probability of a home win unrelated to the variables approximating quality of both teams is a U-shaped parabola with a minimum.

Pawlowski and Anders (2012) have suggested an alternative explanation for U-shaped probability polynomial estimates in econometric analyses of match attendance.[2] They suggest the supposed negative impact of competitive balance on the demand for balanced matches might in fact be driven by the lower quality of away teams (measured by a variable based on brand perception and the sporting success of away teams, thus depending on various factors, which might, at least in the short and medium terms, remain unrelated to sport quality).

Although Pawlowski and Anders (2012) employ a measure more complex than one based on factors directly influencing the match outcome, one could extend the logic to "pure" quality, understood as the ability to win matches. In other words, hosting a relatively weaker opponent—but one still stronger than the home team—means a decrease in attendance. It should be noted, however, that according to this explanation, a visit by a substantially inferior team would have the opposite effect, which should, in turn, result in a positive impact of balance on attendance. In other words, in an empirical study one should expect a decreasing function of home win probability, provided that was allowed for in the model specification. On the other hand, one expects that the strength of the home team has a positive effect on attendance as well. In this case, one would expect attendance to increase with home win probability if home team quality was not properly controlled for. Unfortunately, this is unavoidable, since the quality of teams is not directly observable and can only be approximated by other variables, in some cases very complex (and not known in an explicit form), that can be seen as its functions.[3] Therefore, even if attendance depends solely on the quality of both teams, one could obtain either the result that unbalanced matches are less popular or one exactly opposite, depending on the set of explanatory variables used in the regression and the distribution of quality (and thus the number of balanced matches between strong teams and between weak ones) within the analyzed league. The aim of this article is to further explore this hypothesis.

First, a derivation of a probability polynomial from a Cobb-Douglas function, using the quantities of talent employed by the competing teams as the only arguments, is presented to show that an inverted U-shaped parabola of probability can occur not only in the case of UOH, but also when demand depends positively on the teams' quality.

Next, using data simulated with the Cobb-Douglas function, I show that both a U-shaped and an inverted U-shaped relationship between the probability of home team success and attendance can be obtained. The condition is that imperfect approximations of teams' quality are used as independent variables.

The following analysis is similar, in its fundamental idea and approach, to that presented by Lahvi ka (2013). The present article had been (independently) written and prepared for the 5th ESEA Conference in Sports Economics in 2013, and therefore remained unpublished, before it was possible to read Lahvička's working paper. Nevertheless, the particular assumptions of the simulation differ, as well as—partially as a result—conclusions and recommendations regarding empirical research on match attendance. The crucial differences are discussed within the article.

The Correspondence Between the Probability Polynomial and Demand Function Based on Quantities of Talent

The starting point is that the probability of winning is a function of teams' quality—or of the talent they employ:

$$w_{i,j} = \frac{t_i}{t_i + t_j} \tag{1}$$

where $w_{i,j}$ is the expected ratio of wins of team i in matches against team j, and t_i and t_j stand for quantities employed by the teams.

The function (logit contest success function or Tullock contest success function) is a frequently used assumption in the literature of league models (e.g., Borghans & Groot, 2008; Dobson & Goddard, 2011). One simplifying assumption is the omission of draws. In order to take them into account, one would have to modify equation (1), but the general conclusions would not change. Therefore, to keep it simple, one can think of w_i as the probability of success of team i, which is equal to the sum of the probability of winning and half the probability of a draw.

Now, let us make another assumption, this time less typical of sport economics literature:[4] the demand function can be described by a Cobb-Douglas function (hereafter called CDH, or the Cobb-Douglas hypothesis):

$$Q_D = t_i{}^{\alpha} t_j{}^{\beta} f(X) \tag{2}$$

where X stands for all other demand determinants, such as the price of a ticket to the match or the market size of the clubs.

Using equation (1), one can rewrite equation (2) as a function of winning probabilities and the algebraic sum of both teams' talent:

$$Q_D = w_{i,j}{}^{\alpha} w_{j,i}{}^{\beta} T_{i,j}^{\alpha+\beta} f(X) \tag{3}$$

where $T_{i,j} = t_i + t_j$ and $w_{j,i} = 1 - w_{i,j}$.

Taking the natural logarithm of equation (3) enables us to write:

$$\ln(Q_D) = \alpha \ln(w_{i,j}) + \beta \ln(1 - w_{i,j}) + (\alpha + \beta) \ln(T_{i,j}) + \ln(f(X)) \tag{4}$$

Then, by using a Maclaurin series expansion of equation (4) and a binomial formula, one finds that the logarithm of the demand would be equal to the polynomial of the home team's probability of success:

$$\ln(Q_D) = \sum_{n=1}^{\infty} \frac{-\alpha \sum_{k=0}^{n} \binom{n}{k} \left(-w_{i,j}\right)^k - \beta {w_{i,j}}^n}{n} + g(T_{i,j}, X) \tag{5}$$

For positive values of α and β, the coefficients for the even degrees are negative, and, assuming that β is not large enough in comparison with α, the coefficients for the odd degrees are positive. This means that the logarithm of attendance could be approximated by the sum of other determinants and the polynomial of probabilities, the graph of which would be an inverted U-shaped parabola maximized at a positive value. One should note that such a formulation is often used in empirical research (e.g., see the review of the literature by Coates et al., 2014). This correspondence is not surprising, as the existence of a polynomial approximating any continuous function is guaranteed by the Weierstrass approximation theorem. In particular, for a given sum of talent quantities, there is a unique division of that sum that maximizes the Cobb-Douglas function.

Implications of the Correspondence

Inserting a quadratic function of probability into a regression should not be viewed as a proper empirical test of UOH. Undoubtedly, equation (5) shows that in the case of CDH the polynomial coefficients should be equivalent to certain values. Thus, by looking at the estimated coefficient, one can test whether CDH is possible. The problem is, however, that due to the very strong correlation between probabilities and their squares, the estimates are inefficient. Moreover, further problems with talent approximations described later in this article would make such an attempt futile.

Furthermore, one might still ask about the importance of the functional form—even with the demand function based on the quality of teams in Cobb-Douglas fashion, there is an attendance-maximizing distribution of talent supply. Both approaches have different implications, however, when the supply of talent within a given league is elastic and quality is not included as a variable.

Nevertheless, one might pose two questions: (1) Does this mean that obtaining a positive estimate for the squared probability's coefficient falsifies CDH? and (2) Shouldn't the variables that control for the quantities of talent employed by both teams be enough to ensure that the probability polynomial's coefficients are estimated correctly? Unfortunately, in both cases the answer is negative, because team quality is unobservable and, therefore, cannot be controlled for perfectly. This is a problem, due to the strong dependence of the outcome probabilities (which are unobservable as well) on team quality. In empirical analyses, different measures of talent and probability have been employed. For example, one can use the total salaries of players as a measure of team quality and use betting odds to calculate probabilities (e.g., Buraimo & Simmons, 2008). Even if the source of the data approximating both variables differs, however, one could still argue that the additional information it contains (constituting expansion beyond the elementary formula [1]) is noise. The betting market might be biased,[5] wages might depend on more than just the sports value of a player, etc. Still, the measures in use would be used to approximate either probability or team quality, which are supposed to depend on each other. And even if equation (1) is too simplistic (which it is), the only (and highly controversial) way to resolve the matter would be to state that the talent employed by the rival teams does not influence the match outcome in any significant manner.

Impact of the Unobservability of Talent: A Simulation

In order to illustrate the consequences of the unobservable nature of talent, a simulation was conducted with the use of an estimated distribution of talent quantities of the teams from one of the European leagues (see Appendix) and artificial data on attendance generated with a simple Cobb-Douglas function:

$$Q_D = t_i^{0.75} t_j^{0.25} \tag{6}$$

Probabilities of home team success (understood as the sum of the probability of winning and half of the probability of a draw) were calculated using equation (1). Then, simple OLS regressions of the logarithm of the simulated attendance against approximations of logarithms of teams' quality and the probability polynomial were run. Table 1 summarizes the results.

Table 1. Estimation Results for the Simulated Data on Attendance Based on Right-Skewed Distribution of Talent Employed by 16 Teams Competing in a League

model	A	B	C	D	E	F	G
f(x)=	x	points gathered	ML	ex	x2	x1/2	log(x)
probH	0	1.070	2.2***	3.1***	2.5***	-0.1***	-0.7***
probH2	0	0.027**	-1.1***	-2.0***	-1.4***	0.9	1.7***
implied extremum	-	-20.00	1.00	0.78	0.87	0.06	0.21
coefficient of f(log(ti))	0.75***	0.21***	0.11***	0.09***	0.16***	1.40***	0.72***
coefficient of f(log(tj))	0.25***	0.20***	0.11***	0.08***	0.15***	0.99***	0.63***

Notes: *** denote significance at 0.001, ** at 0.005, and * at 0.01. All specifications are significant based on F-test. Due to lack of importance for the considered problem, estimates of constant have been omitted from the table. Subscript i stands for a home team, subscript j for an away one.

As expected, when the quality of both teams is controlled for (model A), the coefficients of probability and its square are equal to zero. As mentioned before, the problem with analyses of actual data is that the talent employed is unobservable and all of the approximating variables, by definition, reflect it imperfectly. Model B illustrates this point. Supposing the information on the number of points scored by the teams during the whole season was used,[6] the coefficient of probability squared would be positive and significant. In the real world, the relationship between points scored and teams' quality is distorted by other factors (in this particular case the correlation between them is 0.86). This additional noise in proxies for quality results in an attempt by the OLS estimator to adjust the quadratic function of probability to explain the remaining variation in attendance. Similarly, using teams' talent calculated with the maximum likelihood estimation[7] proposed by Borghans and Groot (2008) results in a significant negative coefficient of probability squared (model C). In both cases, however, the extrema of the parabola are outside the range of probability values, which simply implies that the positive influence of the home team's quality on attendance is underestimated (because of the assumed parameters of the Cobb-Douglas function in equation (5), the impact of the home team's talent is stronger than that of the away team).

Nevertheless, meaningful extrema, both maxima and minima, of the probability parabola can be obtained when the quality of teams is approximated in a different manner. In particular, using monotonic transformations of quality to simulate attendance enables estimates consistent with UOH when the function is convex (models D and E), or consistent with LAH when the function is concave (models F and G, although in the former case the coefficient of the squared probability is statistically insignificant and the implied minimum would be close to zero).

In other words, when using an approximation of a team's quality, one must be sure of the exact relationship between the approximation and quality itself to correctly interpret the empirical findings. For example, when using data on total wages, one should determine whether the marginal cost of talent is constant, decreasing, or increasing, and account for this while constructing and interpreting the regression model.

The volatility of the probability polynomial's coefficients results from residual confounding. One can think of this as a case of a specification error, as suggested by Lahviĉka (2013), or of an omitted variable bias, in which case the omitted variable is the difference between the teams' true quality and the approximation used. The latter interpretation will be explored further.

Although the OLS procedure fits coefficients for all variables at the same time, it is instructive to first think about a regression for which the only explanatory variables are constants and measures of the quality of teams. In general, the residual—the difference between "true" (simulated using a concave function) attendance due to the quality of a team and the theoretical value—will surely be concave (convex) in quality if it increases (decreases) in quality and the approximation of quality is convex. In other cases there are no certain results, but since the true function is concave, to have a convex (concave) residual in quality, one needs a greater rate of change of the concave transformation function[8] for an increasing (decreasing) residual.[9] At the same time, for a convex transformation the residual increases for lower values and decreases for greater ones, while for a concave transformation the opposite is true. Whether the extreme value of the residual is reached within the range covered by the data sample for a lower or for a higher value depends on the coefficients calculated with the OLS procedure (and thus on the composition of the sample itself and the set of explanatory variables).

The analyzed case is, however, more complex. The residual that is to be explained by the polynomial is fitted against the home win probability, which is a function of the quality of both teams. Thus, it results from attendance, unexplained by either the home or away team. While the relationship is almost straightforward for matches dominated by one team, the nature of balanced matches is very different. Depending on the distribution of talent within the league, one can have more or less balanced matches between two weak teams, two strong ones, or two "mid-table" ones. Moreover, for different data sets, attendance for each of this type can be either overexplained or underexplained by approximations of quality.

For example, the existence of a substantially stronger team might result in the OLS procedure fitting the coefficients to this team (due to OLS's minimizing squares of residuals). In such a case, a convex transformation would lead to underestimation of theoretical attendance due to the strength of mid-table teams and (possibly) overestimation in the case of weak ones, while a concave transformation would lead to the opposite results. In the first case, matches in which a mid-table team hosts a weak one would have a greater residual to be explained by the polynomial than matches with the opposite situation; balanced matches would be either overestimated or underestimated and matches between weak teams and the strongest would have a low (or a negative) residual, which, due to the assumed stronger influence of the home team, would be greater for matches with a low probability of a home win. Therefore, especially for data sets for which the number of weak teams is not substantially greater than the number of mid-table teams, one should expect a concave polynomial (consistent with UOH—with a maximum above 0.5). However, if it is greater, one should expect a convex polynomial (therefore with a minimum, albeit one achieved for a home win probability lower than the maximum for concave ones, since attendance at matches of mid-table teams against weak ones would still be underestimated by the quality-of-teams approximation).

Once again, one should remember that OLS fits all coefficients at once, and thus, with variables that are inherently and strongly interdependent, one should expect estimates to be extremely unstable.[10] To sum up, the interplay among the biases affecting the measures of talent used, the relative importance of teams' quality, and distribution of talent within the league all decide the estimated shape of the parabola.

To illustrate the latter observation, two sets of talent distributions have been generated randomly (each consisting of 500 trials). The first set was generated with the use of a normal distribution (with parameters 500 and 100), the other with the use of a Pareto distribution (with parameters 1 and 1). Figures 1-8 present the results. In general, one can see that they vary widely. All of the relationships found in the empirical research—(effectively) positive, (effectively) negative, (effectively) U-shaped, and (effectively) inverse U-shaped—can be obtained due to imprecise information on talent and not to the direct influence of the probability of a home win. Nevertheless, it can be said that

- the attendance-maximizing probability can be found when the measure of talent used is a convex function thereof (see Figures 1, 2, 5, and 6);

- the attendance-minimizing probability can be found when the talent distribution is right-skewed (meaning that very few teams are much better than the rest of the league). The U-shaped parabola is obtained not only when the measure of talent used is a concave function (Figures 7 and 8), but also, perhaps, when the function is convex, especially in the case of extremely unbalanced leagues (Figures 5 and 6).

One way to resolve the issue of imperfect approximation of teams' quality is to use a two-way within estimator (equivalent to inserting a set of dummies for both the home and away teams). The influence of talent, constant within a certain period, would be completely controlled for in this way. The problem is that it is far from obvi-

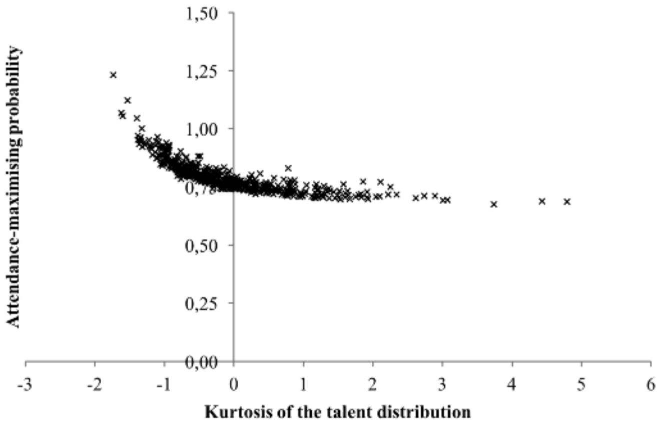

Figure 1. Talent distribution drawn from normal distribution, logarithm of talent approximated by the talent.

Note: For all 500 trials the coefficients of probability and probability squared are statistically significant.

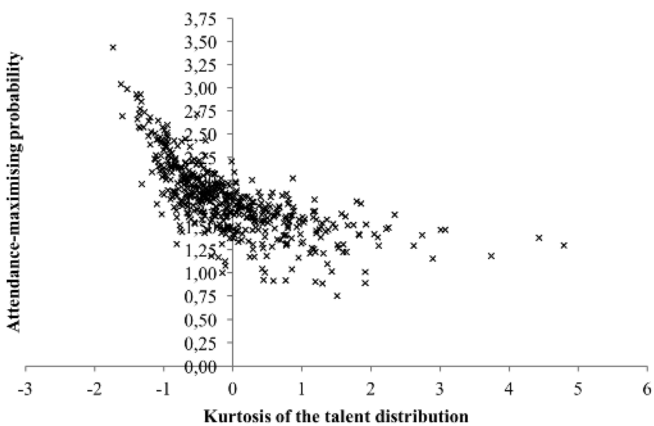

Figure 2. Talent distribution drawn from normal distribution, logarithm of talent approximated by its square.

Note: For all 500 trials the coefficients of probability and probability squared are statistically significant.

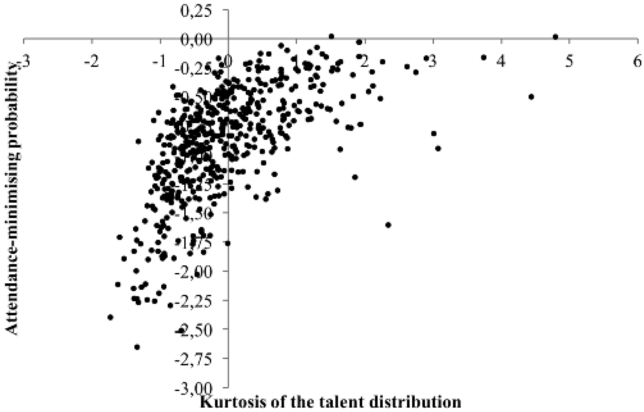

Figure 3. Talent distribution drawn from normal distribution, logarithm of talent approximated by its square root.

Note: For all 500 trials the coefficients of probability and probability squared are statistically significant.

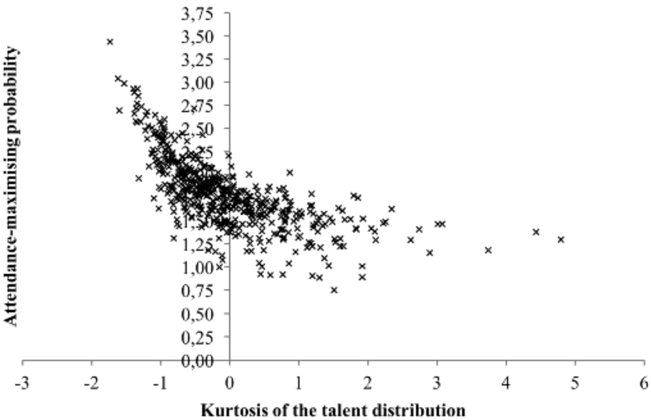

Figure 4. Talent distribution drawn from normal distribution, logarithm of talent approximated by its logarithm.

Note: For all 500 trials the coefficients of probability and probability squared are statistically significant.

ous how long this period should be. For the purpose of this article, it has been assumed that team quality is constant within one season. The reality is probably more complex; there are some short-term variations in talent that might impact attendance directly or through outcome probabilities or both. On the other hand, interpretation of the influence of the quality of teams on attendance, partially lost due to the use of the within estimator, also matters in terms of UOH appraisal. Moreover, as shown by Lahvička (2013), the within estimator would only solve the problem when the assumed functional form of the regression model was the same as the linearized equation representing the true data generating process (assuming that the latter was at all possible). Therefore, the ambiguity problem presented in the article would remain.

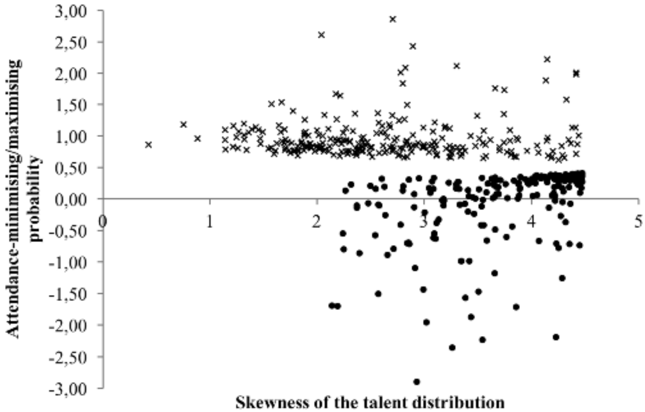

Figure 5. Talent distribution drawn from Pareto distribution, logarithm of talent approximated by the talent.

Note: Crosses represent maxima and dots represent minima. For 287 trials the coefficients of probability and probability squared are statistically significant at 0.001 level, for 311 at 0.005 level, and for 319 at 0.01 level.

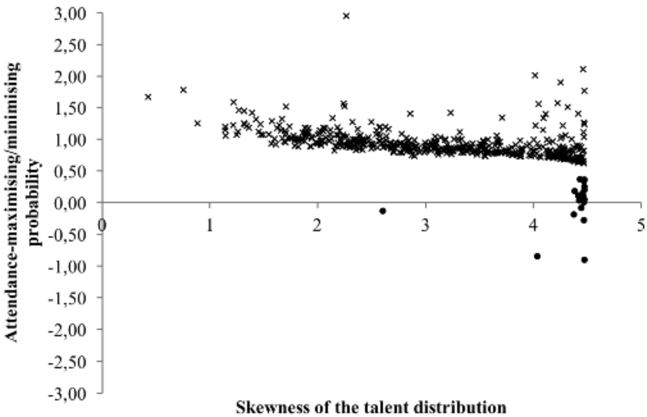

Figure 6. Talent distribution drawn from Pareto distribution, logarithm of talent approximated its square.

Note: Crosses represent maxima and dots represent minima. For 460 trials the coefficients of probability and probability squared are statistically significant at 0.001 level, for 461 at 0.005 level, and for 463 at 0.01 level.

Conclusions

This article attempts to contribute to the literature of sport economics by proposing an explanation of the inconclusiveness and inconsistency of empirical tests of the uncertainty of outcome hypothesis. Both theoretical and methodological problems were discussed.

One should note that the possibility of equivalency between a probability polynomial (of infinite degree) and the Cobb-Douglas function based on quantities of talent is not surprising. On the basis of the Weierstrass approximation theorem, one can use

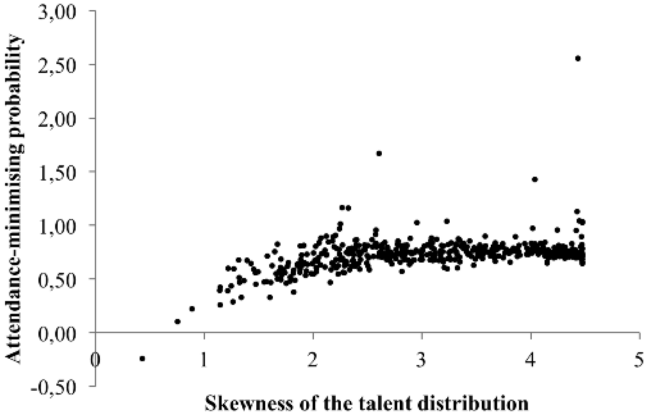

Figure 7. Talent distribution drawn from Pareto distribution, logarithm of talent approximated its square root.

Note: For 480 trials the coefficients of probability and probability squared are statistically significant at 0.001 level, for 486 at 0.005 level, and for 491 at 0.01 level.

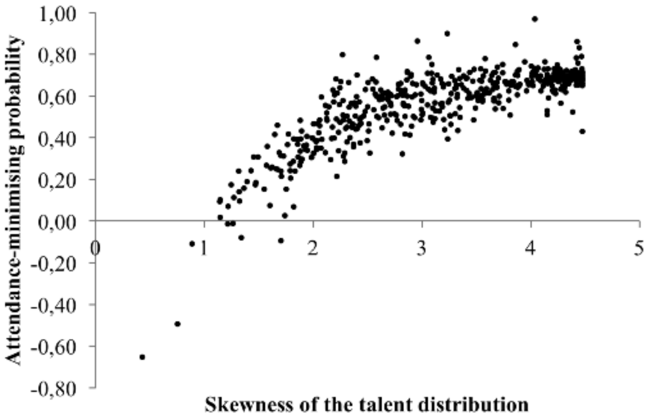

Figure 8. Talent distribution drawn from Pareto distribution, logarithm of talent approximated its logarithm.

Note: For 444 trials the coefficients of probability and probability squared are statistically significant at 0.001 level, for 458 at 0.005 level, and for 462 at 0.01 level.

such a polynomial to fit any set of data that can be described by any continuous function. What is important is that the signs of polynomial coefficients would be (on condition that the quality of the home team was much more important than that of the visiting team) the same when either UOH or CDH was true. The direct reason is that in the case of CDH there is a nontrivial attendance-maximizing distribution of talent supply. Therefore, the Cobb-Douglas assumption is not necessary—any talent-based function of the previous characteristic would lead to a similar result.

Furthermore, as shown by means of simulation, imprecision in controlling for quantities of talent leads to varying conclusions regarding UOH and alternative

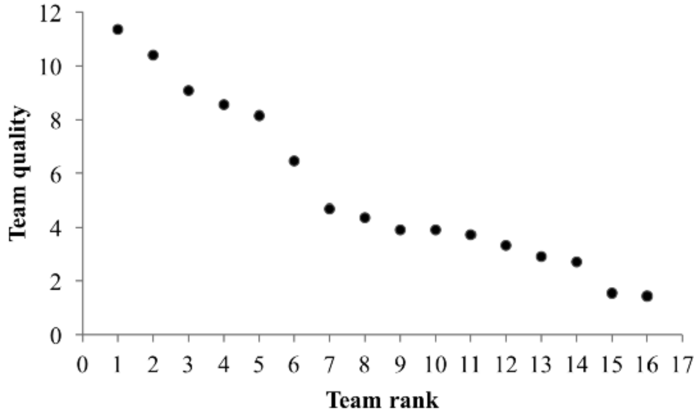

Figure 9. Talent distribution used in the main simulation.

hypotheses. Due to the direct relationship between talent and outcome probabilities, the polynomial's coefficients are biased. Therefore, any conclusions on the adoption of any one hypothesis (of UOH, LAH, or CDH) are doubtful.

Although the article focuses on the probability polynomial, the conclusions can be extended to other measures of short-term uncertainty (i.e., concerning particular matches, not a whole season), the most common being the Theil measure (e.g., Buraimo & Simmons, 2008; Benz, Brandes, & Franck, 2009; Pawlowski & Anders, 2012). The explanation presented here is also consistent with the results of Benz et al. (2009), who, using quantile regression, obtained results consistent with UOH only for the most popular matches in the German *Bundesliga*. Usually, the strongest teams enjoy the largest attendance,[11] so (once again) one could expect that the driving force is the negative impact of the low quality of weaker teams.

Furthermore, one might think of CDH as a special case of UOH combined with the positive impact of the quality of both teams, since it implies the existence of a level of balance that maximizes attendance. Therefore, one could interpret the presented results as having the potential to arrive at regression results inconsistent with UOH, whereas UOH, in fact, would hold. The reason is that the existence of attendance-maximizing balance would be hidden within the variables approximating the quality of teams.

Since it is inconceivable that a direct quantitative measure of teams' talents will ever be possible, one would have to, in order to distinguish between purely uncertainty-based and purely quality-based hypotheses, provide evidence consistent with the former but inconsistent with the latter. Since there is no argument as to why the better quality of a team would lead directly to lower attendance, one way would be to show that a decrease in the quality of the better team in the contest increases attendance. The problem with instances in which the visiting team is weaker, however, is that higher attendance could then be explained by the willingness of the fans of the home team to see it win. Therefore, the only set of cases for which a negative relation between a team's quality and attendance could be explained by (pure) UOH—but not by the other popular hypotheses about match attendance—are those in which any team concerned is the home team and is weaker than its opponents. Of course, the impact of the home team's quality on attendance is once again difficult to distinguish from other unobservable (and most probably interdependent) factors, such as the direct influence of market size. Nevertheless, when analyzing matches in which home teams are the favorites, the negative impact of variables measuring short-term variations in quality on attendance could be an argument for (pure) UOH.

One should bear in mind that Lahviĉka (2013) proposes a comparison of attendance figures at balanced and unbalanced pairs of matches. He argues that this method passes the test of simulated data without the positive impact of balance/uncertainty. This is only true, however, in cases in which the impact of one team's quality on attendance does not depend on the quality of the other (as in the case of algebraic sums of the functions of team quality). Supposing that this was not true (as in the case of the talent-based Cobb-Douglas function and data used in this article), the test would indicate a positive impact of uncertainty as well. Such a case is not improbable, since one could argue that the home team's quality is usually positively correlated with market size, which might lead to a stronger (positive) impact of the away team's quality. To sum up, the method proposed by Lahviĉka does not solve the fundamental problem of attendance analysis highlighted in both articles, because the issue originates in the inherent connection between quality, balance (or probabilities of results), and uncertainty. Furthermore, using residuals from the regression of probabilities against variables approximating the quality of teams, as was done by Humphreys and Zhou (2015), does not entirely solve the problem either. First, the value of residuals depends on the functional form of the first regression and the variables used in it. Second, all of the hypotheses (UOH, LAH, preference for home wins, and CDH) assume the certain impact of inherently interdependent variables.

Some conclusions for further economic analyses of team sports can be drawn. First of all, since using a CDH-based set of explanatory variables (i.e., proxies for team quality) is shown to be equivalent to using a probability polynomial (based on UOH), one could argue that, in order to increase the efficiency of estimation, the first strategy should be adopted. In other words, the very strong correlation between probability and probability squared makes polynomial regression less efficient. Furthermore, when interpreting the results of coefficients of uncertainty measures, one should consider the nature of variables approximating the quality of the competing teams. Second, it should be stated once more that adoption of the demand/revenue function based solely on a probability polynomial when constructing league models while abstaining from the use of functions of talent employed by clubs (e.g., Cobb-Douglas functions) is not supported by empirical studies.

References

Benz M. A., Brandes L., & Franck E. (2009). Do soccer associations really spend on a good thing? Empirical evidence on heterogeneity in fan demand. *Contemporary Economic Policy*, *27*, 216–235.

Borghans L., & Groot L. (2008). Competitive balance based on team quality. In L. Groot (Ed.), *Economics, uncertainty and European football* (pp. 97–116), Cheltenham, UK: Edward Elgar.

Buraimo B., & Simmons R. (2008). Do sport fans really value uncertainty of outcome? Evidence from the English Premier League. *International Journal of Sports Finance*, *3*, 146–155.

Coates D., Humphreys B., & Zhou L. (2014). Outcome uncertainty, reference-dependent preferences and live game attendance. *Economic Inquiry*, *52*, 959–973.

Dobson S., & Goddard J. (2011). *The economics of football* (2nd ed.). Cambridge, UK: Cambridge University Press.

Humphreys B. R., & Zhou L. (2015). The Louis–Schmelling Paradox and the league standing effect reconsidered. *Journal of Sports Economics*, *16*, 835–852.

Lahvička J. (2013). Does match uncertainty increase attendance? A non-regression approach. *MRPA Working Paper*, 48571.

Madden P. (2012). Fan welfare maximization as a club objective in a professional sports league. *European Economic Review*, *56*, 560–578.

Pawlowski T., & Anders, C. (2012). Stadium attendance in German professional football—The (un)importance of uncertainty of outcome reconsidered. *Applied Economics Letters*, *19*, 1553–1556.

Rottenberg S. (1956). The baseball players' labor market. *The Journal of Political Economy*, *64*, 242–258.

Endnotes

1 Humphreys and Zhou (2015) also use "actual" home win probabilities; the results do not differ substantially.

2 One should note, however, that Pawlowski and Anders (2012) use a Theil measure, which means the assumption of a particular functional dependence between the probabilities of result and attendance, with the maximum at equal probabilities of each outcome (home win, away win, and draw).

3 As mentioned, Pawlowski and Anders (2012) examine the perceived quality of the away team, which can be thought of as a function of not only sport quality, connected directly with probability of winning, but also other factors such as historical achievements, being generally popular (or unpopular), or having a substantial number of "away" fans (either covering long distances or scattered across the country).

4 Nevertheless, they are used in theoretical league models, for example, by Madden (2012).

5 An entire chapter on this issue can be found in Dobson and Goddard (2011).

6 The data on league points is actual data for all the teams from the 2011–12 season, for which the talent quantities used in the simulation were estimated.

7 The method proposed by Borghans and Groot (2008) uses the number of points scored by each team during the season as the only information and is thus based on the underlying assumption that no factors other than the season-constant quantity of talent influence the matches' results. However, the estimates of talent used to simulate the attendance data were calculated using theoretical probabilities for the results of each match, estimated with an use of an ordered probit model and with variables influencing the results but not connected to the constant level of talent (see Appendix). The correlation between the two sets of talent estimates is 0.89.

8 In particular, for a twice differentiable function, the second derivative of the transformed function has to be lower than that of the "true" one.

9 One should bear in mind, however, that a concave transformation of a concave function (as used in the following simulation) guarantees such a result. On the other hand, a convex transformation of a concave function does not guarantee the convexity of the whole approximation. Nevertheless, exponential transformation means that the approximation is linear (which is enough to fulfil the criteria described previously).

10 The OLS estimator, depending on the distribution of quality and other explanatory variables used in the regression, fits the assumed function to the data, meaning that the impact of the quality of some of the teams on attendance can be reflected quite precisely. Nevertheless, apart from extreme cases of distributions, it is impossible to do this for all of the teams.

[11] On the other hand, the clubs with largest markets can build the strongest teams; the direction of causality is of no relevance for the purpose of this argument.

Appendix

Estimation of Talent and Probabilities of Outcomes

The distribution of talent used in the main simulation reflects one of the European leagues in the 2011–12 season. The estimation procedure was based on an ordered probit model that was used to calculate theoretical values of outcome probabilities for each match. At this step, in order to obtain estimations of probabilities based on teams' quality, the impact of short-term determinants, such as the difference in the number of days a team rested before the match, was eliminated. Then, assuming that the talent employed by each team was constant through one season and using a formula derived from the equation (1), team quality was estimated. The formula used was:

$$t_i = \frac{T}{\sum_{j \neq i}^{n} \frac{w_{j,i}}{w_{i,j}} + 1} \tag{7}$$

where T is the scaling factor (in theory, this is equal to the sum of talent employed by all the teams, but in practice the sum of all calculated t_i differs from the assumed T value). The resulting talent distribution is right-skewed, as shown in Figure 9.

Author's Note

The author would like to thank Jakub Growiec, members of Department of Economics II at SGH Warsaw School of Economics, participants of the 5th ESEA Conference on Sports Economics in Esbjerg, Denmark, and two anonymous referees for their valuable comments to the article presented here. The article is based on research financed through a statutory grant addressed to young researchers awarded by the Collegium of World Economy, Warsaw School of Economics.

International Journal of Sport Finance, 2016, **11**, 247-261, © 2016 West Virginia University

If You Can't Pay Them, Play Them: Fan Preferences and Own-Race Bias in the WNBA

Jill Harris[1] and David J. Berri[2]

[1] United States Air Force Academy

[2] Southern Utah University

Jill Harris, PhD, is an assistant professor of economics in the Department of Economics and Geosciences. Her research interests include the nature and behavior of the National Collegiate Athletic Association, women in sport, and non-compliance behavior.

David J. Berri, PhD, is a professor of economics in the Department of Economics and Finance. His research focuses on the economics of sport, specifically the topics of consumer demand, competitive balance, worker productivity, and women in sport.

Abstract

During the 2010–2014 seasons, non-white players with non-white coaches played 4.81 fewer minutes per game on average than white players in the WNBA. This difference in playing time is not due to player endowments. A control for the percentage of the white population suggests fan preferences could contribute to coaching decisions about playing time allocation. No evidence of own-race bias is found. As the first investigation into bias in the WNBA, this paper contributes to the growing literature on discrimination in professional sports.

Keywords: WNBA, racial bias, employer discrimination

Introduction

NBA studies on fan preferences and the racial composition of teams confirm what Becker (1957) hypothesized 70 years ago: customer and employer discrimination can be observed in the marketplace. Brown, Spiro, and Keenan (1991), Burdekin and Idson (1991), Hoang and Rascher (1991), and Bodvarsson and Partridge (2001) all found teams in the 1980s in markets with larger white populations had a larger number of white players. Burdekin, Hossfeld, and Smith (2005) examined this issue in the 1990s and found this trend persisted; moreover, as the number of white players declined over the period, the returns to white players increased.

This behavior manifests in instances of own-race bias as well. Past studies on bias in sport focused on wages. More recent studies have examined performance. Price and Wolfers (2007) find own-race bias in basketball referees making more foul calls per minute on players of different races. Parsons et al. (2007) find the same in umpires calling more strikes for pitchers of the same race. Schroffel and Magee (2012) point out that implicit own-race bias may be more common in split-second decisions than under circumstances requiring more careful consideration. Although this result has not been universally reproduced (see McCormick and Tollison, 2001) it is interesting and important.

No studies to date, that we are aware of, explore these questions in the WNBA. While the NBA and WNBA have three letters in common, they are somewhat different in organization and behavior. As the WNBA marks its 20th anniversary, an examination of the league—including customer and employer discrimination—may provide insights into the behavior of teams, players, and fans alike.

This paper investigates playing time allocation decisions by WNBA coaches over a five-year period. Prior work by Harris and Berri (2015) established decision makers in the WNBA suffer from the same types of mistakes while drafting players that their NBA counterparts do (i.e., emphasizing scoring over other performance measures). If we assume coaches want to win games, it follows they should play the most productive players—black or white—from the roster. But it is possible, given the prior work on the draft, that minutes are also allocated primarily to those who score the most.[1]

We estimate the impact on playing time of observable differences in player characteristics and performance measures. After controlling for the most reliable indicators of player talent and player characteristics, we find no statistically significant evidence that coaches favor players of their own race. We do offer some evidence of “other-race bias”; non-white players playing for non-white coaches play 4.81 minutes less. These results differ from those conducted in the NBA. However, the absence of own-race bias in this sample might be more telling than a positive result when considering the history of the NBA and development of the WNBA.

As Burdekin et al. (2005) show, the NBA sorted players based on race in the 1990s with the more skilled white players ending up in markets with relatively larger white populations. This did not happen immediately; it took years for players and teams to find each other and establish a racial “equilibrium.” Could it be the WNBA is developing along these same lines, but is just a decade or two behind the NBA when it comes to the racial distribution of players and teams? Some background information on the WNBA (as it compares to the NBA) may help partially explain our findings. After this history, what follows is a brief summary of the literature involving race and basketball. Next, we estimate the minutes played per game using a production approach that controls for performance and player characteristics including race of the player and race of the coach. We include an Oaxaca decomposition of the difference in minutes played as a robustness check of our basic model. Results, discussion, and directions for future research conclude the paper.

WNBA Background

Conceived in 1996, the WNBA has experienced the typical growing pains of many relatively young sports leagues. As we saw in the early history of the NBA, teams in the WNBA have come and gone while profits and attendance have expanded and contracted. With respect to the number of teams, the league began with eight teams in 1997, expanded to 16 teams by 2000, before contracting to 12 teams by 2010. Currently the league remains with just the following teams: Atlanta Dream, Chicago Sky, Connecticut Sun, Indiana Fever, Los Angeles Sparks, Minnesota Lynx, New York

Table 1. WNBA League Revenue Estimate in 2014

Revenue Factors		**Revenue**
Television Revenue		$12,000,000
Average Attendance	7,578	
Average Ticket Price	$15	
Gate Revenue per game	$113,670	
Total Gate Revenue for 204 Regular Season Games		$23,188,680
TOTAL REVENUE		$35,188,680

Table 2. WNBA Payroll Costs in 2014

Salary Factors	
Average Salary	$75,000
Number of Players	154
Total Payroll	$11,550,000
Payroll as Percent of Revenue	**32.8%**

Liberty, Phoenix Mercury, San Antonio Silver Stars, Seattle Storm, Tulsa Shock, and Washington Mystics.

How financially successful is the WNBA? There is a tendency to compare the league to the NBA. Websites such as Forbes.com report revenue data for the NBA.[2] Other sites report how much revenue is paid to individual players but also the limits on compensation for rookies, veterans, and all players collectively.[3] These websites for the NBA not only indicate the salaries of individual players, but they also make it clear that the NBA pays about 50% of its revenue to its players.

There are some websites that discuss WNBA revenues, but none as complete as those referencing the NBA. Still, we can piece together a picture from information that is available. For example, on the revenue side we can note the league has a $12 million per year contract with ESPN through 2022.[4] In addition, Berri and Krautmann (2013) report that average ticket prices[5] were $15 in 2011 and average per-game attendance in 2014 was 7,531 fans. This attendance mark is more than 10,000 below the NBA but quite consistent with where the NBA was at after it existed for 20 years.[6]

Based on these data, we estimate that league revenue in 2014 was around $35 million (see Table 1). This estimate ignores merchandising, sponsorships, and playoff revenue. So it underestimates the total league revenue.

Although our league revenue is inexact, it is sufficient for us to estimate how little of the league revenue goes to the players. There is no website that reports the salaries paid to each player. We do have the collective bargaining agreement for the WNBA,[7] which indicates that the maximum salary paid to players in 2014 was $107,500. In addition, as Table 2 indicates, the average salary in the WNBA was $75,000.[8] With 154 players in the league in 2014, total payroll in the league was $11.55 million.

Once again, our revenue estimate is likely too low. But given what we know of salaries, it seems like the WNBA is only paying—at most—33% of its revenue to its players. This is far less than the 50% paid to NBA players, but consistent with what NFL players received in the 1950s.[9] It certainly appears that WNBA players are not getting as good a deal as their male counterparts in the NBA.[10]

Despite the difference in player compensation, the leagues have something in common: roughly 80% of the players in the NBA are non-white while 83% of the players in the WNBA are non-white in our sample. In addition, approximately 30% of players in the NBA play for non-white coaches while 25% in the WNBA do. In sum, the racial composition of the WNBA is similar to the NBA; however, due to the league collective bargaining agreement and smaller league revenues, female players lack bargaining power relative to males in the sport.

Female players can compete for a spot on international team rosters to increase earnings. In fact, international play can be quite lucrative for the top players.[11] More playing time gives international scouts better information about a player's potential. Thus, it stands to reason that WNBA players may view more playing time as a substitute for higher wages, other things the same. If fans demand more playing time for whites and white players also want more minutes, coaches may award more minutes than are justified by performance.

Literature on Race and Basketball

Discrimination occurs for a variety of reasons. Becker (1957) identified a "taste for discrimination" on the part of individuals who prefer to associate with or employ members of their own race and are willing to pay a premium to avoid other races. Bodvarsson and Brastow (1999) find the race of a manager affects salaries black and white NBA players earn. Hoang and Rascher (1999) report teams with a black coach have a smaller percentage of white players.[12]

Teams with monopsony power can discriminate and pay players of different races differently. McCormick and Tollison (2001) reveal black players may have more inelastic labor supply elasticities than white players. When this is true, NBA teams can pay black players lower wages in the pursuit of higher profits. Kahn and Shah (2005) support the McCormick and Tollison story. Within groups where teams have monopsony power (i.e., players who are not free agents and not on the rookie salary scale) non-white players have lower salaries, compensation, and contract duration than white players. This result did not hold for older free agents. In work closely related to racial bias, Berri, Deutscher, and Galletti (2015) discovered US-born players receive more time on the court in the NBA and in the Liga ACB after controlling for performance factors.[13]

Racial bias may also emanate from the fan base. Kanazawa and Funk (2001) find Nielsen ratings for NBA games increase when white players have more time on screen. Kahn and Sherer (1998) and Hamilton (1997) show home attendance is higher if a team has more white players. In contrast, Brown, Spiro, and Keenan (1999) found the percentage of minutes played by black players did not impact home attendance. Since other work suggested more white players on a team was correlated with higher attendance, the authors suggest biased fans may settle for seeing white players on the bench. This story is retold in work by Hoang and Rascher (1999), who found a larger white population in a metropolitan area was correlated with a larger percentage of white players on a team during the 1980s. Burdekin, Hossfeld, and Smith (2005) showed this type of effect for the 1990s. Teams in mostly white metropolitan areas had more starters who were white.

Given all this, Kahn and Shah (2005) report evidence for fan discrimination and for pay discrimination based on race diminished after the 1980s. As Berri (2006) summarized, the evidence is mixed when it comes to wage discrimination in professional sports. Due to the nature of the WNBA's collective bargaining agreement, there is very little salary variability and we do not have access to data on most players' pay. Therefore, the question of racial bias must be examined with playing time on the court.

Several papers investigate the relationship between player quality and other characteristics and minutes played. Staw and Hoang (1995) conclude a player's average minutes per game during the season increase if he is drafted higher, regardless of performance. They suggest this could be due to irrational attention to sunk costs. Camerer and Weber (1999) agree with Staw and Hoang (1995) that there seems to be some evidence of this "escalation of commitment effect" in the first three years of a player's career. McCormack and Tollison (2001) examine whether the race of the coach impacts the playing time of players of the same race. They conclude black players average more minutes per game than non-blacks. However, they report no significant difference between black and white coaches for how race affects minutes played. Leeds, Leeds, and Motomura (2015) also examine escalation of commitment and find teams do not award more playing time to highly drafted players. Schroffel and Magee (2012) find NBA coaches award more minutes per game to players of their own race even after controlling for player quality using performance statistics and player fixed effects. This player-and-coach match has weaker impacts on starting rosters. They emphasize the racial bias appears to be stronger when coaches are making decisions under pressure. To date no research (we are aware of) has examined race and minutes played for the WNBA.

Data and Empirical Model of Minutes Played

This study of minutes played per game uses player statistics from Basketball-Reference.com for WNBA teams from the 2010 to 2014 seasons. Photos of players from WNBA.com were cross-referenced with player and coach biographic sketches to categorize the players or coaches as "white" or "non-white." Although this is potentially an overly simplistic method, it is not without precedent.[14]

Summary statistics for our data are detailed in Table 3. The sample contains 513 observations on 29 variables including player characteristics and performance measures, which are used to estimate our model. A complete list of variable names and explanations is detailed in the appendix.

The average player in our sample is 6 feet tall; the tallest is 6 feet, 8 inches and the smallest is 5 feet, 4 inches. The average age is 27 years old. It appears white and non-white players average just more than 20 minutes per game. This is interesting if only because key variables found to be very influential on wins are significantly different between white and non-white players. These differences are included in a separate table (Table 4) with the sample means and significance levels for white and non-white players.[15] Again, all players' performance statistics are per 40 minutes played and adjusted for position as in Berri et al. (2015).[16] These adjustments can result in negative minimum values. In addition to performance measures we include player height (adjusted for position), games played, games started, age and age squared, and dummies for non-white players, non-white coaches, season, and draft position experience.[17]

Table 3. Descriptive Statistics for Dependent and Independent Variables (2010–2014)

Variable	Obs.	Mean	Std. Dev.	Min	Max
HT	513	72.355	2.149	64	80
AGE	513	27.634	4.290	20	42
G	513	28.593	7.657	2	34
GS	513	15.632	13.587	0	34
FTPER	512	0.756	0.125	0	1
REBOUNDS	513	6.535	1.777	0.466	13.627
ASSISTS	513	3.281	1.140	-0.363	8.094
STEALS	513	1.554	0.640	-0.093	4.396
BLOCKS	513	0.747	0.570	-0.884	5.371
TOPER	513	17.843	6.464	0	50.911
FOULS	513	3.956	1.342	1.222	9.671
POINTS	513	14.261	4.876	-0.699	30.712
ADJFG	513	0.461	0.080	0	0.739
NONWpl	512	0.828	0.378	0	1
NONWco	513	0.250	0.433	0	1
DRAFT	432	7.729	8.711	0	36
MGM	513	20.815	7.854	2	35
NONWPLxNONWCO	512	0.205	0.404	0	1
FBIASW	513	0.502	0.236	0	0.816
DFT1	513	7.646	8.612	0	36
DFT2	513	6.938	8.563	0	36
DFT3	513	6.007	8.300	0	36
DFT4	513	5.093	7.847	0	35
DFT5	513	4.403	7.622	0	35
DFT6	513	3.685	7.271	0	35
DFT7	513	2.840	6.527	0	35
DFT8	513	2.019	5.484	0	35
DFT9	513	1.556	5.030	0	36
DFT10	513	1.164	4.177	0	35

Non-white players score more points, have an advantage in rebounds and steals, and do not turn the ball over as often. White players have more assists and fewer personal fouls. Prior research suggests decision makers give too much weight to scoring. For this reason, and because rebounding and steals are higher in this sample, we might expect non-white players to average more minutes per game over the sample period. The summary statistics hint at our key finding: non-white players do not experience preferential treatment in playing time from coaches of their own race.

The empirical model is:

$$MGM_{nt} = \beta_0 + \alpha PRODUCTIVITYnt + \beta_1 RELHT_n + \beta_2\ GAMESnt + \beta_3\ GAMESSTARTEDnt + \beta_4\ AGEnt + \beta_5\ AGESQ + \beta_6 DRAFTEXPnt + \beta_7\ NONWHITEPLAYERnt + \beta_8\ NONWHITECOACHnt + \beta_9\ NONWHITEPLAYER_{nt}\ {}^{*}NONWHITECOACHnt + \beta_{10}\ SEASON + \beta_{11}\ FBIASW_{nt} + e_{nt} \tag{1}$$

Table 4. Average Performance Statistics by Race and Test of Significant Difference

	Non-White	White Players	Statistical Difference
Points	14.440	13.387	≠ at 5% sig
Adj. Field Goal %	0.456	0.485	≠ at 5% sig
Free Throw %	0.753	0.774	cannot reject Ho
Rebounds	6.618	6.091	≠ at 5% sig
Turnover %	17.423	19.916	≠ at 5% sig
Steals	1.584	1.412	≠ at 5% sig
Assists	3.189	3.743	≠ at 5% sig
Blocked Shots	0.750	0.731	cannot reject Ho
Personal Fouls	3.99	3.767	≠ at 5% sig
Minutes per game	20.87	20.541	cannot reject Ho

Note: All statistics are position adjusted. (Ho = no difference in means)

where minutes played per game (MGM) for player n in time period t is a function of: PRODUCTIVITY = vector of player statistics including Points, Adjusted Field Goal Percentage, Rebounds, Turnover, Steals, Assists, Blocks, and Personal Fouls; DRAFT-EXP = vector of variables interacting Draft Position and Experience; NON-WHITEPLAYER and NONWHITECOACH = vector of variables either 1 for any player who is non-white and 0 otherwise and 1 for any coach who is non-white and 0 otherwise; SEASON = vector of dummy variables controlling for the seasons 2010–2014; FBIASW = vector of NONWHITEPLAYER interacted with a percent white population variable for each team's SMSA; and an error term.

The expected signs on the productivity measures are positive for points, field goal percentage, rebounds, steals, assists, and blocks. Turnovers and personal fouls should have negative signs on their coefficients. We expect minutes played to increase with the height of the player. As the saying goes, "You can't coach height." Generally, we expect the same relationship with age. A squared term is included for age to control for the diminishing impact of age over time. Games can serve as a proxy for injury, while games started signals the relative strength of a player. Therefore, as games played increase we might expect a negative impact on minutes played per game, while games started should be positively correlated with MGM.

Draft position reflects expected talent; research by Leeds et al. (2015), Staw and Hoang (1995), and Camerer and Weber (1999) shows decision makers often place too much emphasis on draft position and sunk costs.[18] That is, they likely use it to determine minutes played even after controlling for performance. By including 10 years of experience we should be able to see if and when coaches stop considering draft position when allocating time to players.[19] If bias against non-white players exists the sign on the NONWHITE coefficient should be negative; likewise, if there is own-race bias in the minutes played per game the sign on the interactive term (NONWHITEPLAYER*NONWHITECOACH) should be positive. Another interaction term captures the impact of coaching changes midseason where the race of the coach changes. We follow Schroffel and Magee (2012) by letting NONWCHANGE equal 1 for players whose coach changes from having a different race to having the same race, -1 for players

Table 5. Estimation of Equation (1) Dependent Variable = MGM (minutes played per game)

Variable	Model 1	Model 2	Model 3
PTS	0.412**	0.403***	0.402***
REB	0.060	0.037	0.220*
AST	0.040	0.067	0.317*
STL	-0.269	-0.277	0.287
BLK	-1.063**	-0.718*	-0.741*
PF	-1.137***	-1.120***	-0.867***
TOPER	0.077	0.86	-0.018
FTPER	0.895	1.076	3.497*
ADJFG	7.735	2.207***	3.088
HT	5.084	4.888	1.827
AGE	0.244	0.211	-0.219
AGESQ	-0.007	-0.006	0.004
G	-0.046	-0.042	0.003
GS	0.339***	0.338***	0.374***
NONW PLAYER	4.336*	4.076*	0.126
NONW COACH	5.159***	4.534**	1.915*
NONWPL*NONWCO	-4.814**	-4.842**	-0.626
FBIASW	-6.600*	-6.587*	-0.063
NONWCHANGE	-5.644***	-5.340**	-6.377**
PLAYER FE	YES	YES	NO
TEAM FE	NO	YES	YES
	R-sq 0.721	R-sq 0.720	R-sq 0.765

Notes: Models use data from 2010–2014; *N*=503 on 154 players. Model 1 uses player fixed effects only, Model 2 uses both player and team fixed effects, and Model 3 is an OLS model. In the sample, 56 players experienced coaching changes involving a change in the race of the coach between years, while 40 players experienced a coaching change midyear where the race of the coach changed from non-white to white or white to non-white. The midyear changes are captured by the NONWCHANGE variable. * denotes significance at 10%, ** 5%, and *** 1%.

whose coach changes from being of the same race to being of a different race, and 0 for other players. If own-race bias exists and a player experiences a coaching change with the race of the coach changing from different race to same race, the sign on the coefficient should be positive. Finally, if playing time is influenced by fan discrimination the sign on FBIASW should be negative.

Empirical Results

Equation 1 is estimated using both player and team fixed effects estimators and OLS for comparison. Five years of WNBA data from 2010–2014 are employed with 513 total player-year observations. Players with fewer than 10 minutes per game were dropped from our sample. Results are reported in Table 5.

Before discussing the results on own-race bias, the non-performance factors invite comment. Height is not significant in awarding playing time in this sample. Typically both in the NBA and the WNBA height is an advantage. Even after controlling for skill in blocking, scoring, and rebounding, decision makers tend to draft taller players and award playing time to taller players in the NBA. It could be that coaches associate height with confidence, the ability to deflect passes, or intimidate other players. Another interesting result is that games are not important but games started are very important in terms of playing time through the season. If a player starts in one more game she plays 0.34 minutes more per game. Over the course of the season this means almost 13 more minutes of playing time. The negative sign on games played could be due to the cumulative effect of essentially year-round play for many of these female athletes who participate in international leagues. In the interest of avoiding injury (and so they can play in the far more lucrative international season) players may self-select out of additional minutes or the coaches may be protecting their investments by playing them less.

In most NBA studies, older players get more playing time initially but eventually sit the bench more. Although the coefficients on AGE and AGESQ are of the expected sign in model 1 and model 2, age is not significant in our sample. This might be because WNBA players start older in the league than their NBA counterparts in general. Virtually all players finish a college career in the US or are picked up from international league play. The average age for a rookie WNBA player is 22 and only 1% of our sample is between 18 and 21 years of age. In contrast, in the sample employed by Berri, Deutscher, and Galletti (2015), 9.8% of NBA players were in that age group.

Turning to the performance factors, points, blocks, and personal fouls are all statistically significant and of the expected signs except for blocks. None of the coefficients on draft position and years of experience are significant in any model specification (we do not include them in Table 5). It seems draft position and years of experience do not appear to be important to the coaching decision with respect to playing time. This result has some outside support in the literature (see Leeds et al., 2015). Factors influencing draft position are not always the best predictors of performance in the pro leagues.[20]

Given the performance and personal characteristics described, is there any evidence of employer discrimination? The coefficient on NONWHITE player is positive and significant. Non-white players with white coaches play 4.33 minutes more per game. The coefficient on NONWCOACH tells us that white players get about 5.16 more minutes if they play for non-white coaches. Certainly neither of these results is evidence of own-race bias. The estimated coefficient on the interaction term is negative and significant at the 5% level. This result indicates that non-white players with non-white coaches play 4.81 fewer minutes, controlling for performance. The "other-race bias" is even more severe for players experiencing a coaching change (with change of race) midseason; non-white players in this group played 5.64 fewer minutes on average. What about fan discrimination? For a 1% increase in the white population in the team SMSA, non-white players receive 6 fewer minutes of playing time. This suggests, other things the same, that fan bias may be partially responsible for the differential in playing time.

All this suggests something quite interesting is happening in the WNBA. Coaches appear to play white players more regardless of performance. In particular, non-white

Table 6. The Impact of a One Standard Deviation Increase in Statistically Significant Performance Vari-ables (2010–2014)

Variable	# min per game player gains
POINTS	2.01
BLOCKS	-0.42
PERSONAL FOULS	-1.46

Note: *N*=503. If a player has a one standard deviation increase in performance, on average, minutes per game played will be impacted by the levels reported above. Scoring points and avoiding fouls are the most important performance actions for players in the sample.

coaches seem to play white players more than their counterparts, controlling for performance. So, we do not have evidence of employer discrimination (or, own-race bias). On the contrary, there is evidence of "other-race bias" when the race of the coach and player differ. In addition, it may be the case that the bias on the part of coaches is being driven, in part, by fan discrimination.

Next, we turn to economic significance. As Table 5 indicates, blocks, fouls, and points are all influential on minutes played per game. Given these predicted results, how meaningful are they? Table 6 reports how an estimated one standard deviation increase in each statistically significant performance variable impacts playing time. Points and fouls matter most: a one standard deviation increase in points translates to 2.01 more minutes of playing time. The penalty for increased personal fouls is a decrease of 1.46 minutes. A player with 2 more minutes per game could score 14 more points over the course of a season.

Such a result is consistent with previous studies of the NBA and WNBA. Scoring totals dominate player evaluation in basketball. Harris and Berri (2015) noted this for the WNBA draft. Now we see this for minutes per game as well. Players clearly have an incentive to look for their shot in both the NBA and WNBA.

Robustness Test

Labor economists often employ an alternative method for investigating the difference between two groups: the Oaxaca-Blinder Decomposition (Oaxaca, 1973; Blinder, 1973). The general idea is that an observed difference in return to performance between two groups can be decomposed into explained and unexplained parts. The unexplained portion of the difference can then be related to bias. Table 7 reports the decomposition for white and non-white players. Non-white players play 1.34 minutes more than white players after controlling for performance. The first part of the difference reflects the mean increase in playing time for non-white players if they had the same characteristics as the white players. This means that 1.17 of the 1.34 additional minutes played (about 65%) can be accounted for by performance and personal characteristics of the players in our sample. The remaining 35% of the differential is not explained by player endowments. This playing time gap could possibly be the result of bias on the part of the coaches. The decomposition supports our empirical findings in two ways. First, it shows the significant difference in playing time afforded to players grouped by race. Second, it reveals that only a portion of this difference can be attrib-

Table 7. Oaxaca-Blinder Decomposition Results WNBA 2010–2014 Seasons

Independent Var.	Coefficient	Standard Error	z-statistic
White	19.93***	1.103	18.08***
Non-White	21.27***	0.461	46.18***
Difference	-1.336	1.195	-1.12
Explained	-0.872	1.638	-0.53
Unexplained	-0.464	0.542	-0.26
Obs. White	88	1.369	-0.34
Obs. Non-White	415		

Note: ***significant at 1% level

uted to differences in player endowments. While we cannot be certain that the unexplained portion of the playing time is the result of discrimination, we can report that something other than player performance and personal characteristics is responsible for the difference.

Concluding Observations

This inquiry into employer discrimination in the WNBA finds no evidence of own-race bias on the part of coaches in the 2010–2014 seasons. On the contrary, non-white coaches play their non-white players (on average) 4.81 minutes less per game than white players. This differential can be partially explained by differences in player ability. Is this "other-race bias" coming from the fans? The sign and significance of our population variable interacted with the player race variable (FBIASW) suggests some fan discrimination may exist in the WNBA.

Discrimination can reflect tastes and preferences as in Becker (1957) and Kahn (2012), or follow from statistical reasons as in Arrow (1973) or Phelps (1972). Our model's performance variables are likely picking up most of the underlying statistical discrimination in which coaches might engage. As Berri et al. (2015) point out, coaches may consider other factors about their players that researchers cannot measure. Factors they might consider include perceived levels of confidence, deflecting passes, and intimidation. These are unobservable and probably influence the minutes played per game. However, given the breakdown of abilities along racial lines it seems apparent that some coaches—non-white coaches—are taking great pains to not display preferential treatment of non-white players. This could result in fewer wins for their teams over the course of a full season. If this behavior is playing to fan discrimination, it has implications beyond won-loss records. Students of history know history often repeats itself. If it is true that WNBA players and teams are starting to sort themselves along racial lines (as studies indicate the NBA has done), a great deal can be learned about the institutional effects of this behavior in the coming years. One additional path for future research could be to investigate the role of sex in the playing time decision. Half of the WNBA coaches in the 2010–2014 seasons were male. Do these coaches make playing time decisions differently than their female counterparts? Finally, in a world where race, bias, and performance of job-related duties is constantly in the news, it seems clear we can still learn much from the behavior of decision makers in sports.

References

Arrow, K. J. (1973). The theory of discrimination. In O. Ashenfelter & A. Rees (Eds.), *Discrimination in labor markets* (pp. 3–33). Princeton, NJ: Princeton University Press.

Becker, G. S. (1957). *The economics of discrimination*. Chicago, IL: University of Chicago Press.

Berri, D. J. (2005). Economics and the National Basketball Association: Surveying the literature at the tip-off. In J. Fizel (Ed.), *The handbook of sports economics research* (pp. 21–48). London, UK: M.E. Sharpe, Inc.

Berri, D. J. (2010). *Measuring performance in the National Basketball Association*. Working paper.

Berri, D. J., & Krautmann, A. C. (2013). Understanding the WNBA on and off the court. In M. Leeds & E. Samkova Leeds (Eds.), *Handbook on the economics of women in sports* (pp. 132–155). New York, NY: Springer.

Berri, D. J., Brook, S., & Fenn, A. (2011). From college to the pros: Predicting the NBA amateur player draft. *Journal of Productivity Analysis, 35*, 25–35.

Berri, D. J., Brook, S., Fenn, A., Frick, B., & Vicente-Mayoral, R. (2005). The short supply of tall people: Explaining competitive imbalance in the National Basketball Association. *Journal of Economic Issues, 39*, 1029–1041.

Berri, D. J., Deutscher, C., & Galletti, A. (2015). Born in the USA: National origin effects on time allocation in US and Spanish professional basketball. *National Institute Economic Review*, *232*, R41–50.

Berri, D. J., & Schmidt, M. B. (2010). *Stumbling on wins: Two economists explore the pitfalls on the road to victory in professional sports*. Princeton, NJ: Financial Times Press.

Berri, D. J., & Simmons, R. (2009). Catching a draft: On the process of selecting quarterbacks in the National Football League amateur draft. *Journal of Productivity Analysis, 35*, 37–49.

Berri, D. J., Schmidt, M. B., & Brook, S. L. (2006). *The wages of wins: Taking measure of the many myths in modern sport*. Palo Alto, CA: Stanford University Press.

Berri, D. J., Brook, S. L., & Schmidt, M. B. (2007). Does one simply need to score to score? *International Journal of Sport Finance, 2*, 190–205.

Blinder, A. S. (1973). Wage discrimination: Reduced form and structural estimates. *The Journal of Human Resources, 8*, 436–455.

Bodvarsson, O. B., & Brastow, R. T. (1999). A test of employer discrimination in the NBA. *Contemporary Economic Policy, 17*, 243–255.

Bodvarsson, O. B., & Partridge, M. D. (2001). A supply and demand model of co-worker, employer, and customer discrimination. *Labour Economics, 8*, 389–416.

Brown, E., Spiro, R., & Keenan, D. (1991). Wage and nonwage discrimination in professional basketball: Do fans affect it? *American Journal of Economics and Sociology, 50*, 333–345.

Burdekin, R. C. K., Hossfeld, R., & Smith, J. K. (2005). Are NBA fans becoming indifferent to race? *Journal of Sports Economics, 6*, 144–159.

Burdekin, R. C., & Idson, T. L. (1991). Customer preferences, attendance and the racial structure of professional basketball teams. *Applied Economics*, *23*, 179–186.

Camerer, D. F., & Weber, R. A. (1999). The econometrics and behavioral economics of escaltion of commitment: A re-examination of Staw and Hoang's NBA data. *Journal of Economic Behavior and Organization, 39*, 59–82.

Coates D., & Oguntimein, B. (2010). The length and success of NBA careers: Does college production predict professional outcomes? *International Journal of Sport Finance, 5*, 4–26.

Gourieroux, C., Monfort, A., & Trognon, A. (1984). Pseudo-maximum likelihood methods: Applications to Poisson models. *Econmetrica, 52*, 701–720.

Harris, J., & Berri, D. J. (2015). Predicting the WNBA Draft: What matters most? *International Journal of Sport Finance, 10*, 299–309.

Hollinger, J. (2003). Pro basketball prospectus: 2003-2004. Washington, DC: Brassey's Inc.

Humphreys, B. (2000). Equal pay on the hardwood: The earnings gap between NCAA Division I basketball coaches. *Journal of Sports Economics, 1*, 299–307.

Kahn, L. M., & Sherer, P. D. (1988). Racial differences in professional basketball players' compensation. *Journal of Labor Economics, 6*, 40–61.

Leeds, D., Leeds, M., & Motomura, A. (2015). Are sunk costs irrelevant? Evidence from playing time in the National Basketball Association. *Economic Inquiry 53*, 1305–1316.

Marlowe, C. M., Schneider, S. L., & Nelson, C. E. (1996). Gender and attractiveness biases in hiring decisions: Are more experienced managers less biased? *Journal of Applied Psychology, 81*, 11–21.

Massey, C., & Thaler, R. H. (2006). *The loser's curse: Overconfidence vs. market efficiency in the National Football League Draft*. NBER Working Paper, (W11270).

McCormick, R. E., & Tollison, R. D. (2001). Why do black basketball players work more for less money? *Journal of Economic Behavior and Organization, 44*, 201–219.

Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *Internationl Economic Review, 14*, 693–709.

Oliver, D. (2004). *Basketball on paper*. Washington, DC: Brassey's Inc.

Phelps, E. S. (1972). The statistical theory of racism and sexism. *The American Economic Review, 64*, 659–661.

Price, J., & Wolfers, J. (2010). Racial discrimination among NBA referees. *The Quarterly Journal of Economics, 125*, 1859–1887.

Robst, J., Van Gilder, J., Coates, C., & Berri, D. J. (2011). Skin tone and wages: Evidence from NBA free agents. *Journal of Sports Economics, 12*, 143–156.

Schroeffel, J. L., & Magee, C. S. (2012). Own-race bias among NBA coaches. *Journal of Sports Economics, 13*, 130–151.

Staw, M. M., & Hoang, H. (1995). Sunk costs in the NBA: Why draft order affects playing time and survival in professional basketball. *Administrative Science Quarterly, 40*, 474–494.

Endnotes

[1] Winning may not be most important to some coaches; profit or some other variable may be the focus for the coach. However, in the WNBA, losing coaches are quickly dispatched. Given the league's relatively "poor" status compared to the NBA, win maximization seems to be a reasonable behavioral assumption.

[2] "The Business of Basketball," *Forbes*. Retrieved from http://www.forbes.com/nba-valuations/

[3] Larry Coon's website details the NBA's collective bargaining (http://www.cbafaq.com/salarycap.htm). In addition, various websites report salaries for individual players (see http://espn.go.com/nba/salaries; http://hoopshype.com/salaries/; http://www.basketball-reference.com/contracts/).

[4] Details on this contract were reported by http://www.sportsbusinessdaily.com/Daily/Issues/2013/03/28/Media/WNBA.aspx. We should also note that viewership on ESPN2 averaged 240,000 over 19 games (up from the previous year) and views on NBA TV increased over this time period as well (53,000 over 34 games).

[5] Over the 2012–2013 seasons it appears average ticket prices increased by several dollars. We do not have average ticket prices for 2014, so the revenue estimates we provide are likely too low. See http://www.sportsbusinessdaily.com/Daily/Issues/2014/08/19/Research-and-Ratings/WNBA-gate.aspx

[6] See http://www.apbr.org/attendance.html. The NBA did not average more than 7,500 fans per game until the 1969–70 season, or more than 20 years after it began operations in the late 1940s.

[7] See http://wnbpa-uploads.s3.amazonaws.com/docs/WNBA%20CBA%202014-2021Final.pdf

[8] This was reported in the *Dallas Morning News*. Retrieved from http://www.pressreader.com/usa/the-dallas-morning-news/20150726/282364038377418/TextView

[9] Stefan Szymanski reports that NFL players received 32% of league revenue in the 1950s while Major League Baseball players only received 17%. *Soccernomics.* Retrieved from http://www.soccernomics-agency.com/?p=639; last updated October 10, 2014.
[10] The WNBA reports that only six of its teams are profitable. It is important to note, though, that the NBA also claimed as recently as 2011 that many of its teams were not profitable as well. In fact, owners consistently argue in professional sports that teams are not profitable. See http://www.huffingtonpost.com/david-berri/think-the-wnba-is-in-trouble-lets-talk-nba-history_b_10279354.html
[11] Diana Taurasi was paid $1 million by her Russian team to sit out the 2014–2015 season with the Phoenix Mercury, for example.
[12] The authors find the difference between teams with white coaches and teams with black coaches is not statistically significant.
[13] The Liga ACB is the Spanish professional men's basketball league.
[14] See Robst et al. (2011) for details of their study using skin tone to explore race and wages.
[15] When adjusting for position played the average for the players in that position is subtracted first, then the average for all players is added back in. Therefore it is possible to have a negative minimum value in these performance measures after they are position adjusted.
[16] Position bias is overcome by calculating a position adjusted value for each metric. Each player's per-minute performance with respect to points, rebounds, steals, blocked shots, assists, and turnovers is determined. Then, the average per-minute accumulation at each position in our data set is subtracted. The average value of the statistic across all positions is added back in. After these steps, the result is multiplied by 40 minutes (the length of a college game), to return the player's per 40 minutes production of each statistic.
[17] Games played and games started are both correlated with minutes played per game. Games are included as a proxy for injury. Games started are included as a signal about the relative strength of a player on the team roster. We do not include players with less than 10 minutes played per game. This cut-off (theoretically) should eliminate so-called "mop-up" players from our sample.
[18] These studies conclude that decision makers—even after controlling for performance—overemphasize draft position and scoring while making playing time decisions. In other words, in spite of evidence to the contrary they will play a player more often than she might deserve based on observed performance variables. The exception is Leeds et al. (2015). They find teams do not award more playing time to highly drafted players.
[19] As draft position is "worse" the higher the number, the expected sign on the draft experience variables is negative.
[20] See Berri, Brook, and Fenn (2011) and Harris and Berri (2015) for examples. A referee suggested taking the logs of draft position to better fit the data. We ran the model with logged draft variables; there was no change in results.

Appendix

Variable Description	Variable Label	Description
Height (relative)	HT	Height - avg height for position + avg overall
Age	AGE	Age of player
Games	G	Games played
Games Started	GS	Games started
Free Throw Percentage	FTPER	Free throws made/free throws attempted
Rebounds	REB	Total offensive + defensive re-bounds
Assists	AST	Total assists
Steals	STL	Total steals
Blocks	BLK	Total blocks
Turnover Percentage	TOPER	Turnovers/(Turnovers+Field Goal at-tempts + 0.44Free Throw attempts)*100
Fouls	PF	Personal Fouls
Points	PTS	Total points
Field Goal Percentage (adjusted)	ADJFG	[(Points-Free Throws made)/ Field Goal Attempts)]
Non-white player	NONWHITE PLAYER	Dummy variable = 1 if non-white player
Non-white coach	NONWCOACH	Dummy variable = 1 if non-white coach
Coaching Change	NONWCHANGE	Dummy = 1 if midseason coaching change with change to same race, =-1 if change to different race
Draft position	DRAFT	Position drafted 1-36
Minutes per game	MGM	Minutes played/games played
Height Squared	HTSQ	Height squared
Age squared	AGESQ	Age squared
Draft Experience	DFT1	Dummy variable = 1 if one year experi-ence*DRAFT
Home Attendance	HOMEATT	Average attendance per season/ arena capacity
Percent Team White	PCTTEAMWHT	White players on roster /total players on roster
All-Stars	STARS	The number of All-Stars on team
Stadium	STAD	The stadium or arena capacity
Population	POP	The population of a team SMSA
Population white	POPW	The percentage white population in a team SMSA
Fan Bias	FBIASW	Interaction term = POPW*NONWHITEPLAYER

Submission Guidelines for the International Journal of Sport Finance

General

The purpose of the *International Journal of Sport Finance* is to provide a forum for the dissemination of current research on sport finance topics on a worldwide basis. The objective is to advance knowledge of the topic area by publishing theoretical and empirical papers of the highest quality from a globally diversified and multidisciplinary perspective. Given the foundational contributions of accounting and economics to the domain of finance, research drawn from these basic disciplines pertinent to the sport industry is strongly encouraged. Appropriate topics include stadium economics, team and/or league valuation methods, capital financing techniques, economic impact analysis, public financing, and the financial implications of team operations related to salary control, profit maximization, and tax treatment. Special attention will be paid to papers that examine these topics from a comparative and cross-cultural perspective. The principal criteria by which manuscripts will be judged when deciding to publish are quality, originality, rigor, timeliness, and practical relevance.

Manuscripts are reviewed with the understanding that they have not been simultaneously submitted to any other publication, that they represent the original work of the author(s), and that they have not been published previously either in whole or in part.

How to Prepare the Manuscript

Manuscripts should be written in English and submitted *electronically* by visiting http://editorialexpress.com/ijsf and following the instructions.

Since manuscripts are evaluated anonymously, authors' names should not appear anywhere in the manuscript. The submitting author should also ensure that the authors' names do not appear under the Properties of the file they are sending. A separate cover sheet listing the manuscript title and the order of authors as well as the primary author's name, mailing address, preferred phone and fax numbers, and email address should accompany each manuscript. In addition, information regarding each author's rank, institution, and research interests should be listed. If appropriate, identify if the manuscript is derived from a master's thesis or doctoral dissertation.

A 150-word abstract should preface each manuscript followed by a list of keywords. Manuscripts should be double-spaced with 1.5-inch margins, using an easily readable 12-point font. Authors should follow the style of the *Publication Manual of the American Psychological Association* (6th edition) in preparing all text, tables, and figures (e.g., *italics* used to report statistical information, indented second line in references listing).

Manuscripts should not exceed *30 pages, including* text, tables, figures, charts, footnotes, and references. Major headings used in the text should be centered on the page and in all uppercase letters; subheadings should be flush with the left margin and typed in upper- and lowercase letters. Footnotes should not be used in the body of the paper. If used, please place endnotes in a numbered list after the body of the text and before the reference section.

Each table and figure should be prepared on a separate page and grouped together at the end of the manuscript, with each numbered in Arabic numerals and appropriately titled. Figures must be clean, crisp, black-and-white, camera-ready copies. *Adobe Illustrator*, *CorelDraw*, *Pagemaker*, and *QuarkXPress* are the preferred software for *IJSF* figures. The number of tables and figures should be limited to only those necessary to complement the text of the manuscript.

The order of the submitted manuscript is as follows:

- Title page
- Blind title page (without name(s) and addresses)
- Abstracts (150 words) with keywords
- Text (double spaced)
- Endnotes (if included)
- References
- Tables
- Figures
- Appendices

Manuscripts submitted to the *International Journal of Sport Finance* undergo double blind review. Reviewers' comments will be returned via email attachment as soon as practically possible. The goal is to complete the review process and provide authors with a decision regarding the status of their submission within three months of receiving the manuscript.

All inquiries about reviews related to refereed research manuscripts should be directed to:

Arne Feddersen, Editor
af@sam.sdu.dk