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**What Shapes Players'
Performance in Soccer?**

Empirical Findings from a Panel Analysis

Benno Torgler
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WHAT SHAPES PLAYERS' PERFORMANCE IN SOCCER?

EMPIRICAL FINDINGS FROM A PANEL ANALYSIS

by

Benno Torgler and Sascha L. Schmidt*

ABSTRACT: In this paper we investigate the pay-performance relationship of soccer players using individual data from eight seasons of the German soccer league *Bundesliga*. The results of our panel analysis show that not only the absolute income level, but also the relative income position affects players' performances. We also find the tendency of a non-linear effect. Finally, the paper investigates the performance impact of team effects. Our analysis provides evidence of a direct impact of teammates' attributes on individual player performance.

JEL Classification codes: J310, J440, L830

Keywords: soccer, sport economics, performance, salary, positional concerns, team effects

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I. INTRODUCTION

The application of economic thinking to the business of sports gained increased attention in the last few years. A sub-field of this research is soccer, a sport discipline with global reach that has increasingly been commercialized over the last decades.¹ Contrary to North American sports, such as baseball, basketball, or American football that are analyzed since the 1950s (see e.g., Bodvarsson and Brastow 1999, Hamilton 1997, Kahn 2000, MacDonald and Reynolds 1994, Richard and Guell 1998, Rosen and Sanderson 2000, Scully 1974, 1995), the economics of soccer is still its infancy. Soccer has been investigated at the club level (for an overview, see Dobson and Goddard 2001) as well as international level (e.g., Hoffmann et al. 2002, Houston and Wilson 2002, Torgler 2004a, 2005). Although a higher commercialization of soccer led to more transparency and new data sources², there is still a lack of available data compared to North American sports activities. In this respect, Dobson and Goddard (2001) point out that despite soccer's "prominent public profile, and despite the fact that its weekly or daily audience (including television viewers) run into millions, academic economists have devoted relatively little attention to professional football (p. xv)".

One of the most interesting questions in soccer – where players' salaries are relatively high – is whether salary structures and player performance are correlated. According to Dobson and Goddard (2002) studies investigating this relationship are "virtually non-existent at the microeconomic level, because in most countries individual players' wage details are not disclosed" (p. 221). As we will further elaborate in the next section, some work has been done in this direction. However, contrary to most of the existing research efforts, our study concentrates on the determinants of *individuals'* soccer *performance* measured in goals and

¹ For instance the FIFA World Cup has become a great spectacle and one of the world's biggest sporting events, having been broadcasted in 2002 in more than 200 countries and regions around the world, covering over 41'100 hours of programming and reaching an estimated 28.8 billion television viewers (see FIFA Media Information, November 21, 2002, <http://fifaworldcup.yahoo.com>).

² For example, in England stock exchange listed clubs must publish their annual reports (Kern and Süßmuth 2003).

assists rather than the determination of the salary itself. Doing so we use a broad sample from the Germany soccer league (*Bundesliga*) covering eight seasons between 1995/1996 and 2003/2004³. To our knowledge, our paper provides further novelties compared to previous studies: We intensively investigate *players' performance* instead of *team performance* as a dependent variable, using a rich set of control variables in a *time-series analysis* over several seasons. We evaluate different aspects in a possible pay-performance relationship that has not been investigated in detail. First we checked whether there is a non-linear effect. Furthermore, instead of focusing only on the absolute income level, we also investigate the impact of the *relative* level. The relative income position may influence players' performance. For soccer players, what also may count are not only their salary in absolute terms, but also the salaries in terms of relation to their teammates'. Finally, we investigate the impact of team colleagues on players' performance. According to the authors' knowledge the teammates have only been considered in three previous studies, which focus in a cross-sectional analysis on ice hockey (Idson and Kahane 2000, Kahane 2001, salary structure as dependent variable) and on cycling (Torgler 2004b, performance as dependent variable).

The remainder of the paper is as follows: First, we provide in Section II a short overview of the relevant literature. In Section III, we present our theoretical approach and develop our predictions. Section IV presents the empirical results and Section V finishes with some concluding remarks.

II. OVERVIEW OF THE LITERATURE

The economics of soccer draw upon traditional economic research such as labor economics, industrial organization, law and economics, political economy or consumer economics (for an overview see, e.g., Dobson and Goddard 2001 or Fort 2003). The investigation of soccer is

³ It was not possible to consider the year 1997, as players' salary was not available.

often an interdisciplinary attempt including an extensive scope of academic disciplines that go beyond economics, such as sociology, law, psychology or political science (see, e.g., Garland et al. 2000). As of today, soccer has mainly been studied for European leagues. The emergence of professional athletes led to an increasing attention of scholars on employment issues such as players' earnings and performances. Recently, some studies also investigated soccer's labor market thanks to new data sets collected, for example, in Germany, Spain and Italy.

Looking at the empirical research available today, two groups of soccer studies can be classified that look at the pay-performance relationship of players and clubs. *Table 1* provides a detailed overview of these studies. The first group investigates players' salary or market value as dependent variable and searches for factors shaping it (Eschweiler and Vieth 2004, Garcia-del-Barrio and Pujol 2004, Huebl and Swieter 2002, Lehmann and Weigand 1999, Lucifora and Simmons 2003). These studies investigate to what extent club-specific factors (e.g. revenues from sponsoring, qualification for international competition) or player specific factors (e.g. age, origin, reputation, appearance, player position in the team) influence players' salaries or estimated market value/transfer price. For the German soccer league Eschweiler and Vieth (2004), Huebl and Swieter (2002) as well as Lehmann and Weigand (1999) confirm a positive pay-performance relationship. In addition, Huebl and Swieter (2002) explore a concave relationship between players' age/number of games played in one season and their salary. Garcia-del-Barrio and Pujol (2004) identified within the Spanish soccer league the existence of two segments in the labour market supply and the presence of a winner-take-all effect leading to strong bargaining power of superstars. Finally, Lucifora and Simmons (2003), investigating the players' earnings function in the Italian soccer, find a convex structure across some performance measures (goal/scoring rates and assist rates) controlling for other factors.

The second group of empirical soccer studies investigates the pay-performance relationship in the other direction and takes team performance as dependent variable (see Forrest and Simmons 2002, Szymanski and Kuypers 1999). Investigating whether club expenditures have a positive impact on the team's success within the English soccer league Szymanski and Kuypers (1999) find a significant correlation between teams' pay and performance. Using data from Italian, English, and German soccer leagues Forrest and Simmons (2002) find a strong team salary-performance relationship for the leagues in Italy and England. On the other hand, only a marginal significant wage-performance relationship has been found for the German *Bundesliga*.

Overall, the empirical results from European soccer studies are in line with many North American professional sport studies (see Buchanan and Slottje 1996, Scully 1995, Quirk and Fort 1999, Hall et al. 2002, Zimbalist 1992, 2002) supporting a positive pay-performance relationship. However, the findings for North American team sports reported in the literature are mixed. On the one hand side, it can be argued that large market teams dominate small market teams. On the other hand, mistakes in assessing talents prior to long-term contract assignments and institutional restrictions on players' mobility, creating a monopsonistic player labor market, work against a positive relationship between wage and success in team sports (Simmons and Forrest 2004).

Table 1: Summary of previous findings on pay-performance relationship

Authors	Research question	Dependent variable	Independent variable	Time intervals (seasons)	Number of observations	Key results
Huebl and Swieter (2002)	To what extent do club-specific or player specific factors influence players' salaries?	Players' annual salary	Club-specific: Revenues from jersey sponsoring, qualification for international competition in last season Player-specific: Age, tenure (number of games in <i>Bundesliga</i>), player in national team (yes/no), origin, player position (goal keeper, defender, midfielder)	1994/95-2000/01	547 players	Extent of players' salaries is significantly dependent on player-specific factors, concave relationship between age/number of games within Bundesliga and salary
Lehmann and Weigand (1999)	To what extent do club-specific or player specific factors influence players' salaries?	Players' annual salary	Club-specific: annual sponsoring revenues, annual number of spectators, qualification for international competition in last season Player-specific: origin, player position (goal keeper, defender, midfielder, striker), tenure (number of games in <i>Bundesliga</i>)	1998/99	Salaries from 468 players	Extent of players' salaries are significantly dependent on player-specific and club-specific factors
Lucifora and Simmons (2003)	What shapes players' earnings function in the Italian league? Is there a superstar effect?	Players' salary	Variables representing player experience including age and appearances, performance (goals, strike, assists), position, reputation (internationals), team specific effects (home attendance, coaching attributes)	Salary: 1995-1996 Others: 1994-1995	533 players	Existence of a convex structure across some performance measures (goal/scoring rates and assist rates) controlling for other factors
Eschweiler and Vieth (2004)	To what extent do club-specific or player-specific factors influence transfer prices?	Transfer price per player	Club-specific: Revenues from main sponsor, average number of spectators from prior season, qualification for international competition in next season Player-specific: Age, tenure (number of games)	1997/98-2002/03	254 transfers (full sample), 82 transfers within <i>Bundesliga</i> (sub sample)	Extent of transfer price is significantly dependent on club- and player-specific factors
Garcia-del-Barrio and Pujol (2004)	Are there two segments in the labor market supply in the Spanish league? Is there a winner-take-all effect?	Estimated proxy of the market value of a soccer player	Index of performance, reputation, superstar, age, international appearance, games in the Champions League/UEFA, position	2001/2002	369 players	Existence of two segments in the labor market supply, presence of a winner-take-all effect and thus strong bargaining power of superstars.
Littkemann and Kleist (2002)	What factors influence team success in German <i>Bundesliga</i> ?	Team success measured in points earned (three for a win, 1 for a draw)	Performance of players (marks from Kicker Sportmagazin), coordination between team units, context of the match (location, teams' current position in <i>Bundesliga</i> ranking, number of spectators)	2000/01	582 games	Player and team unit performance, relative team strength and the location of the match significantly influence team success. Significant supporting influence is exerted by the choice of an offensive team strategy
Forrest and Simmons (2002)	What is the relationship between team wage bills and team performance using data from Italy, England, and Germany?	Team success measured in points ratio (three for a win, 1 for a draw)	Team wage bills, coaches' win percent ratio	1998/99-1999/00	36 wage bills from teams	Strong team salary-performance relationship for the leagues in Italy and England, but less obvious for Germany.
Szymanski and Kuypers (1999)	Is there a pay-performance relationship for English soccer?	Average log odds of league position	Main independent variable: log of club average wage expenditure		40 over the period 1978-97 and 20 over 1950-60	Significant correlation between pay and performance

III. THEORETICAL APPROACH AND PREDICTIONS

1. German Bundesliga

The *Bundesliga* is one of Europe's 'big five' soccer leagues (for an overview, see Dobson and Goddard 2001). Interestingly, *Table A1* in the Appendix indicates that the *Bundesliga* had consistently the highest goal per game ratios of all the five leagues between 1995 and 2004. Dobson and Goddard (2001, p. 31) report that in 1999 Germany was the most 'cosmopolitan' league, with only 58 per cent of German players. For the season 2000, the *Bundesliga* had 31'882 spectators, the highest average home attendances of all leagues. The official *Bundesliga* exists since 1902 (for an overview see www.germantv.info/index.php?id=main). The structure of the league is similar to other European leagues, but there are key differences compared to USA sports leagues (for a detailed overview see Hoehn and Szymanski 1999). The structure is open with annual promotion and relegation. Thus, teams compete simultaneously in many hierarchical competitions. The *Bundesliga* consists now of 18 teams. Three teams are relegated and promoted each season. Furthermore, there is an active transfer market, in contrast to US sport markets that try to maintain a competitive balance between clubs, using a rookie draft system, longer player contracts, and salary caps. In the past, German clubs traditionally had the legal structure of a private social club (*Verein*, non-profit-making organization), but some of them were also owned by industrial enterprises (e.g., Bayer Leverkusen). However, clubs have been commercialized in the last decades. Bayern Munich, for example, had total revenue of around 150 million EURO in the season 2000/2001 (Haas et al. 2004). Furthermore, clubs increasingly interact with the financial markets. For example, in 1997 members of Borussia Dortmund voted to transform the club into a shareholding company (Hoehn and Szymanski 1999).

2. Data Set

We will work with a unique data set of professional soccer players covering a total of 8 seasons between 1995/1996 and 2003/2004. We will have the chance to investigate an unbalanced panel of 1040 players covering 2833 observations, with an average of 2.7 seasons per player. During the 8 seasons, 28 different clubs participated in the league due to annual promotion and relegation.

Player performances and players' background data are collected by the firm *IMP* in Munich. *IMP* is the official data provider of the German Football League and several broadcasters. The data allows to develop several seasonal variables at the individual player level. Furthermore, *IMP* also provides personal characteristics such as age, nationality, or position.

Data on players' salaries in Germany are not publicly available. Thus, previous studies on the *Bundesliga* used proxies derived from press reports (Forrest and Simmons 2002, Huebl and Swieter 2002, Lehmann and Weigand 1999, Swieter 2000). Most of these studies are based on data collected by the *Kicker Sportmagazin* (see Forrest and Simmons 2002, Eschweiler and Vieth 2004, Huebl and Swieter 2002, Lehmann and Weigand 1999, Littkemann and Kleist 2002, Swieter 2000, Haas et al. 2004). Furthermore, the Internet portal *Transfermarkt.de* uses its online community of 70000 members to collect salary data for a limited number of players and years, but due to the low number of observations not many studies worked with this data set (for an exception see Eschweiler and Vieth 2004).

In line with previous studies we also use the salary proxy provided by the *Kicker Sportmagazin*. Before a new season starts the editorial staff of the *Kicker Sportmagazin* – the most prominent soccer magazine in Germany – assesses the market value of each *Bundesliga* player taking into account individual (position in the team, performance in the previous season, obtained transfer price) and team characteristics (e.g., ticket sell earnings,

merchandizing, sponsoring) information. Importantly, the data has been collected in a consistent and systematic manner for several years⁴. To reduce possible causality problems we use the players' values of the *previous* season (dependent variable = current season). This allows us to use salary as independent variable. Otherwise, players' salary would reflect output aspects, as players receive bonuses depending on the team's success during the current season, which would lead to a reverse causality. Furthermore, teams doing well may spend more money on better players to improve their chance to perform in the international contests (Simmons and Forrest 2004). Working with National Hockey League data, Zimbalist (2002) shows that mid-season payrolls are more strongly correlated with the percentage of games won than the payrolls at the beginning of the season, as then there is the incentive to improve the chance to perform in the playoffs.

In order to check to which extent market value estimations used in our paper correctly reflect actual salaries we investigate the correlation between players' effectively reported salaries and their estimated market values provided by *Transfermarkt.de*, and the *Kicker Sportmagazin's* market values we use (pre-season and post-season values) for the season 2003/2004⁵. *Table 2* presents the correlation matrix indicating a strong correlation between the two data sources. These results encourage us to work with the *Kicker Sportmagazin* data covering a large number of seasons and players.

⁴ The obtained data are used in a so called manager game ("Kicker-Managerspiel"), where individuals (age 18 +) can participate.

⁵ Historical data are not provided by *Transfermarkt.de*, as the site just started to collect this information.

Table 2

Correlation between Different Data Sources for the Season 2003/2004

		Salary	Market Value	Pre Seasonal Value	Post Seasonal Value
Salary (<i>Transfermarkt</i>)	Pearson Correlation	1	0.735(**)	0.754(**)	0.541(**)
	Sig. (2-tailed)	.	0.000	0.000	0.000
	N	168	168	108	118
Market Value (<i>Transfermarkt</i>)	Pearson Correlation	0.735(**)	1	0.816(**)	0.832(**)
	Sig. (2-tailed)	0.000	.	0.000	0.000
	N	168	168	108	118
Pre Seasonal Value (<i>Kicker Sportmagazin</i>)	Pearson Correlation	0.754(**)	0.816(**)	1	0.666(**)
	Sig. (2-tailed)	0.000	0.000	.	0.000
	N	108	108	108	103
Post Seasonal Value (<i>Kicker Sportmagazin</i>)	Pearson Correlation	0.541(**)	0.832(**)	0.666(**)	1
	Sig. (2-tailed)	0.000	0.000	0.000	.
	N	118	118	103	118

Note: ** Correlation is significant at the 0.01 level (2-tailed).

3. Theoretical Predictions

Overall, we investigate three main research questions in this paper. The first follows up on Simmons and Forrest (2004) who have investigated whether there is a quadratic relationship between wage and team performance, focusing on different sports leagues. They measured team performances in the North American leagues (National Basketball Association, National Football League, National Hockey League, Major League Baseball) by win percent ratios and the probability of qualification for playoff competition. For the European soccer leagues, they analyzed team performances by points achieved divided by maximum possible points and the probability of obtaining a top six position. In the European leagues' wages represent salaries paid to *all staff members* and not just the players. The results indicate that the relative wage bill defined as team *i*'s wage bill divided by the league average in a given season raises the performance of teams in all seven leagues investigated. The squared term is statistically

significant in all leagues except the *Bundesliga* and the Major League Baseball. This supports the theory of diminishing returns of wage bills. In other words, teams can improve their performance by spending more on wages than the other teams, but at a decreasing rate. For those five leagues where the quadratic form is supported the turning point was inside the sample range; increasing the relative wage bills beyond the turning point can actually lead to a harmful reduction of team performances. The number of such cases was quite substantial in the National Football League and National Hockey League, but very small in the English and Italian soccer league.

The question now remains whether the non-linear effect that Simmons and Forrest (2004) couldn't find for Germany at the *team level* are observable at the *individual level*. Thus, to investigate a possible non-linear effect we include besides a player's salary of the previous season, also its squared term. Monetary rewards are an instrument to enforce extrinsic work motivation. Soccer salaries on average offer high individual incentive payments to perform. However, it can be supposed that players are not only extrinsically motivated by monetary payments, but also intrinsically. It is a profession with certain internalized standards of excellence, which can be seen as a type of motivation to achieve personal and team goals. It may be comparable to professions such as being an artist or a scientist⁶. When soccer players are supposed to have a high motivation to play soccer, external interventions can induce psychologically unstable situations (see Frey 1997). As a consequence, a player may be over motivated. He would still play soccer even if one motivation were reduced. A rational player could respond by reducing that part of his motivation which is under his control, that is, he would lower his intrinsic work motivation. In labor economics some evidence supports such a crowding-out effect (see, e.g., Barkema 1995, Holmström and Milgrom 1990).

⁶ In general, both arts and sports have many similarities such as community impacts, demand interdependencies and the presence of superstars (Seaman 2003).

Our second research question is based on the assumption that soccer players compare themselves to other players, especially their teammates. An individual's salary position relatively to the other teammates may have an impact on his/her performance. Thus, it is highly interesting to empirically investigate not only the absolute salary level, but also the impact of the relative position to the other teammates. Senik (2004), providing an overview of the literature points out that "It is surprising that in spite of the large theoretical literature on relative income and comparison effects [...] empirical validation of this conjecture is still scarce" (p. 47). Focusing on the relative income position may help to investigate behavioral implications of positional concerns or envy. Ainslie (1992) argues that "Putting oneself in another's shoes may offer a single, distinct, and thus robust alternative to the perception of life in one's own shoes. This alternative perception of reality is experienced as envy" (p. 323). Envy is a "subtle and powerful feeling, motivating everything from political movements to murders" (Zeckhauser 1991, p. 9). Envy comes from comparisons with similar individuals (Elster 1991, Schoeck 1966). Thus, it is not a surprise that envy is extremely widespread in the workplace. Elster (1991) reports that in China, model workers spend their bonus on a good meal for everybody to avoid harassments by their fellow employees. A manager keeps the bonus down because he fears the other workers and because he wants to avoid the envy of other executive officers. However, it is very difficult to empirically measure the impact of the relative income position, positional concerns or envy on workers' performance. Such studies have been hindered by the lack of data on individuals' performances and the lack of publicized salaries.

Due to our access to professional soccer players' performance data and the availability of a good proxy on salary data we exploit the unique possibility to empirically assess the effect of the absolute and the relative income on individuals' performances. Differences in the distribution of the salaries among teammates provide the opportunity to test for the presence of positional concerns. The interesting question is whether envy has a positive or a negative

impact on individuals' performances. Comparisons with other players' may lead to a better performance as it can induce the incentive to achieve a similar status. If players did not compare themselves with other teammates they might be satisfied with less than what they have already achieved. Thus, comparisons may provoke a "positional arm race", which even leads to working too hard (see Landers et al. 1996). On the other hand, an envious person may "prefer that others have less, and he might even sacrifice a little of his own wealth to achieve that end" (Zeckhauser 1991, p. 10). For example, Elster (1991) criticizes that the experimental evidence found in ultimatum games (rejection of a proposal that deviates too much from an equal-split) is characterized as fairness: "[...] "envy" would sometimes be more appropriate for analogous behavior in real life" (p. 66). Thus, the welfare of an envious person increases by destroying some of the others' assets, even if such an action leads to own costs (*cutting off one's nose to spite one's face*). Furthermore, performance may decrease due to frustration ("it could have or it should have been me") and a certain resignation.

The third research question is concentrated on the impact of team effects. According to the literature, individuals' productivity and thus players' performance vary when working in different settings as coworkers offer different levels of assistance (see Idson and Kahane 2000). Teamwork is an important topic in labor economics. It is desirable, as it allows realizing gains from complementarities in the production and facilitates gains from specialization by accumulating task-specific human capital, which may be valuable to other team members (see Lazear 1998). Hamilton, Nickerson and Owan (2003) find that the composition of the team has a strong impact on its productivity. However, empirical studies are still rare due to the difficulties to obtain data (see Idson and Kahane 2000). Our data set allows investigating the impact of team colleagues on a player's performance. In line with Idson and Kahane (2000) and Torgler (2004b) we measure the teammates' impact on an individual i calculating the average values of the teammates (excluding the values of player i). Concretely, we investigate whether the teammates' average age, exchanges, and sending-offs

in a game affect an individual's performance. More exchanges may be correlated with higher individual performance due to an increase in the average physical strength of the teammates. Higher exchange values can also be seen as an indicator of good second lineup players. On the other hand, sending-offs should be negatively correlated with performance. Investigating the World Cup tournament in Korea/Japan, Torgler (2004a) found that expulsions have a strong negative impact on the probability of winning a game. Losing a teammate reduces a team's strength. The team structure has to be reorganized which can reduce players' and teammates' comparative advantages, as the skills in soccer are highly specialized.

It is also useful to control for a players' experience or physical condition. As a proxy we consider the variables AGE and AGE SQUARE. We can expect that the relationship between a player's age and performance has a non-linear form. Age may be connected to a greater experience of the game, but as players get older, their physical abilities such as speed and athleticism decline. Thus, we predict a positive sign for the variable AGE and a negative one for AGE SQUARE. Another possibility would be to measure experiences rather than age. Years of experience in the league, or number of career appearances, or years of professionalism can be used as proxies. However, such data is not available. Players are very mobile. In our data set they stayed on average less than 3 seasons in the *Bundesliga*. Furthermore, data on career appearances in other leagues were not available.

Using two different dependent variables helps to investigate whether team effects work in different ways. For example, one may expect that the goals scored are more subject to team effects, as they sign the last stage in a team's ball relay.

Changing the team may also affect individuals' performance. A change is often connected with a higher salary, which leads to a higher extrinsic motivation to perform better. Furthermore, a player has to "make his mark" in the new team and may be checked out in detail by other team and staff members. On the other hand, a change is connected to transaction and adaptation costs (professional and personal) that may negatively affect

players' performances. He has to find his place in a team that consists of many players who know each others well. He has to gain the acceptance of many colleagues to be fully integrated in such a manner as to perform in an optimal way. His family members may also need adaptations that could even affect his mental abilities and therefore perhaps also his performance. Thus, a clear prediction is difficult to generate. We use a dummy to check for such an impact (value one for one season after the change).

We also use three dummy variables associated with the field position of a soccer player (DEFENSE, MIDFIELD, ATTACK (reference group)) as we observe changes over time. Obviously, goalkeepers have been neglected in the estimations. It is important to control for the position of the players in the field as it helps to control for the heterogeneity linked to their positions. *Table 3* presents a summary of the variables used and effects expected.

Table 3

Variable Definitions and Predictions

Variables	Definition	Expected Effect on Player Performance
A) SALARY		
ABSOLUTE VALUE _(t-1)	Absolute monetary value of a player in the previous season	positive
SQ ABSOLUTE VALUE _(t-1)	Squared value of the absolute monetary value of a player in the previous season	negative
RELATIVE VALUE _(t-1)	Difference between teammates' average values and players' individual values in the previous season	mixed
B) SOCIO-DEMOGRAPHIC		
AGE	Players' age	positive
AGE SQ	Squared value of players' age	negative
C) SITUATION		
CHANGED TEAM	Dummy variable value 1, if a player is new in a team (changed the team after the previous season)	mixed
D) TEAMMATES		
AGE	Average age value of the teammates	mixed
EXCHANGES	Average number of exchanges of teammates	positive
SENDING-OFFS	Average number of sending-offs of teammates	negative

4. Econometric Specification

In order to test our predictions, we propose thus the following baseline equation:

$$PERF_{it} = \beta_0 + \beta_1 CTRL_{it} + \beta_2 ABSAL_{i(t-1)} + \beta_3 RELSAL_{i(t-1)} + \beta_4 TEAM_{it} + TEAMD_i + TD_t + \mu_i + \varepsilon_{it}$$

where $PERF_{it}$ is the performance of player i at time t measured in goals in one case and assists in another case for every played season; $ABSAL_{i(t-1)}$ is the lagged absolute salary of a player. To check for non-linearity, we also consider the squared value of the absolute salary. $RELSAL_{i(t-1)}$ is the lagged relative salary of a player i , measured as the difference between teammates' average salaries and players' individual salary. Using lagged values helps to reduce causality problems. $TEAM_{it}$ denotes a vector that contains teammates' values of each player i at time t , calculating in such a manner as to remove each individual i value. For example, we calculate the average age for the team as a whole, excluding the individual player i 's age. We follow the same procedures to construct the variables EXCHANGES and SENDING-OFFS. The regression contains also several control variables $CTRL_{it}$ such as AGE, AGE SQUARED, CHANGED TEAM (dummy that measures whether a player changed the team after the previous season), players position in the game (ATTACK, MIDFIELD, DEFENSE) and team dummy variables ($TEAMD_i$). Furthermore, TD_t is a set of season dummy controlling for possible differences in players' environment; μ_i is the individual effect of player i , and ε_{it} denotes the error term.

IV. ECONOMETRIC RESULTS

In *Table 4* we present two different kinds of empirical methodologies: pooling and fixed effect estimations using two dependent performance variables (GOALS and ASSISTS). In the pooled estimations we present team and time dummy variables, using standard errors adjusted for the clustering on individuals, thus taking into account specific characteristics of the players which can not be observed. We furthermore use the number of minutes played as a weighted variable. Using two different methodologies allow examining the robustness of the results.

We first present results without considering any team effects. In a next step we add the teammates' factors age, exchanges and sending-offs and the relative income of the players.

As can be seen, salary has a statistically significant impact on individuals' performances. The joint hypothesis that none of the variables (absolute and relative income position) has a coefficient that differs from zero can be clearly rejected. A strong impact can be observed for the relative income position. A bigger difference to the average salary of the teammates leads to a crowding out of an individual performance, when we control for the absolute individual salary level. The squared term also shows that there is a non-linear effect.

Looking at the other variables, we find a statistically significant impact of age and its square in a limited number of regressions. Age has a robust tendency to influence the performance when we focus on the variable goals. On the other hand, the correlation between assists and age is less robust (not statistically significant in the pooled estimation). Thus, it seems that for assists more experiences over time are less overshadowed by a decrease in the physical abilities. On the other hand, goals seem to be more connected to the physical condition of a player. It is the variable where we observe the tendency for a human capital performance function with its conventional concave form rising with age but at a decreasing

rate due to the worsening physical condition. Equation (1a) and (2a) indicate that the turning point of age in the age-performance profile is between 30 and 31. Beyond this turning point, greater experiences (e.g., knowledge of the game, tactical ability) are overshadowed by worsening physical performance (speed, fitness, more vulnerable to injuries etc.) that leads to a lower ability to score goals. Interestingly, Lucifora and Simmons (2003) find an earlier turning point (age 28) focusing on an age-earning rather than an age-performance function in the Italian league.

Specifications (2) and (4) additionally include a vector of team variables that measure average teammates' factors. The results of these estimations also indicate that team effects matter. Using a Wald-test for coefficient restrictions testing for joint significance we can conclude that team factors play a significant role in the determination of individuals' performances. We also observe an increase of the R-squared. Strong effects are observable for the variables EXCHANGES and SENDING-OFFS. This result suggests that a player who played in a team with more exchanges performs better, keeping other variables equal. Furthermore, sending-offs negatively affect the individual performance, which is in line with findings of a previous study that focused on team performances in the World Cup (see, e.g., Torgler 2004a). In general, these two findings are in line with our predictions. Only the age of the teammates seemed not to have a robust impact on individual performances (statistically significance in one estimation, showing a negative sign). The results also indicate the tendency that teammates' effect is more important for goals than for assists.

Table 4: Determinants of Performance

	(1a) Dep. V.: Goals WEIGHTED ^a CLUSTERING ON PLAYERS	(1b) Dep. V.: Goals FIXED EFFECT	(2a) Dep. V.: Goals WEIGHTED ^a CLUSTERING ON PLAYERS	(2b) Dep. V.: Goals FIXED EFFECT	(2a) Dep. V.: Assists WEIGHTED ^a CLUSTERING ON PLAYERS	(2b) Dep. V.: Assists FIXED EFFECT	(2a) Dep. V.: Assists WEIGHTED ^a CLUSTERING ON PLAYERS	(2b) Dep. V.: Assists FIXED EFFECT
Independent Variables	Coeff. t-value	Coeff. t-value	Coeff. t-value	Coeff. t-value	Coeff. t-value	Coeff. t-value	Coeff. t-value	Coeff. t-value
A) SALARY								
RELATIVE VALUE _(t-1)	-0.632*** -5.15	-0.328*** -3.00	-0.518*** -4.33	-0.295*** -2.70	-0.544*** -4.68	-0.393*** -3.99	-0.463*** -4.05	-0.366*** -3.72
ABSOLUTE VALUE _(t-1)	-0.002 -0.02	-0.114 -0.93	0.061 0.47	-0.089 -0.73	-0.045 -0.32	-0.244** -2.22	-0.007 -0.05	-0.224** -2.03
SQ ABSOLUTE VALUE _(t-1)	-0.016*** -2.63	-0.011** -2.47	-0.013** -2.28	-0.010** -2.23	-0.012** -2.08	-0.005 -1.34	-0.009* -1.73	-0.005 -1.14
B) SOCIO- DEMOGRAPHIC								
AGE	0.479** 2.01	1.293*** 3.95	0.507** 2.12	1.232*** 3.79	0.200 0.96	1.137*** 3.85	0.220 1.06	1.088*** 3.70
AGE SQ	-0.008* -1.74	-0.025*** -5.45	-0.008* -1.89	-0.024*** -5.32	-0.003 -0.88	-0.021*** -5.27	-0.004 -1.01	-0.021*** -5.14
C) SITUATION								
CHANGED TEAM	-0.061 -0.24	-0.066 -0.40	-0.082 -0.33	-0.098 -0.59	0.131 0.74	0.109 0.72	0.109 0.63	0.087 0.58
D) TEAMMATES								
AGE			-0.190* -1.82	-0.044 -0.52			-0.095 -1.20	-0.045 -0.60
EXCHANGES			0.926*** 5.96	0.651*** 4.94			0.760*** 5.60	0.487*** 4.09
SENDING-OFFS			-2.075** -2.29	-1.694** -2.39			-1.198* -1.72	-1.343** -2.10
Team	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Position	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Saison	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test Salary	37.97***	7.85***	15.72***	6.85***	25.39****	9.48***	20.56***	8.38***
F-Test Teammates			31.79***	10.53***			13.91***	7.39***
Prob > F / Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-Squared	0.456	0.098	0.468	0.114	0.290	0.084	0.303	0.095
Groups		1040		1040		1040		1040
Number of Observations	2833	2833	2833	2833	2833	2833	2833	2833

Notes: Robust standard errors. ^a weighted variable: number of minutes played. *,** and *** denote statistical significance at the 10%, 5% and 1% level.

V. CONCLUSIONS

Conducting a panel analysis with empirical data from the German *Bundesliga* this paper investigates the determinants of individuals' performance in soccer - specifically the relationship between pay and performance. We have taken advantage of a rich data set covering 8 seasons between 1995/1996 and 2003/2004 which allows us conducting a panel analysis. Contrary to most of the previous soccer papers we neither take team performance nor team or individual salary but *individual* performance as dependent variable, measured with two important proxies (goals and assists made per season).

We have investigated whether there is non-linear pay-performance relationship in the *Bundesliga*. Our empirical results confirm such a relationship. Second, we have investigated the impact of the relative income level on players' performance assuming that not only salary in absolute terms, but also in relation to teammates counts. Despite a large literature on relative income and comparison effects, empirical evidence on the behavioral implications is hardly available. We have measured the relative income position in terms of the difference between teammates' average salaries and players' individual salary. However, the consequences for the pay-performance relationship are difficult to predict. As discussed in Section III of the paper, relative income effects may lead to an improvement or reduction of players' performance. Interestingly, our results clearly indicate that a bigger difference is connected to a lower performance, when controlling for the absolute income level and focusing on two different performance variables.

Third, we investigated the impact of team effects. Although it can be argued that it is obvious that team effects should matter in a team sport (or a team environment such as a project organization), studies that empirically quantify such effects are rare. Our results indicate that team effects are observable. The results suggest that a player who played in a team with more exchanges and less sending-offs *ceteris paribus* performs considerably better.

There is also the tendency that team effects are more important for goals than for assists.

We also find the tendency of an age effect when focusing on goals, but not when looking at assists. The age effect on goals scored has the tendency to be non-linear. The turning point is between 30 and 31 (depending on the regression). After this age, a greater experience is overshadowed by a lower physical performance. However, these results were not fully robust (age and age square are not statistically significant in all estimations). On the other hand, assists performances are not overshadowed by a decrease in the physical abilities over time.

Looking at our research findings it would be interesting to see whether similar observations can be drawn from other soccer leagues, other team sports, such as basketball, (ice) hockey, baseball, cycling or handball or even from the business practice. Small firms are perhaps the closest setting to team sports (see Idson and Kahane 2000), but results may also apply to relatively independent departments or project teams in larger firms. In such team environments positional concerns or envy and a non-linear salary-performance relationship seem to be reasonable. Along these lines, Frank and Sunstein (2001) report evidence that perceptions of the relative position have large effects on the employees' work morale. Elster (1991) provides real life examples of envy-avoidance and envy-reduction mechanisms. In addition, the effects of teammates' exchanges we observed in our analysis raise some interesting questions, for instance, whether the analogy to teams in a corporation can be drawn. Amongst others it would be interesting to investigate whether higher turnover in a working team enforces healthy competition among team members or rather destroys team cohesiveness diluting individual performance.

All in all, as demonstrated in the paper professional sports data offer the opportunity to investigate empirically under-explored economic areas and topics.

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APPENDIX

Table A1: Performances in the Top Five European Leagues.

	Serie A (ITALY)			La Liga (Spain)			EPL (England)			Bundesliga (Germany)			Ligue 1 (France)		
Season	Goals	Games	GPG	Goals	Games	GPG	Goals	Games	GPG	Goals	Games	GPG	Goals	Games	GPG
1995-1996	814	306	2.66	1244	462	2.69	988	380	2.6	831	306	2.71	863	380	2.27
1996-1997	805	306	2.63	1264	462	2.73	970	380	2.55	911	306	2.98	884	380	2.33
1997-1998	847	306	2.77	1009	380	2.65	1019	380	2.68	882	306	2.88	722	306	2.36
1998-1999	845	306	2.76	1003	380	2.64	959	380	2.52	866	306	2.83	723	306	2.36
1999-2000	765	306	2.5	996	380	2.62	1058	380	2.78	856	306	2.8	785	306	2.57
2000-2001	845	306	2.76	1095	380	2.88	992	380	2.61	897	306	2.93	767	306	2.51
2001-2002	806	306	2.63	961	380	2.53	1001	380	2.63	893	306	2.92	716	306	2.34
2002-2003	789	306	2.58	1016	380	2.67	999	380	2.63	821	306	2.68	837	380	2.2
2003-2004	816	306	2.67	1015	380	2.67	1012	380	2.66	909	306	2.97	884	380	2.33

Source: www.soccer-europe.com