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Egon Franck [a]; Stephan Nüesch [a]
[a] University of Zürich, Institute for Strategy and Business Economics, Zürich, Switzerland

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ARTICLE

Mechanisms of Superstar Formation in German Soccer: Empirical Evidence

EGON FRANCK & STEPHAN NÜESCH

University of Zürich, Institute for Strategy and Business Economics, Zürich, Switzerland

ABSTRACT Based on the competing theories of superstar formation proposed by Rosen (1981) and Adler (1985) it is controversial if first hand observable talent or other factors like past consumption and popularity influence stardom. This article investigates the emergence of superstars in German soccer. We use data on market values and individual player performance and publicity data to differentiate between Rosen's and Adler's theory of superstar formation. Running quantile regressions we find evidence that Adler's theory applies to German soccer stars. Therefore, not only investments in physical talent but also the cultivation of popularity is an adequate strategy for becoming a superstar.

Introduction

While clubs outbid each other and pay enormous transfer fees and salaries for so-called superstars, other players receive comparably low remuneration. But what makes a soccer player a superstar? In the literature there are basically two competing theories of superstar formation proposed by Rosen (1981) and Adler (1985).[1] Whereas Rosen (1981) stresses clearly observable talent superiority in order to explain the emergence of superstars, Adler (1985) maintains that besides talent, the player's popularity and fame as well increase stardom. Using data on individual market values and a set of personal characteristics of all soccer players appearing in the top level of the German league in the 2004–2005 season for more than 30 minutes, we differentiate between Rosen's and Adler's theory of superstar formation. Running quantile regressions we find empirical evidence that variables associated with Adler's theory contribute to the explanation of market value differentials in German soccer. Thus, besides investments in physical talent,

Correspondence Address: Egon Franck, University of Zürich, Institute for Strategy and Business Economics, Plattenstrasse 14, CH-8032 Zürich, Switzerland. Email: egon.franck@isu.unizh.ch

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the cultivation of popularity is another suitable strategy for becoming a superstar.

The remainder of this paper is organized as follows. Section 2 illustrates the two alternative theories of superstar formation. Section 3 presents the related literature. In Section 4 we outline our hypothesis. Subsequently, we explain the main features of the data and give some basic facts on German soccer. The variables and the method used as well as the results are presented in Section 6, with Section 7 drawing out overall conclusions.

Theories of Superstar Formation

Theories of superstar formation agree that superstars emerge in the provision of certain services where large economies of scale on the supply side are combined with high appreciation on the demand side.

The technology of soccer games facilitates the reproduction of the service at low cost. The cost of production is largely independent of the size of the audience (Lucifora & Simmons, 2003). Since most of the costs are up-front, average costs decrease with consumed output. Large soccer stadiums and various media allow many paying spectators to observe a soccer game simultaneously, while at the same time enabling teams to exclude non-paying customers. Thus, there are no issues of free riding due to non-exclusion. The World Cup, the European Championship or even just a game of the German Bundesliga can attract a remarkably large audience all over the world by television broadcast. As a result of these large economies of scale, only a few sellers are needed to serve the whole market. However, large economies of scale do not guarantee high salaries for a restricted number of players. In addition, players of this quality have to be perceived as very scarce so that demand becomes highly concentrated on their services (Rosen & Sanderson, 2001).

While on the supply side both Rosen (1981) and Adler (1985) agree on the necessity of large economies of scale, their explanation of the demand for superstar services is different. Rosen (1981) considers a performer's talent as costlessly observable to all potential consumers. Since lower talent is an imperfect substitute for higher talent, the artist or sportsman who has slightly higher talent than his competitors may attract the whole market demand under ceteris paribus conditions.

Adler (1985) explains the phenomenon of superstars as a learning process that occurs if consumption requires knowledge. A performer's talent is considered as a hidden characteristic rather than as a clear feature. Based on the notion of "consumption capital" introduced by Stigler and Becker (1977), Adler (1985) argues that appreciation increases with knowledge: "the more you know the more you enjoy" (Adler, 1985, pp. 208–209). Stigler and Becker (1977) use good music as an example of how past consumption activities lead to beneficial addiction through an accumulation of consumption capital. By having exposed themselves to good music in the past, consumers have built up consumption capital that enables them to derive more pleasure from listening to good music in the present. Adler

(1985) extends this well-known Stigler/Becker-framework by adding the element of discussing consumption with similarly knowledgeable individuals. A person interested in soccer may increase player specific knowledge by both watching games (Stigler/Becker-effect) and discussing the game with other people who know about it (Adler-effect). The more popular the sportsman in question is, the lower the searching costs to find competent discussants will consequently be. These positive network externalities explain why stars may even emerge among equally talented performers. Searching cost economies imply that one is always better off patronizing a well-known star as long as other sportsmen are not perceived as superior by an order of magnitude. Given that consumers face certain budget constraints, the more popularity a specific player already enjoys, the more player specific consumption capital will be accumulated. In Adler's theory the demand for superstar services depends both on hidden talent characteristics and on consumption capital which itself is affected by both past consumption (Stigler/Becker-effect) and the player's popularity (Adler-effect). Hence, a potential advantage in knowledge about the talent of a non-star would have to be balanced against the higher searching costs for discussants if one were to abandon the already popular star.

According to Adler (1985), luck (by luck, he means factors other than talent) determines who amongst equally talented people will snowball into a star. Stars may be born because initially (slightly) more people happen to know one player than any other players of possibly equal talent. However, more than twenty years later, Adler (2006) dismisses the idea of luck as the only possible mechanism driving the initial selection among equally talented people. Just as the suppliers in other businesses prone to superstar effects, sportsmen too do not usually entrust this choice to pure chance. Instead, they consciously use publicity, such as appearances on talk shows and coverage in tabloids, magazines and the Internet to strengthen their popularity. Adler (2006) emphasizes that the acquisition of consumption capital occurs not only by exposure to the activity itself, or through discussing it with friends or acquaintances, but also by reading about it in newspapers, magazines and the Internet.

Related Literature

The theories of superstar formation have their origin in the field of arts,[2] which was also the subject of various empirical investigations of superstar effects (see Hamlen, 1991, 1994; Chung & Cox, 1994). Schulze (2003), however, mentions that in sports the empirical analysis of the superstar phenomenon is even more promising, because in most sports talent is easier to measure than in art or entertainment activities.[3] Hausman and Leonard (1997) were the first to empirically analyze superstar effects in professional sports.[4] They found out that the mere presence of stars had a substantial positive impact on club revenues, even after controlling for team quality measured by the number of All-Star players in a team. By analyzing all NBA local and national television ratings as well as match attendances, Hausman

and Leonard (1997) identified that—back in 1993—the estimated value of Michael Jordan for the National Basketball Association (NBA) was $53 million.

Berri, Schmidt and Brook (2004) and Berri and Schmidt (2006) extended the work of Hausman and Leonard (1997) by investigating the two-sided relationship between match attendance and both team performance and the team's employment of star players in the NBA. Their results suggest that it is performance on the court, not star popularity, which attracts the fans. However, both papers only cover superstar effects on a team level and not on an individual basis. The question why superstars arise is not considered.

Using longitudinal individual data from two North American team sports leagues—the National Hockey League (NHL) and the National Basketball Association (NBA)—Frick (2001) analyzed the salary differentials between superstars—defined as players who received all-star vocations—and "bench-warmers". His results show that performance measures like the numbers of scores, rebounds, steals, assists or blocks are good predictors of the observed salary differentials. Frick (2001) found evidence for Rosen's explanation of superstars. However, a final answer whether Rosen's or Adler's theory of star formation applies is still open. His empirical investigation does not differentiate between these two standpoints, since variables measuring the Adler-effect are missing in the set of independent variables.

Lucifora and Simmons (2003) investigated wage determination looking for superstar effects among professional soccer players appearing in the Italian league. The authors used rare data on individual salaries as a dependent variable and individual performance indicators, experience, reputation and team quality as regressors. They found empirical evidence for Rosen's theory. Talent—measured by goals and assists—exercises significant influence on the skewness of the salary distribution of Italian forwards and midfield players. Lucifora and Simmons (2003) do not control for popularity.

Lehmann and Schulze (2005) tested the competing predictions of existing superstar theories in German soccer. Using three measures for individual player's performance (goals, assists and tackles) and an indicator for media presence (number of "hits" of a player's name in the online version of the *Kicker* sports magazine) they find that neither performance nor publicity can explain the salaries of superstars. Our study extends the paper of Lehmann and Schulze (2005) in several ways: Firstly, we divide a player's performance into firsthand observable talent measures which are identifiable without costs, and indirect quality measures capturing hidden talent characteristics. Secondly, indicators for past consumption and three different popularity measures that specify media presence in more than 20 German newspapers and magazines as well as publicity in the Internet are included. Thirdly, we use market values as endogenous variable since they are a proxy for the total value generated by a player. In this sense they can be interpreted as incorporating salaries, signing fees, bonuses, potential transfer fees and a remaining producer surplus. And last but not least, the analysis of our

unique data set delivers new results. We are able to find empirical evidence for Adler's superstar theory in professional team sports.

Hypothesis

Both Rosen (1981) and Adler (1985) believe that talent is an important determinant of stardom. However, while in Rosen's sense superstars necessarily have superior talent, Adler (1985) delivers an explanation which allows for the superstar phenomenon to arise even among equally talented people. Rosen (1981) treats talent as observable without cost by all economic agents, while Adler (1985) makes clear that superstars only exist if the consumption of their services requires knowledge. According to Adler (1985), a player's talent is a hidden characteristic that has to be discovered through personal and interpersonal learning processes. The appreciation of a particular player grows with the knowledge consumers have acquired about him. The assumption of observable talent marks a key difference between Rosen's and Adler's theory. The appropriateness of a certain theory, therefore, largely depends on the relevance of knowledge for consumption.

In individual sports talent is generally more observable than in team sports. In an Olympic 100 meter sprint final for example, there is less uncertainty about participants' talent than in a soccer game. Talent is clearly measured by milli-seconds which tip the scales between success and failure. Consumers do not need specialized knowledge to single out the best sprinter. In line with Rosen (1981) even small differences in talent are leveraged into disproportionate differences in earnings.

In team sports like soccer, however, every game is a team product. Team production is characterized by the fact that it is difficult to determine each individual's contribution to the output of the cooperating inputs (Alchian & Demsetz, 1972). Soccer is a highly interactive game based on the combination of complementary player skills. Together with relatively low scores and limited "set" plays, the interactivity does not facilitate decomposition, record and measurement (Carmichael, Thomas, & Ward, 2000, 2001). A playing team consists of one goalkeeper plus 10 outfield players who can generally be categorized as defenders, midfielders and attackers. A player's performance always depends on complementary skills of other team mates. Even the best goalkeeper hardly manages to impede opposition's goal scoring, if the defence is virtually nonexistent. Or even outstanding attackers become lame ducks if they are not supported by offensive passes of midfielders or defenders. In soccer, all outfield players are involved in all aspects of the game to varying degrees. A player's talent involves many hardly measurable capabilities like passing the ball to free-standing team-mates, retaining possession of the ball, running or dribbling with the ball, creating goal-scoring chances, tackling opponents, blocking or intercepting opposition's passes and shots, or clearing the ball from pressure situations (Carmichael *et al.*, 2001). The exact talent of a soccer player is fuzzy and requires much player specific knowledge to be properly discovered and assessed. We, therefore, expect German soccer players to be Adler stars

whose market values depend on hidden talent characteristics, past consumption of the consumers and the player's popularity.

Data and Basic Facts on German Soccer

In contrast to US leagues, which are generally "hermetic", the composition of European soccer leagues changes annually through promotion and relegation. The best teams from a lower league are promoted to the next higher league, while the weakest in the latter are demoted to the next lower league. Due to the profile of the first Bundesliga as the highest German soccer league, we rule out superstar status to players appearing in lower leagues. While the first Bundesliga had an average match attendance of 35,183 in the 2004–2005 season, the next lowest division only attracted 12,074 fans on average.[5] For the empirical analysis we concentrate, therefore, solely on players of the first division of the Bundesliga. Our sample contains all players who played for at least half an hour during the 2004–2005 season[6]—in total 427 players. These players or rather their teams generated an estimated turnover of €1.1 billion in the 2004–2005 season. The German league first division is the third largest European soccer league after the English Premier League and the Italian Serie A (Jones & Boon, 2005). We chose the German league because of its well documented games in the specialized press and two independent institutions that assess the market values of all players appearing in the first division. Data on a set of personal player characteristics (e.g., goals, assists, appearances, tactical position, team, age, or race) is available from two special editions of the *Kicker* soccer magazine covering the 2004–2005 season.

The analysis of the market values of 427 players appearing in the German first division reveals a highly unequal distribution with substantial skewness. The Gini-coefficient is 0.56, which indicates high inequality. Figure 1 illustrates the density allocation of the logarithm of the market values in the first German league during the 2004–2005 season.

The distribution of the logarithm of market values is skewed to the right. The fatter (upper) right tail indicates the presence of a restricted number of players with very high market values. While the median player is valued €1.25 million, star players at the 95% quantile are exchanged for €9 million. The market value of Michael Ballack, who was the winner of the "Player of the Year"-award[7] in the 2004–2005 season, amounts to €30 million. This corresponds to 600 times the lowest market value in the sample equaling €0.05 million. The skewness of the distribution is lower than in many individual sports like for example in tennis,[8] but higher than in other team sports like in American football, baseball, hockey or basketball.[9] The earnings distribution in individual sports is expected to be more skewed than in team sports, because in individual sports no prize money awaits the player coming last, but at least a minimum salary is available to rookies in team sports (Scully, 1995). The fact that the distribution of market values in European soccer is more skewed than the distribution of salaries in typical

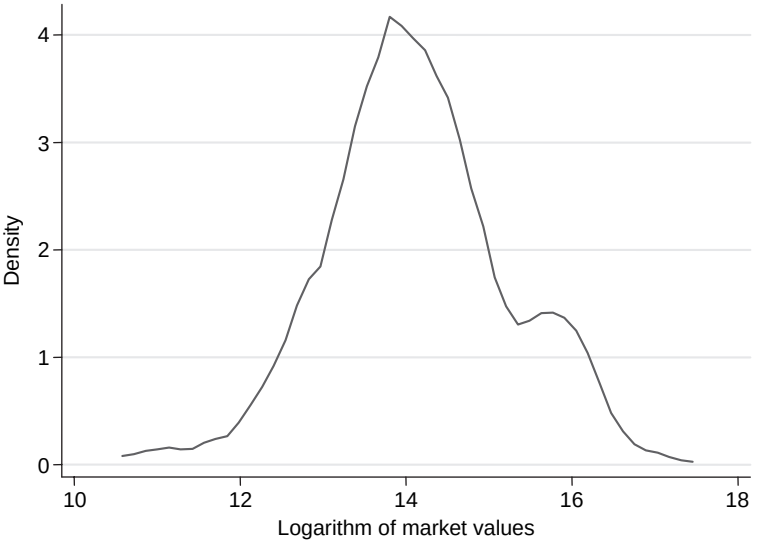

Figure 1. Density allocation of logarithm of market values

US team sports at least partly depends on the different institutional restrictions in the US leagues (e.g., salary caps).

Empirical Framework

Dependent Variable

The dependent variable in our study is the logarithm of a player's market value at the end of the 2004–2005 season. The used market values are estimated by industry experts of a team independent institution that runs the webpage www.transfermarkt.de.[10] The market values used not only incorporate salaries but also signing fees, bonuses, transfer fees and a remaining producer surplus. They reflect the total value generated by a particular player for his team and equal, therefore, the team's maximal willingness to pay. The player himself appropriates a part of this value through salary payments, bonuses and signing fees,[11] whereas the selling club receives potential transfer fees. The buying club retains a possible producer surplus. However, the market values do not include individual endorsement fees. In order to explore the reliability of our market value data, we compared it with the market values provided by a second independent source, namely the *Kicker* soccer magazine. The two estimations are strongly correlated (correlation is 0.89), which indicates high reliability.[12] Both data sources have been widely used for empirical research studies in the past (see Eschweiler & Vieth, 2004; Hübl & Swieter, 2002; Lehmann & Weigand, 1999; Lehmann & Schulze, 2005; Torgler, Schmidt & Frey, 2006).

Independent variables. We distinguish between four groups of independent variables: talent variables, variables of past consumption, popularity variables and control variables. While the first three groups of variables are employed to differentiate between the Rosen-, Stigler/Becker- and the Adler-effect, the control variables are used to eliminate alternative explanations such as age, contractual status, race, and club or position characteristics.

In soccer, one performance characteristic that is clearly identifiable and measurable is goal scoring. The number of goals scored by each team of a particular fixture including those unintentionally scored by the opponent team determines the result of a game. Goal scoring and preventing the opposition to score are the critical success factors in a soccer game. Even though there are many constructive elements in a game which enable the teams to score goals, the public's attention is largely concentrated on the players who finally score. There is no need for specialized consumer knowledge in order to ascertain the goal scorer. Since the sequence of goal scoring is replaid and analyzed several times in the live broadcast of a game, in the television newscast or on large screens in modern stadiums, not only the goal scorer but also the player making the final pass (called assist) prior to a goal being scored is easily identified. Thus, we label GOALS and ASSISTS as firsthand observable talent measures, because they are clearly identifiable and measurable by the spectators without requiring significant specialized knowledge. They fit into Rosen's conception of talent that is based on factors observable without cost. In contrast to the study of Lucifora and Simmons (2003) our firsthand observable talent measures GOALS and ASSISTS are not constructed as per game ratios, because the mere fact of low appearances should not have a positive impact on these performance measures. According to the law of large numbers, starters would have a lower chance to randomly achieve high scores than newcomers if the firsthand observable talent measures were per game ratios. As an observable talent measure for goalkeepers we used OPPGOAL counting the number of opponent's goals per game of a particular goalkeeper. Here we employed OPPGOAL as per game ratio to control for the effect that the number of opponent's goals increases on average with the number of appearances, even though the latter is generally a sign of high talent.

A different set of talent variables is needed to control for the possibility that soccer celebrities are Adler stars. According to Moshe Adler talent is not easily identifiable or observable. It is rather hidden and requires, therefore, specialized knowledge to be properly evaluated. Talent involves many hardly measurable factors like, e.g., physical characteristics, fitness, form, technical and social abilities and motivation. Thus, assessing a player's true talent may imply a learning process that requires a lot of observations, reading and discussions with other competent individuals. In order to handle this complexity, consumers often rely on indirect talent indicators like expert opinions. Reinstein and Snyder (2005) show that expert opinions are an important source of "product" information especially for goods with high quality uncertainty. In European soccer, so-called expert opinions often

appear as comments by professional critics or journalists. They deliver valuable information that help consumers to indirectly assess a player's talent.[13]

We use three different expert appraisals as Adler talent variables in our study: average match evaluation published by the *Kicker* soccer magazine (GRADE), votes for the "Player of the Year"-election among sports journalists (PLAYOTY), and membership of the national team (NAT). In German soccer every match performance of a player who plays more than half an hour is individually evaluated by sports experts. The grades, which are published in the *Kicker* soccer magazine, vary between 1.0 (excellent) and 6.0 (very bad). But since we use the average grade of all evaluated match performances in our study, the variable GRADE spreads only from 2.5 to 5. The *Kicker* soccer magazine also organizes an annual voting for the "Player of the Year". At the end of the 2004–2005 season approximately 3400 sports journalists were asked to vote for any player in the German league or any German player in any other league. PLAYOTY measures how many votes a player received. In total 995 valid votes entered the investigation. Compared to the variable GRADE the measure PLAYOTY considers more general overview impressions of players than precise match analyses. A further indicator of exceptional talent is the membership of the national team. The national coach and his assistants screen potential players and select the most talented ones to form an excellent team for international team competitions like the European Championship or the World Cup. The membership in the national team is thus a sign of a remarkably high talent.[14]

The variables measuring appearances in the first German league during the 2004–2005 season (APP) and prior to that season (PRIAPP) are used as proxies for past consumption. According to Byers, Peel and Thomas (2001) spectators range in type from the committed regulars, who make up the "core" of attendance, to the "floaters" whose attendance is determined by the attractiveness of a particular fixture. Since the percentage of attendance having a season ticket varies between 10% and 40% (Roy, 2004), we assume that the "core" supporters attending match after match regardless of the team's current form or star attraction is small. Most of the fans are "floaters", however, within the same league. Potential accumulated knowledge, therefore, depends on the number of appearances in the first German league.[15] The more often a particular player appeared on field, the higher is the expected consumption capital a fan may have accumulated. Not only the current productivity attracts fans but also memories of past performances (Rosen & Sanderson, 2001). In order to specifically analyze the consumption capital of the "core" of a team support, we also experimented with the separate effect of appearances for the present team only. This effect, however, was not significant, which is in line with the findings of Lehmann (2000). Unfortunately, more detailed variables measuring past consumption are not available. It is impossible to quantify the amount of time effectively used by all potential spectators in watching a particular player. As a result of missing alternatives we use APP and PRIAPP although potential distortion

could result from a direct talent enhancing effect due to greater field experience.[16]

The Internet offers new and promising indicators of the popularity of a player. We collected data about whether a player has a personal homepage (HOMEP) which provides the opportunity to directly address large groups[17] with personal statements, personal characteristics or club information. In summer 2005, 23% of the players already ran a personal homepage and several planned to start one. We held an extensive interview with the head of a company that operates every fourth homepage in our sample.[18] He told us that the main reason why players instruct him to design and operate a personal Internet platform is to have a channel of information which is controlled by the player and serves, therefore, to allow oneself to be promoted in the right light. Nowadays, personal Internet platforms seem indispensable in comprehensive public relation activities in order to increase one's own popularity. General publicity in the Internet was measured by the logarithm of hits given by the *Google* search engine (LNGOOGR) searching for "name" and "Bundesliga".[19] If there were multiple players having the same name, we also included the first name in the search job too. Thus, we minimized potential distortion to an acceptable level. In addition, we analyzed the media presence in the German press. The variable PRESS indicates how often players are cited by surname and first name[20] in over 20 German newspapers and magazines between the first July 2004 and 30th June 2005.[21] In Table 1 the whole set of variables as well as the descriptive statistics are listed.

We use several control variables to eliminate alternative explanations, such as age, contractual status, race, team effects or position effects. We control for age (AGE) because several studies show that a player's age has a positive but diminishing impact on salaries (Frick, 2001; Lehmann & Weigand, 1999; Lehmann & Schulze, 2005; Lucifora & Simmons, 2003). To capture this nonlinearity we also control for age square (AGESQ). Even though empirical studies of North American Major Leagues typically do not include both appearances and age, in European soccer it is appropriate to utilize age and appearances separately, because players are not drafted and can, therefore, enter the industry at many different ages. Using age and experience together does not generate multicollinearity to an extent to be worried about (see Table 3).

In addition, we control for the contractual status of a player using two dummy variables. The first dummy variable (LASTY) indicates if the contract ends in summer 2005 (coded 1) and the second (LASTBOY) if the player contract ends in summer 2006 (coded 1). The impact of contract duration on market values is controversial: some scholars (see Lehn, 1982; Scoggins, 1993) argue that guaranteed multi-year contracts reduce player effort due to a moral-hazard effect while others (see Kahn, 1993; Maxcy, 2004) argue that only the better players receive comparably long contracts (self-selection effect).

Two dummy variables concerning a player's race are included: FOREU coded 1 for European players that are not German and FORNONEU coded

Table 1. Variables and descriptive statistics

Variable	Description	Mean	SD
Dependent variables			
LNVALUE	Logarithm of a player's market value	14.13	1.09
Independent variables			
Talent variables			
Firsthand observable talent measures:			
GOALS	Goals	2.07	3.46
ASSISTS	Assists	1.75	2.50
OPPGOAL	Opponent's goals per game of a goalkeeper	0.12	0.42
Indirect talent measures:			
GRADE	Average match grade by the *Kicker* sports magazine	3.77	0.46
PLAYOTY	Votes for the "Player of the Year"-election for the 2004–2005 season	2.09	25.69
NAT	Membership of the national team (dummy)	0.32	
Proxies for past consumption			
APP	Appearances in the 2004–2005 season	19.33	9.94
PRIAPP	Accumulated appearances prior to the 2004–2005 season	67.23	76.91
Popularity variables			
HOMEP	Personal homepage (dummy)	0.23	
LNGOOGR	Logarithm of results of the google search	9.32	1.10
PRESS	Citations in over 20 German newspapers and weekly magazines	155.83	266.35
Control variables			
AGE	Player's age	27.31	4.18
AGESQ	Squared term of AGE	763.39	232.12
LASTY	Contract ends in summer 2005 (dummy)	0.34	
LASTBOY	Contract ends in summer 2006 (dummy)	0.27	
FOREU	Foreign player from a European country (dummy)	0.41	
FORNONEU	Foreign player from a non-European country (dummy)	0.12	
ATTACKER	attacker (dummy)	0.24	
DEFENDER	defender (dummy)	0.33	

Note: The model also includes 17 team dummies that are not reported.

1 for non-European players. Since cost considerations (screening costs, mobility costs, communication costs, etc) would seem to favour the hiring of a German player given two equally talented players, we predict that non-German players who actually got engaged in the German league have superior talent and thereby higher market values. In addition, the variable FORNONEU also controls for the effect that German teams are still not allowed to select more than three non-Europeans to play simultaneously in a

game. By restricting the number of non-European players, this regulation has the effect that only the very best from the talent distribution of non-Europeans will be employed at all.

We take account of team-specific effects by using team fixed effects estimations assigning unobserved team effects to team dummies. Team effects are supposed to have significant influence on player market values (Idson & Kahane, 2000). Somebody who is in the squad of the team winning the championship enjoys much greater publicity and finances than someone in the team being relegated to the next lower league. Position dummies are used to control for specific effects resulting from the tactical position of a player. Lehmann and Weigand (1999) for instance find evidence that in the German league midfielders earn significantly more money than other players.

Results

A standard approach is to specify the unknown parameters of a linear regression using the method of ordinary least squares (OLS) or least absolute deviation (LAD). Both methods lead to an approximation to the mean (OLS) or median (LAD) and represent the ''averaging'' behaviour or the ''central'' tendency of a conditional distribution. However, they tell little about the tail behaviour (Kuan, 2004). The ordinary least squares (OLS) procedure that tests on the mean value will, therefore, not be able to capture the superstar phenomenon correctly (Lehmann & Schulze, 2005). The quantile regression approach, originally developed by Koenker and Bassett (1978), allows characterizing a particular point of the conditional (asymmetric) distribution. It minimizes an asymmetrically weighted sum of absolute errors, where the weights are functions of the quantile of interest. The standard errors are estimated using the bootstrap procedure.[22]

Table 2 illustrates the estimates of the logarithm of a player's market value running different quantile regressions. Sherwin Rosen defined superstars as ''the relatively small numbers of people who earn enormous amounts of money and dominate the activities in which they engage'' (Rosen, 1981, p. 845). Obviously Rosen (1981) bases his definition of superstardom on the distribution of earnings among the suppliers of a certain good or service. However, Rosen does not propose a clear percentage number as ''boundary'' between ''normal'' suppliers and superstars. We, therefore, decided to analyze different quantiles in order to examine the robustness of the results. In addition, we also present the OLS estimates with White-robust standard errors as comparison. Table 2 shows that the coefficients generally loose statistical significance by moving from OLS to quantile regression (see also Schulze & Lehmann, 2005). Whereas the number of goals scored and the opponent's goals per game of a goalkeeper significantly influence the market values on the mean, the same does not hold for the top 10%, 5% or 2% quantiles. The observable talent measures (goals, assists and opponent's goals per game of a goalkeeper) do not significantly affect the market values

Table 2. Estimates of the logarithm of a player's market value

	OLS		90% quantile		95% quantile		98% quantile	
Variable	β-coef.	Std. Error	β-coef.	Std. Error	β-coef.	Std. Error	β-coef.	Std. Error
GOALS	0.0179^{+}	0.0120	0.0227	0.0211	0.0219	0.0237	0.0221	0.0227
ASSISTS	0.0125	0.0152	0.0088	0.0236	0.0022	0.0274	0.0135	0.0282
OPPGOAL	−0.1748*	0.0822	−0.0815	0.1449	−0.1476	0.1492	−0.1371	0.1617
GRADE	−0.426**	0.0931	−0.3397*	0.1458	−0.3393*	0.1538	−0.3029*	0.1589
PLAYOTY	−0.0001	0.0006	−0.0021	0.0071	0.0005	0.1605	0.0003	0.0071
NAT	0.1338*	0.0680	0.0239	0.1494	0.0523	0.1605	0.1002	0.1612
APP	0.0294**	0.0039	0.0176**	0.0067	0.0156*	0.0077	0.0136*	0.0078
PRIAPP	−0.0009*	0.0005	−0.0017^{+}	0.0010	−0.0015^{+}	0.0011	−0.0012	0.0011
HOMEP	0.1609*	0.0740	0.2332*	0.1146	0.2068^{+}	0.1291	0.1159	0.1419
LNGOOGR	0.0944*	0.0447	0.0988^{+}	0.0628	0.1413*	0.0636	0.1492*	0.0708
PRESS	0.0007**	0.0002	0.0012**	0.0004	0.0010**	0.0004	0.0009*	0.0004
AGE	0.6225**	0.0806	0.6139**	0.1395	0.4982**	0.1623	0.4494**	0.1705
AGESQ	−0.0115**	0.0014	−0.0114**	0.0025	−0.0093**	0.0029	−0.0085**	0.0031
LASTY	−0.0928	0.0761	0.0052	0.1176	0.0365	0.1302	0.0310	0.1326
LASTBOY	−0.0567	0.0776	−0.0627	0.1178	−0.0720	0.1216	−0.0776	0.1366
FOREU	0.3130**	0.0850	0.3953**	0.1331	0.3706*	0.1483	0.3609*	0.1495
FORNONEU	0.4042**	0.1010	0.2618	0.1889	0.2853	0.2103	0.3155	0.2150
ATTACKER	−0.1016	0.0948	0.1404	0.1660	0.2406	0.1770	0.2360	0.1820
DEFENDER	−0.0398	0.0722	0.2412^{+}	0.1266	0.2476^{+}	0.1395	0.2596^{+}	0.1474
Constant	5.8471**	1.0685	0.6430**	2.0741	7.7799**	2.3423	9.3597**	2.5219
Team fixed effects	yes**		yes*		yes^{+}		yes**	
Pseudo R^2	0.72		0.56		0.57		0.61	
Number of observations	427		427		427		427	

Note: Significance levels: $^{+}$10%, *5%; **1%; Significance tests are one-tailed for directional independent variables and two-tailed for control variables.

of stars. This result does not change if interaction terms between GOALS and ASSISTS with tactical position dummies are included. Thus, not even the market values of forwards are driven by firsthand observable scores but rather by indirect talent measures like, e.g., the *Kicker* grade. If the average grade of the match evaluations given by *Kicker* sports journalists is one score better, this increases the star's value by more than 30%.[23] The coefficient of the variables PLAYOTY and NAT have the expected positive sign; however, both variables are statistically insignificant regarding the quantile regressions. It seems that accurate match evaluations better detect and represent the talent of a star player than the rather global judgments of sports journalists or of national team coaches.

Analyzing the variables of past consumption, we see that the number of appearances in the 2004–2005 season (APP) correlates with the dependent variable at least at a 5% significance level. The stronger fans specialize on a particular star player, the higher the appreciation of this player gets. The coefficient of the variable PRIAPP measuring prior appearances is negative (at the 10% level of significance or lower). It seems that only recent experience displays positive influence on market values.[24]

A special focus of our study lies on the popularity variables. Table 2 shows that all popularity measures used in our study have the expected positive impact on a star's market value. For star players in the 95% quantile, the existence of a personal homepage (HOMEP) increases market values by 20.7%. One percent more hits in the *Google* search enhance the demand by 0.14%, and every press citation leads to an increase of 0.1%. This means that the media presence of star players significantly enhances their market values even when all the talent and performance variables are held constant. Therefore, we find evidence that Adler's theory of superstar emergence is supported for German soccer stars. It seems that the hardly measurable task of soccer players requires player specific knowledge in order to be properly evaluated and appreciated. Hence, the demand for a star player is not only determined by his talent, but also by his popularity and the past consumption opportunities for the fans.

The significant influence of the control variables AGE and its square confirms what a general human capital earnings function would predict: The market value of a star player rises with age but at a decreasing rate. The turning point for star players slightly increases if the star definition is modified to encompass 5% or even 10% of the players. A superstar at the 98% quantile reaches his personal peak already at the age of 26.4, while a star at the 90% quantile arrives at the maximum strength at the age of 26.9. Beyond that age, higher consumption capital is in general offset by worsening talent concerning physical performance, reduced speed and fitness. The analysis of the control variables FOREU and FORNONEU confirms our prediction that overall non-German players have higher market values than German players. The premium for non-German European star players is even higher than for non-Europeans. The latter coefficient though is not significant regarding the chosen quantile regressions.

Table 3. Pearson correlation coefficients ($n = 427$)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 GOALS	1.000																		
2 ASSISTS	0.624	1.000																	
3 OPPGOAL	−0.161	−0.190	1.000																
4 GRADE	−0.201	−0.251	−0.349	1.000															
5 PLAYOTY	0.345	0.293	0.080	−0.357	1.000														
6 NAT	0.280	0.270	−0.142	−0.147	0.145	1.000													
7 APP	0.441	0.494	−0.054	−0.312	0.287	0.259	1.000												
8 PRIAPP	0.079	0.175	0.039	−0.202	0.113	0.095	0.298	1.000											
9 HOMEP	0.172	0.278	0.057	−0.172	0.294	0.199	0.251	0.266	1.000										
10 LNGOOGR	0.382	0.392	−0.040	−0.258	0.343	0.279	0.467	0.368	0.340	1.000									
11 PRESS	0.477	0.339	−0.003	−0.303	0.521	0.301	0.359	0.321	0.345	0.497	1.000								
12 AGE	0.023	0.050	0.164	−0.114	0.075	0.010	0.200	0.573	0.040	0.110	0.093	1.000							
13 AGESQ	0.009	0.039	0.176	−0.125	0.076	−0.005	0.185	0.581	0.039	0.103	0.090	0.996	1.000						
14 LASTY	−0.043	−0.075	0.026	0.085	−0.033	0.009	−0.072	−0.009	−0.061	−0.033	−0.068	0.198	0.193	1.000					
15 LASTBOY	−0.032	0.036	−0.040	0.069	−0.001	−0.054	−0.018	0.091	0.030	−0.017	−0.001	−0.060	−0.058	−0.443	1.000				
16 FOREU	0.042	0.028	−0.153	0.147	−0.097	0.250	−0.020	−0.104	−0.137	−0.054	−0.132	0.152	0.141	0.104	−0.005	1.000			
17 FORNONEU	0.136	−0.075	−0.106	0.001	0.008	0.108	0.041	−0.046	−0.008	0.081	0.131	−0.052	−0.063	−0.041	−0.080	−0.335	1.000		
18 ATTACKER	0.380	0.181	−0.156	0.210	0.025	0.079	0.028	−0.090	0.047	0.040	0.083	−0.126	−0.134	−0.049	0.071	0.102	0.110	1.000	
19 DEFENDER	−0.276	−0.287	−0.193	0.044	−0.073	−0.035	−0.102	−0.065	−0.105	−0.114	−0.111	0.003	0.003	0.001	−0.105	−0.010	0.014	−0.394	1.000

Since we have both observable and hidden talent variables, we have to respond to the issue of multicollinearity. Table 3 thus provides a correlation matrix which shows that a correlation above 0.7 is found only for AGE and AGESQ. Since the Variance Inflation Factors (VIFs) for all regressors except AGE and AGESQ are well below 10, we are not concerned with multicollinearity due to different operationalizations of a player's talent in our model.[25] Despite the high correlation between AGE and AGESQ we do not drop AGESQ from our model for two reasons: Firstly, even high multicollinearity (as long as it is not perfect) does not violate unbiased estimates. Actually, worrying about high degrees of correlations between the independent variables is really no different from worrying about a small sample size: both work to increase the variance of the coefficient estimates and might lead to statistical insignificance (Wooldridge, 2003). However, in our model both AGE and AGESQ display high significance. Secondly, a general Mincer-type human capital formulation expects that player salaries increase with age at a decreasing rate and that salaries would fall with age as players experience declining speed and athleticism (Lucifora & Simmons, 2003). Thus, dropping the variable AGESQ would lead to biased estimates, because it really belongs to the model.

Whenever correlational designs are used, concerns about internal validity such as possible reverse causality may be raised as well. However, since most of the independent variables concern the whole 2004–2005 season, while the market values were estimated at the end of the 2004–2005 season, the issue of reverse causality is appeased by this lag structure.

Conclusion

Rosen's theory of superstar formation stressing the importance of firsthand observable talent is not supported for German soccer stars. Easy measurable and identifiable talent indicators like goals and assists have no significant impact on their market values even if only attackers or midfielders are considered. The specific contribution to a soccer game and hence the exact talent of a star player is indeed difficult to determine. A soccer match is a typical team product. It seems that the assessment of soccer players requires specific consumption capital as stipulated by Adler's theory of superstar emergence. The market values of German soccer stars are better predicted by expert evaluations revealing hidden talent characteristics than by firsthand observable talent measures. We also find clear empirical evidence that both past consumption of the spectators (Stigler/Becker-effect) and the player's popularity (Adler-effect) are significant predictors of the stars' market values. Media presence which is a good proxy of the player's popularity clearly increases the demand for star players. This implies that even mediocre players might reach stardom thanks to their popularity. Soccer stars may have a "personal appeal" that activates fan interest above and beyond actual playing ability. We believe that the predictive power of the popularity measures is even underestimated in our study, because the used market values did not include any individual endorsement fees which are

highly contingent on a player's popularity. According to Adler's superstar theory, two different strategies for becoming a superstar arise: players can either intensify their investments in physical talent in order to receive better expert appraisals and/or they can make higher popularity investments.

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Notes

1. MacDonald's theory of superstar formation is not treated separately in this paper, since he basically presents a dynamic version of Rosen's superstar model (MacDonald, 1988).
2. Rosen (1981) uses examples of full-time comedians or classical music, and Adler (1985) mentions singing and painting as artistic activities generating superstars.
3. Seaman (2003) analyzed the similarities between the arts and the sports literature. He strongly suggests fruitful collaboration and extensive cross-referencing between these two areas of application.
4. Scott, Long and Somppi (1985), Brown, Spiro and Keenan (1991), as well as Burdekin and Idson (1991) already controlled for the effect of a team's star attraction in their analyses of match attendance prior to Hausman and Leonard (1997). However, they did not emphasize the superstar effects. Of these studies only Brown *et al.* (1991) were able to find a statistically significant relationship between a measure of consumer demand and a team's star attraction.
5. Average match attendance was calculated by the *Kicker* soccer magazine.
6. Unfortunately, we were not able to include further seasons because popularity data on previous seasons was only partially available.
7. "Player of the Year" is an award assigned by sports journalists to the best player in the German league or the best German player in any other league.
8. In 1997 Kubat (1998) calculated a Gini-coefficient of 0.73 for the distribution of prize money to tennis players.
9. Scully (1995, p. 74) provides an extensive analysis of the distribution of player earnings in the US Major Leagues: The listed Gini-coefficients for the US Major Leagues vary between 0.22 (Hockey, 1978) and 0.51 (Baseball, 1990).
10. The same data source was also used by Eschweiler and Vieth (2004) or Torgler, Schmidt and Frey (2006).
11. Unfortunately data relating to salaries, signing fees, bonuses, or transfer fees are not available on a grand scale. In the 1999–2000 season, salary data of players appearing in the German league was collected and published in a special edition of the magazine *Sportbild* (Lehmann, 2000; Schulze & Lehmann, 2005) and in the newspaper *Welt am Sonntag* (Kern & Süssmuth, 2005). However, these salaries did not include any bonuses, signing fees, or transfer fees.
12. In addition, the Pearson χ^2 independence test rejects independency at the 0% level of significance. Thus, the two institutions seem to deliver corresponding data. However, having only estimations we cannot prove that the data used were totally free from arbitrariness.

13. Of course, the evaluations of sports journalists do not necessarily depend on the same criteria as those employed by coaches and club managers.
14. We also tried to weight the national membership dummy with the *FIFA*-ranking of the particular team in order to consider quality differences between national teams. However, this did not change our results in any significant way. Due to the ease of interpretation we use the unweighted dummies.
15. We assume that past consumption of player performances in foreign leagues is negligible.
16. Lucifora and Simmons (2003) used the number of appearances as a variable measuring the experience of a player.
17. The homepages of well-known players are visited more than 100'000 times a month.
18. The interview was held on 18th August 2005.
19. Both data on homepages and the results of the Google search were collected between 25 and 30 August 2005.
20. This way we minimize the distortions coming from the short match reviews in which players are quoted only by name. We excluded citations by name alone in order to prevent issues concerning multicollinearity with appearances and scores.
21. The database used contained quality nationwide newspapers (including Frankfurter Allgemeine Zeitung, Süddeutsche Zeitung, Stuttgarter Zeitung, Hamburger Abendblatt, Die Welt, taz, Berliner Morgenpost, Financial Times Deutschland) and weekly magazines (including Der Spiegel, Stern, Bunte).
22. We ran 1000 replications so that the estimates of standard errors are rather stable (see Koenker & Hallock, 2000).
23. However, we have to be cautious with the generalization of the interpretation, since it implies that a person who happens to be in a specific quantile of one conditional distribution will also find himself in the same quantile had his independent variables changed (Buchinsky, 1998).
24. Appearances can also be interpreted as an indicator of the star's (not the consumers') experience that might be subject to diminishing (or even negative) returns.
25. A commonly given rule of thumb says that only VIFs above a value of 10 may be a reason of concern (see Williams, 2006).

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