Superstar Effects in Sport

Evidence From Italian Soccer

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This article investigates wage determination among professional soccer players appearing in the Italian league. Given the popularity of "top" soccer players, the relationship between individual productivity and pay can lead to "superstar" effects. In that context, the marginal revenue product of a soccer player is related to the extra price that a spectator is willing to pay to see him play (live or on television) times the number of spectators who are attracted. The authors use rare data on individual earnings and other personal characteristics of a set of soccer players in the 1995-1996 Italian league season to estimate human capital earnings equations and test for superstar effects in wage determination via convexity of earnings in performance. Earnings are found to be highly convex in two performance measures after controlling for a set of personal characteristics and team fixed effects.

Keywords: *earnings; soccer; superstar effect*

One fact that characterizes modern labor markets is the very high earnings that some professions command. Of course, the scarcity of talents should be able to account for the large differences in pay for some workers. In most professions, however, even very talented workers—Nobel prize winners, for example, who can expect to earn much higher salaries as compared to most of their workmates—compare unfavorably with the very high earnings professions—like movie stars

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(see Nelson, Donihue, Waldman, & Wheaton, 2001). The fact that a few individuals in selected professions can enjoy huge salaries has been denoted in the economic literature as the "superstar" phenomenon (Rosen, 1981). Casual observation suggests that superstar effects are most likely to be observed in the entertainment business and in professional sports (Adler, 1985; Fort & Quirk, 1995).

So why is it that some professional sportsmen and media stars earn very high salaries whereas even more talented workers in other fields do not get as much? Economists characterize the situation as evidence of "scarcity rents."[1] In a seminal paper, Rosen (1981) showed how human capital interacts with production technology so that small differences in talent become magnified into large differences in earnings. In particular, Rosen discussed the role that nonconvexities in production may have on the distribution of revenues. He showed how the interaction between technology and demand can create the opportunity for even small differences in talent—that is, professions in which "talent" is highly valued by consumers—to determine disproportionate differences in earnings. It is scale economies that facilitate such high potential earnings. In sport and media professions, consumers' demand for excellence has a significant role in determining the market value of the products offered by the most talented individuals. In (professional) sports, for example, the marginal revenue product of a player is related to the (extra) price that a consumer is willing to pay to see him or her play (live or on television) times the number of consumers. Clearly, the increase in demand is not driven by the price mechanism; it is the reputation effect that a superstar's talent has in attracting large audiences that dominates. As long as most soccer fans agreed—in Italy, back in 1995—that Baggio was one of the very best players, he was able to earn salaries far larger than those earned by other players who were only slightly less talented. Reputation effects are not the only explanation of why large differences in earnings are found among professional soccer players. Technology facilitates the reproduction of the product at low cost, and this, together with consumer demand, permits expansion of the market (Rosen, 1981). Soccer matches can be seen in large stadiums by many (paying) spectators simultaneously; second, media coverage has significantly increased the scope of these events in recent decades. A World Cup Championship or European Cup Final or even just a *serie A* league match can attract a remarkably large audience all over the world. It is large audiences generated both by television broadcasts and by attendance at games, together with consumers' perceptions that other players are imperfect substitutes, that generate superstar rents.[2] The marginal cost of television broadcast of a serie A soccer match is zero with duplication of the service. As with other forms of entertainment, live broadcasts of soccer matches have the potential to reach a vastly greater number of spectators than are present inside the stadiums.

There some factors that might moderate the extreme earnings of soccer players relative to, say, movie stars and pop singers. First, soccer fans usually declare allegiance to teams rather than individual players. Associated with this, there might be

a lack of consensus about who the best players really are, because fans of Juventus are unlikely to fully acknowledge the ability of a player from Internazionale. Second, there may be difficulties in separating an individual's contribution from the team, which mean that quality differences cannot be easily assessed by consumers. Third, fans may have different tastes for different styles of play, for example, as between physical aggression and elegant passing play. Fourth, in professional soccer, each match is different and, most important, consumers value "live" performances (whether on television or at the stadium) far more than video replays. Hence, although soccer superstars can reach very large markets at a relatively low price, the argument that zero marginal cost of production is an important feature of superstar effect may be less relevant in the context of soccer than for popular musicians and actors who reach their audiences via recorded work. Hence, the appearance of superstar effects in a sports league is not self-evident and should be tested in an appropriate empirical framework.

In this article, we develop such an empirical framework with which to test for superstar effects in team sports. A characteristic of industries with superstar effects on earnings is that wages are highly convex with respect to performer "quality" as perceived by consumers. In a sports league, it is not clear which performance characteristic, if any, is valued by consumers in a manner that leads to superstar effects in wage outcomes. We apply our empirical strategy to wage determination of professional soccer players contracted to teams in the Italian serie A and B. We use data on individual earnings and other personal characteristics of Italian soccer players in the 1995-1996 season to estimate human capital earnings equations in which performance variables play a key role.[3] In the context of Italian soccer, we demonstrate that salaries are highly convex in terms of measures of goals scored per games played and assists, denoted as number of final passes leading to goals scored. Thus, we demonstrate that superstar effects exist, because of the high degree of convexity, and appear to be generated by consumer (fan) interest in forward players who are high scoring or who have an unusually high rate of assists. This key result is found by inspection of the relevant marginal effects on wages from these performance indicators.

The article contributes to the existing literature by presenting an empirical framework for investigating superstar effects. This is then fitted to a unique data set of professional soccer players appearing in Italian soccer. The presence of superstar effects in wage determination is tested for, using information on individual earnings as well as a set of indicators of individual and team performance.[4] Our results show that significant superstar effects are present in Italian soccer.

The article is organized as follows. In the next section, we briefly describe the structure of Italian (professional) soccer and present the main features of the data used. After that, we discuss the empirical strategy and the econometric specification. We then present the main results. The last section concludes.

DATA AND STYLIZED FACTS ON ITALIAN SOCCER

Italian (professional) soccer is structured along three major divisions (serie): A, B, and C; however, only the first two (A, B) can be really considered as composed of "professional" players, and player characteristics relating to serie C are not considered here. Serie A comprises 18 clubs, whereas 20 clubs make up serie B. Team membership in the divisions is contingent on performance and ranking in the national championship. Every year, the worst-performing teams are relegated to the next lowest division, whereas the best-performing teams from the lower divisions are promoted upwards.[5] Specifically, four teams are relegated from serie A to B and are replaced by the same number of promoted clubs. This system facilitates a high degree of turnover of serie A clubs, allowing for equality of opportunity for smaller teams but not necessarily equality of outcomes, because the top places in serie A are typically dominated by a small number of large clubs (Szymanski, 2002). Most Italian cities have a local team (some more than one) that is supported by the community both in terms of committed fans and commercial sponsorship. The best-performing teams, such as AC Milan and Juventus, tend to attract greater fan support, generate higher revenues (i.e. sales of tickets, broadcast rights, merchandising, etc.), and pay higher earnings to their top players.

Data

Our empirical analysis requires data on individual player earnings together with data on player and team characteristics. Salary data for the 1995-1696 Italian season are taken from an annex to the newspaper *Il Giornale* published on March 15, 1996. These salaries are gross of tax but net of bonuses and signing-on fees and represent preseason values as at August 1995. The players are all first-team squad members and youth trainees. Salary information is available for all clubs in serie A and B, and details can be found for 730 players.

Player career performance statistics and team information, for the 1994-1995 season and earlier, are taken from *Almanacchi del Calcio*, *Tuttocalcio 1998-99* (Nassi & Tofanelli, 1999), and the *European Football Yearbook 1995-96* (Hammond, 1995). Goalkeepers are excluded from the analysis as their performances are not measured in the same way as outfield players'. Not all the players for whom salaries are recorded have matching career details, and the number of players for which all data are available is 533.[6] *Tuttocalcio 1998-99* also provided us with information on career records of coaches employed by the clubs at the start of the 1995-1996 season.

Descriptive statistics for our variables are shown, with definitions, in Table 1 using the sample of 533 outfield players. The average age of players is 25 years, whereas their (work) experience as professionals amounts to an average of 45 appearances in serie A and 50 in serie B.

TABLE 1: Variables and Descriptive Statistics (533 observations)

Variable	*Description*	*Mean*	*Standard Deviation*
Individual data			
ln(*SALARY*)	Gross salaries (net of bonuses and signing-on fees) preseason values 1995	5.68	1.06
AGE	Age (in years)	25.5	3.50
AGE SQ	Quadratic term in age (in years)	660.7	181.0
PREVIOUS APPSA	Accumulated appearances prior to the 1994-1995 season in serie A	36.5	64.2
PREVIOUS APPSA SQ	Squared term of *PREVIOUS APPSA*	5,446.2	17,003
PREVIOUS APPSB	Accumulated appearances prior to the 1994-1995 season in serie B	39.1	53.7
PREVIOUS APPSB SQ	Squared term of *PREVIOUS APPSB*	4,413.4	10,276
APPS94A	Appearances in 1994-1995 season in serie A	8.63	12.1
APPS94A SQ	Squared term of *APPS94A*	221.9	351.6
APPS94B	Appearances in 1994-1995 season in serie B	10.6	14.2
APPS94B SQ	Squared term of *APPS94B*	311.6	462.1
Individual performance indicators			
FOR[a]	Forward	0.233	
MID[a]	Midfielder	0.379	
DEF[a]	Defender	0.388	
FOR GOALS RATE 94A	Goals per game scored by forward in serie A in 1994-1995	0.023	0.094
MID GOALS RATE 94A	Goals per game scored by midfielder in serie A in 1994-1995	0.011	0.042
DEF GOALS RATE 94A	Goals per game scored by defender in serie A in 1994-1995	0.006	0.049
FOR GOALS RATE 94B	Goals per game scored by forward in serie B in 1994-1995	0.026	0.095
MID GOALS RATE 94B	Goals per game scored by midfielder in serie B in 1994-1995	0.012	0.040
DEF GOALS RATE 94B	Goals per game scored by defender in serie B in 1994-1995	0.004	0.020
FOR ASS RATE 94A	Assists per game by forward in serie A in 1994-1995	0.008	0.039
MID ASS RATE 94A	Assists per game by midfielder in serie A in 1994-1995	0.009	0.035
FOR STRIKE RATE	Career goals per game by forward in serie A	0.026	0.089
FOR STRIKE RATE SQ	Square of *FOR STRIKE RATE*	0.009	0.038
MID STRIKE RATE	Career goals per game by midfielder in serie A	0.014	0.041

(continued)

TABLE 1 (continued)

Variable	*Description*	*Mean*	*Standard Deviation*
MID STRIKE RATE SQ	Square of *MID STRIKE RATE*	0.002	0.008
ITALY INT[a]	Appearance in Italian national team (1992-1995), not superstar	0.069	
OTHER INT[a]	Appearance in other national teams (1992-1995), not superstar	0.024	
UNDER 21 ONLY[a]	Appearance in Italy under-21 team but not full national team	0.116	
Superstar indicators (at least two seasons in serie A)			
SUPERSTAR1[a]	0.25 to 0.40 goals per game in serie A	0.017	
SUPERSTAR2[a]	More than 0.40 goals per game in serie A	0.011	
Team characteristics			
LOG ATTEND	Log home attendance 1994-1995	2.59	0.77
COACH WIN A	Career points ratio of coaches in serie A (win = 3 points, draw = 1 point)	0.568	0.70
COACH WIN B	Career points ratio of coaches in serie B (win = 3 points, draw = 1 point)	0.529	0.68

SOURCES: *Almanacchi del Calcio*, *European Football Yearbook 1995-96* (Hammond, 1995), *Il Giornale* (March 15, 1996), *Tuttocalcio 1998-99* (Nassi & Tofanelli, 1999).

a. Dummy variable indicating relative proportion in the sample.

TABLE 2: Quantiles of the Salary Distribution by Type of Player

Quantile	*(1) Noninternational, Non-Forward, Non–Goal Scorer*	*(2) Forward, Serie A Goal Scorer*	*(3) All*	*(4) Ratio of Columns 1 and 2*
.10	60	305	74	5.08
.25	128	404	153	3.16
.50	241	710	291	2.95
.75	439	1,322	573	3.01
.90	675	2,502	1,164	3.71

NOTE: Salaries are shown in millions of lira at 1995 values.

Median earnings are approximately 254 million lira (at 1995 prices) for noninternational players, in any outfield position, who have career goal-scoring rates in serie A less than 0.2. In contrast, the median forward player with a serie A record of 0.2 or more goals per game commands 1,157 million lira. Hence, the implied earnings ratio of the median superstar to the median "ordinary" player is greater than 4:1. This comparison gives a hint of potential convexity of earnings in a particular performance measure, that of career goal-scoring rates.

Further details of the salary distribution are shown in Table 2, with forward players in serie A who have scored goals being paid more than 3 times as much as other players. This reveals a highly unequal distribution with substantial skewness, as one would expect for popular entertainers. In Figure 1, we also report a nonparametric kernel density estimate of the overall earnings distribution and compare it with a log-normal distribution, which often provides a good fit to the distribution of earnings in many other professions. The lack of symmetry in the distribution, plus the fatter (upper) right tail, indicates the presence of a restricted number of individuals with very high earnings. In this context, a player located at the 99th percentile of the distribution earns more than 10 times as much as players located around the median of the distribution, 45 times as much as those located at the 10th percentile of the distribution.

It is not possible in Italian soccer to construct a measure of superstar status that is independent of performance. Nevertheless, an insight into superstar status can be gained by inspecting the number of career goals per serie A appearance for each player *(STRIKE RATE)*. We rule out superstar status for serie B players because these have lower profiles (e.g., as indicated by gate attendance at matches and extent of TV broadcast coverage) than those in serie A. Within the industry, a goal-scoring rate of 1 goal in every two games would be regarded by commentators as highly successful (the mean for all serie A forwards was 1 goal in six games). This rate of 0.5 goals per game is actually the lower bound of the top decile for goal scoring. Only nine players are in this category. They include some easily recognizable names such as Roberto Baggio of AC Milan (and Italy), Gabriel Batistuta of Fiorentina (and Argentina), and Giuseppe Signori of Lazio (and Italy). We would

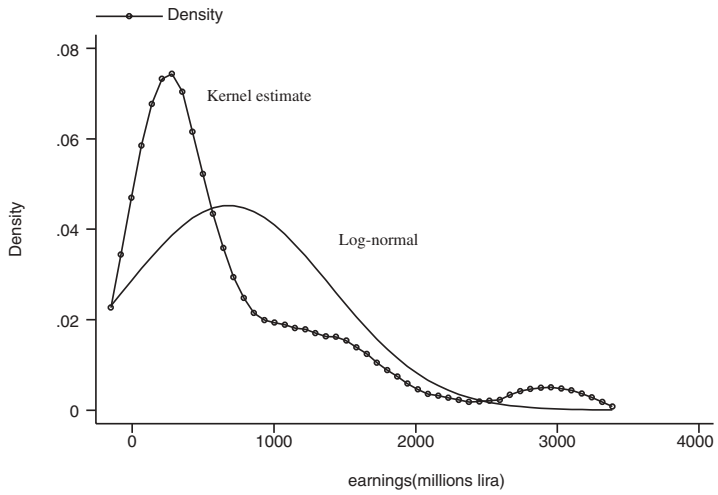

Figure 1: Nonparametric (Kernel) Estimates of the Earnings Distribution Compared With the Log-Normal Distribution
NOTE: Earnings are given in millions of lira at 1995 values.

expect attackers, as goal scorers, to be the more glamorous players with higher media profiles than defenders, for example. Hence, we distinguish between forwards' strike rate *(FOR STRIKE RATE)* and midfielders' strike rate *(MID STRIKE RATE)*. It appears that the top decile of *FOR STRIKE RATE* contains the top two players in the 1995 salary distribution, Baggio and Signori. Roberto Baggio was the highest-paid player; his salary of 6 billion lira was more than 60% greater than that of the second highest earner, Giuseppe Signori.[7]

EMPIRICAL SPECIFICATION

The empirical strategy consists of specifying and estimating a human capital earnings equation that incorporates performance variables. In practice, the empirical specification adopted is

$$\ln(W_i) = \alpha_0 + \boldsymbol{\alpha}_1 EXP_i + \boldsymbol{\alpha}_2 PERF_i + \boldsymbol{\alpha}_3 REP_i + \boldsymbol{\alpha}_4 TEAMQUAL_j + \varepsilon_i, \quad (1)$$

where $\ln(W_i)$ represents the log of the earnings of the ith player, α_0 is a constant, $\boldsymbol{\alpha}_1$ to $\boldsymbol{\alpha}_4$ are vectors of parameters to be estimated, and ε_i is the error term.

Variables representing player experience *(EXP)* include age and appearances. In a Mincer-type human capital formulation, we would expect that player salaries increase with age at a decreasing rate and that earnings would fall with age as play-

ers experience declining speed and athleticism in older age. The use of age and appearances jointly in a players' earnings function represents a departure from the established practice of North American studies (Gius & Johnson, 2000; Hamilton, 1997; Idson & Kahane, 2000; Jones, Nadeau, & Walsh, 1999; Kahn, 1993), which typically include years of experience in the league studied or number of career appearances but not both and not jointly with age. Those studies can legitimately exclude age because most North American sports have a draft system where players enter major leagues at a fairly uniform age of entry, just after college graduation. Entering age and experience together would generate multicollinearity in estimated earnings functions for North American team sports. In European soccer, however, players are not drafted and can enter professionally at many different ages. Hence, it is more appropriate to utilize age *(AGE)* and appearances separately. The age variable is given the quadratic form standard in estimated age-earnings profiles *(AGE SQ)*. Squared terms are also employed for the appearance variables.

Some literature on estimation of models of transfer fees (payments by clubs to other clubs for purchase of player registrations) for soccer players in England makes a distinction between most recent experience (the previous season) and accumulated experience prior to that season (Carmichael, Forrest, & Simmons, 1999). We follow this procedure in our model of player salaries. Given a short playing career, of 8 years' duration on average, we would expect most recent experience to have a higher weight in the determination of player salaries than accumulated experience up to the start of the previous season.

Because Italian soccer has a tiered structure, with promotion and relegation between serie A, B, and C, we would expect experience gained in serie B to have a smaller impact on player salaries compared to experience gained in serie A. The level of experience gained is a reflection of player quality and hence marginal revenue product. Better players will be selected and sorted by mobility into serie A clubs, whereas lesser able professionals will gravitate to serie B clubs. Our measures of accumulated experience prior to the most recent season include *PREVIOUS APPSA*, *PREVIOUS APPSA SQ*, *PREVIOUS APPSB*, and *PREVIOUS APPSB SQ*. Our measures of recent (1994-1995) experience are *APPS94A*, *APPS94A SQ*, *APPS94B*, and *APPS94B SQ*. The label *94* denotes the 1994-1995 season, whereas the extensions *A* and *B* refer to serie A and B, respectively. Each indicator is entered with a squared term to capture nonlinearity, consistent with the treatment of players' age.

In the case of Italy, we have only limited data on player performance measures *(PERF)*. We assign positional categories (*FOR* = forward, *MID* = midfielder, *DEF* = defender) as presented in *Tuttocalcio 1998-99*. For each player, we have details on goals scored and assists, defined as passes leading directly to goals scored. The goals measures for the 1994-1995 season are each interacted with positional categories and with serie A and B status and then divided by corresponding appearances to generate *FOR GOALS RATE 94A*, *MID GOALS RATE 94A*, *DEF GOALS RATE 94A*, *FOR GOALS RATE 94B*, and *MID GOALS RATE 94B* as goals

per game ratios. Thus, *FOR GOALS RATE 94A* denotes goals rate of forwards per serie A appearance in the 1994-1995 season, and *MID GOALS 94A* is the comparable measure for midfield players. All performance measures are constructed as per game ratios to permit ease of comparison of returns measured by our estimates.

As shown above, we employ *FOR STRIKE RATE* and *MID STRIKE RATE* as performance measures with which to (indirectly) address superstar effects. We experiment with the squared terms, *FOR STRIKE RATE SQ* and *MID STRIKE RATE SQ*, to consider the issue of convexity. We do have an additional measure of performance for midfielders and forwards. In addition to scoring goals, these players often play creative roles in setting up goals. A measure recorded in *Tuttocalcio 1998-99* is assists. An assist is the final pass made prior to a goal being scored and is an indicator of player creativity. We compiled the total number of assists, for forwards and midfield players separately, in serie A in the 1994-1995 season, for which records were available, and divided by total serie A appearances in this season to obtain *FOR ASSIST RATE 94A* and *MID ASSIST RATE 94A*. This permits us to consider whether returns to setup plays are greater or less than returns to goal scoring. Are superstar effects generated by consumer interest in players who make telling, penetrative passes, or in players who actually score the goals, or in both aspects of play?

We do not have information for midfielders on tackles made or passes completed or for defenders on blocks, interceptions, and tackles. In this respect, we do not have the depth of player performance indicators available for more individualistic North American team sports such as baseball and basketball.[8]

The absence of a full set of player performance indicators might lead to omitted variable bias. In addition to goals and assists as performance measures, we can indirectly control for performance by including variables to proxy player reputations *(REP)*. Players who perform outstandingly well for their clubs are selected for international team appearances (henceforth *internationals*) in friendly matches and international tournaments (European Cup and World Cup). *ITALY INT* and *OTHER INT* denote dummy variables for Italian and non-Italian internationals who made appearances for their countries at any time in the three previous seasons, 1992-1993 through 1994-1995.[9] The purpose of this distinction is to estimate separate salary premia for international players, over and above returns to our performance variables.

The international categories comprise the full range of positions, unlike superstars. We would expect that players of current international standing would command a salary premium relative to nonselected players but would derive a lower salary premium compared to high goal scorers. It should be noted that very few serie B teams had international players in their squads.

In the 1995-1996 season, labor market restrictions denied Italian teams the opportunity to field more than three foreign-born players in a particular serie A or B match. This restriction was removed toward the end of the 1995-1996 season following the "Bosman ruling" of the European Court of Justice in December 1995

(Simmons, 1997; Szymanski, 1999).[10] With labor market restrictions still in force at the beginning of the 1995-1996 season, we predict higher salaries for other international players compared to Italian internationals, on the grounds that only the very best foreign international players would be sought by Italian clubs. In 1995, the international coverage of players embraced France, Denmark, Eastern Europe, and South America. Following the Bosman ruling of 1995, a greater number of non-Italian international players migrated to serie A to seek improved earnings opportunities.

Some North American studies make use of a reputation variable defined as selection for Major League Baseball or National Hockey League "all star" midseason games, where fans select the best teams from their respective conferences (Idson & Kahane, 2000; Jones et al., 1999; Kahn, 1993). Frick (2001) goes further and nominates appearances in all star games for the National Basketball Association as a (significant) measure of superstar status. Our measure of international status differs from measures used in North American sports. International soccer teams play a regular sequence of games, including tournaments (with entry competition and finals), whereas North American all star games tend to be one-off exhibition games. Also, international soccer teams are typically selected, with large squads, by an appointed coach, whereas North American all star teams may be chosen by fan voting.

As well as games involving the Italian national team, there are also lower level international fixtures, including a European tournament reserved specifically for younger players aged 21 or less. These are "under-21" matches. Some players selected for the under-21 team also play, currently or eventually, for the full international team. But many players selected for the under-21 team do not graduate to full international status. We expect these players, denoted by *UNDER 21 ONLY*, to command some premium relative to those not selected but a lower premium relative to full internationals. Data availability restricts the under-21 category to Italian players only, and there are 68 of these in our sample.

We can take account of team-specific effects in two ways *(TEAMQUAL)*. One is to use team fixed effects estimation, assigning unobserved team effects to team dummies. Alternatively, team characteristics can be measured explicitly. In a fixed effects specification, the team attributes are anonymous by construction. We searched for some team attributes that could offer a behavioral interpretation in pay determination. Three variables were selected. The first indicator of team performance is (log) average attendance in the 1994-1995 season *(LOG ATTEND)*.[11] The higher is average home league attendance, the greater, we predict, will be revenues, club wealth, and club reputations and the greater will be the salary commanded by all players of that team, ceteris paribus.

It is also possible that player salaries may be determined by the ability of the coaches they work with. Coaching and player ability may be complementary inputs in team production. Hence, we construct variables to measure coaching attributes. Career details of the head coaches in Italian soccer *(allenatori)* are reported in

Tuttocalcio 1998-99. Idson and Kahane (2000) proposed measures of coaching experience and coaching performance in their study of complementary team inputs and player salaries in the National Hockey League. In the case of Italian soccer, we find a high correlation between number of games coached in a particular serie and ratio of points achieved to maximum in the same serie (correlation coefficients of .69 for serie A and .49 for serie B). Coaches who win more survive longer in the industry and coach more games.[12] We include in our set of team attributes the career ratio of points achieved to maximum possible for these coaches (where a win is given the value 3 and a draw is given the value 1, just as in the compilation of actual league standings), again separately constructed for achievement in serie A and B *(COACH WIN A)* and *(COACH WIN B)*. To be precise, we contend that player salaries will depend primarily on the performance of coaches in the division in which they are currently located.[13] This means that serie A records are used to assess coaching performance for players in serie A, and serie B records are used to assess coaching performance pertaining to players in serie B. This procedure has the merit of consistency with the treatment of other variables as separated by each serie to capture interdivision differentials in performance and reputation. Hence, for serie A players, *COACH WIN B* is set equal to zero, whereas for serie B players, *COACH WIN A* is set equal to zero.

RESULTS

The relevance of team attributes in wage determination for professional soccer players, as previously discussed, led us to begin our specification search with estimation of Equation 1 by generalized least squares with random team effects. Although the random effects specification may appear implausible, because the sampled clubs are actually the entire population of all teams in Italian professional soccer, it nevertheless yielded significant random effects. We also experimented with a specification with team-specific intercepts (i.e., fixed effects), and these proved to be highly significant, thus ruling out simple ordinary least squares (OLS). When testing the validity of the random effects versus fixed team effects models, a Hausman test comprehensively rejected the random effects specification (as shown in column 1 of Table 3, $p = .001$),[14] suggesting that our chosen team attributes may not have performed adequately as measures of team quality in wage determination.[15]

Hence, we proceed to report OLS regressions with team fixed effects in Table 3. Column 1 reports results from the main specification. Column 2 offers the same specification as column 1, but with the sample restricted to forwards only. The main performance measure (goals per game) is not as relevant for midfielders (possibly) and defenders (definitely). Use of a forwards-only specification enables us to determine whether international team selection has an effect apart from goal scoring (because estimation in column 1 may be subject to omitted variable bias with defenders' performance measures absent). In column 3, we replace the continuous

TABLE 3: Estimates of Players' Earnings Function With Superstar Effects

Variable	*1*		*2 (Forwards Only)*		*3*	
AGE	0.886	(0.000)	1.114	(0.000)	0.879	(0.000)
AGE SQ	–0.016	(0.000)	–0.020	(0.000)	–0.016	(0.000)
APPS 94A	0.037	(0.000)	0.046	(0.048)	0.0385	(0.000)
APPS 94A SQ	–0.00043	(0.090)	–0.0012	(0.095)	–0.00046	(0.068)
APPS 94B	0.0178	(0.025)	–0.0070	(0.702)	0.019	(0.018)
APPS 94B SQ	–0.00002	(0.927)	0.0003	(0.535)	0.0000	(0.845)
PREV APPA	0.0029	(0.005)	0.0043	(0.089)	0.0028	(0.005)
PREV APPA SQ	–4.28E-06	(0.174)	–5.30E-06	(0.522)	–4.30E-06	(0.167)
PREV APPB	0.0036	(0.001)	0.0037	(0.147)	0.0037	(0.001)
PREV APPB SQ	–0.00001	(0.005)	–0.00001	(0.303)	–0.00002	(0.004)
FOR ASSIST RATE 94A	1.304	(0.065)	1.614	(0.117)	1.009	(0.159)
MID ASSIST RATE 94A	0.460	(0.504)	—		0.443	(0.518)
FOR GOALS RATE 94A	0.332	(0.367)	0.373	(0.449)	0.428	(0.183)
FOR GOALS RATE 94B	0.782	(0.001)	0.545	(0.250)	0.750	(0.002)
MID GOALS RATE 94A	1.036	(0.086)	—		1.141	(0.042)
MID GOALS RATE 94B	0.267	(0.668)	—		0.199	(0.745)
DEF GOALS RATE 94A	–0.076	(0.858)	—		–0.104	(0.807)
DEF GOALS RATE 94B	0.690	(0.520)	—		–0.104	(0.807)
FOR STRIKE RATE SQ	2.296	(0.029)	2.454	(0.050)	—	
MID STRIKE RATE SQ	1.676	(0.598)	—		—	
UNDER 21 ONLY	0.319	(0.000)	0.322	(0.074)	0.330	(0.000)
ITALY INT	0.410	(0.000)	0.428	(0.205)	0.419	(0.000)
OTHER INT	0.505	(0.001)	0.204	(0.622)	0.559	(0.000)
SUPERSTAR1	—		—		0.337	(0.017)
SUPERSTAR2	—		—		0.674	(0.024)
Team fixed effects	Yes (significant)		Yes (significant)		Yes (significant)	
R^2 (within)	.690		.693		.674	
Number of observations	533		124		533	

NOTE: Dependent variable = ln(*SALARY*). *p* values are in parentheses. A constant term is included in each regression.

measure of career goal-scoring rate by bands of goal-scoring rates to capture potential superstar status. *SUPERSTAR 1* denotes a dummy variable equal to one for serie A goal-scoring rates of greater than 0.25 and less than or equal to 0.4, whereas *SUPERSTAR 2* denotes the exceptional achievement of more than 0.4 goals per serie A game (comprising the top decile of serie A goal-scoring forwards).

The model specification shown in Table 3 is a parsimonious version of Equation 1 with some insignificant variables deleted. In the set of performance measures, we experimented with level and squared terms for midfielders' and forwards' career goals per game variables and found that the squared term *FOR STRIKE RATE SQ* gave a significant coefficient whereas the linear term did not.[16]

The influences of our control variables for experience are, for the most part, consistent across specifications with significant impacts of both age and appearances. The significant roles of age, and its square, are very much as one would predict for a human capital earnings function. The conventional concave form, with earnings rising with age but at a decreasing rate, is just as valid for footballers as for other professions. The turning point of age in the age-earnings profile in the specifications with team variables is 28.0 (column 1 of Table 3), and this conforms to the industry consensus on the age at which footballers reach peak levels of performance in their careers. Beyond the age of 28, greater experience, in terms of tactical ability and knowledge of the game, is offset by worsening physical performance, including reduced speed and fitness and greater susceptibility to injury. This is reflected in player salaries.

Our finding that age and appearances influence player salaries does not imply that maturity and experience determine footballers' salaries over and above ability. Experience and age of players in the sample are determined by a sample selection process that is largely based on ability; an older player is still playing only if he is of greater ability. Thus, age and experience are probably measuring unobserved ability.

It is clear, though, that serie A experience is rewarded more highly than serie B experience. The turning point for accumulated serie B appearances before 1994-1995 is 124. Salary is monotonically increasing in pre-1994 serie A appearances for all specifications. The absence of a peak of the experience-earnings profile for serie A is a reflection of the superiority of the top division. The turning point for 1994-1995 serie A experience is above the maximum of 34 games for the season in all specifications. Hence, the role of *APPS 94A SQ* is just to capture nonlinearity. Similarly, for serie B, we cannot reject linearity between salary and 1994-1995 appearances in our main regression results in column 1 of Table 3.

The pattern of coefficients of the four appearance variables vindicates our decision to partition experience into recent and previous appearances and between serie A and B. It is clear that extra appearances in serie A are rewarded more highly than extra games played in serie B. Extra appearances in the 1994-1995 season generate greater salary increments than extra appearances prior to 1994-1995 in both serie A and B, so more recent experience has a higher weighting in player salaries, given age.

Significant coefficients on the performance variables are found, applying one-tailed tests at the 5% level for *FOR ASSIST RATE 94A*, *MID GOALS RATE 94A* and *FOR GOALS RATE 94B* in the estimates in column 1 of Table 3.

The overall lack of significance of *FOR GOALS 94A* may simply be a reflection of the dominance of the career goals per game variable, *FOR STRIKE RATE SQ*. This is significant at the 5% level in both the main estimates and in the estimation restricted to forwards only in column 2 of Table 3. The impact of sustained career goal scoring in the top tier is picked up quite dramatically. In contrast, forwards with serie B clubs who have higher strike rates are rewarded with larger salary

TABLE 4: Marginal Effects on Earnings of Performance Variables

Variable	*Median*	*Top Decile*
FOR STRIKE RATE	0.99	2.71
FOR ASSIST RATE 94A	1.40	1.74
FOR GOALS RATE 94B	0.96	1.16
MID GOALS RATE 94A	1.14	1.26

NOTE: Marginal effects are computed for *FOR STRIKE RATE* as $2\beta x \times \exp(\beta x^2)$, where β is estimated coefficient from Table 3, column 1, and x is the specific value of the variable; likewise, for other performance variables, marginal effects are $\beta\exp(\beta x)$.

increments than forwards with fewer goals to their credit. The significant coefficient on *FOR GOALS 94B* may reflect the lack of superstar status and the much lower probability of selection for international representation for serie B players. For midfield players in serie A, who are meant to be more versatile than forwards or defenders, the ability to score goals generates a salary premium above midfielders who do not. However, additional goals for midfield players in serie B do not appear to be rewarded at all. The significant coefficient on *FOR ASSIST RATE 94A* is evidence that forwards in serie A who create goals, as well as score, are rewarded for this extra dimension to their game.

We now turn to the impact of superstar status on player salaries, which is our main focus of attention. The estimates in column 1 of Table 3 clearly point to strongly convex returns to salary in career goals per game in serie A.[17] With a semi-log functional form, all the significant goal-scoring and assist variables exhibit convexity (each indicator x has $\partial^2 \text{wage}/\partial x^2 > 0$). The marginal effects on earnings, for players at the median and top deciles of each measure (conditional on positive values of performance) are shown in Table 4.

For the top decile, the marginal effects are 2.71 (forwards' career goal-scoring rate in serie A), 1.74 (forwards' assist rate in serie A), 1.26 (midfielder's recent strike rate in serie A), and 1.16 (forwards' recent strike rate in serie B). At the top end of performance, the marginal effects of forwards' goal scoring in serie B and midfielders' goal scoring in serie A in 1994-1995 are considerably lower than the marginal effects for forwards' career goal-scoring rates in serie A and forwards' assist rates in 1994-1995. The impact of goal scoring is greater than the impact of assists for forwards, suggesting that the market rewards high rates of goal scoring rather more than creative forward play (assists). It is quite possible, though, that the same players can achieve a top decile ranking in each category. The very best players might be expected to perform well in both goal scoring and creative play. This is indeed the case. There are six players in the top decile of career goal scoring and just three players in the top decile of 1994-1995 serie A assist rates. Two players (Baggio and Fonseca) are in both categories, and as noted previously, Baggio is the highest-paid player by some distance from the second-ranked player. Hence, *both*

goal scoring and assists represent ingredients of superstar status, as captured by convexity of earnings in performance measures. Superstar effects are generated by consumer interest in forward players who frequently score goals and/or create goals for their colleagues.

Inspection of the coefficients on international status in column 1 of Table 3 suggest a ranking of salary premia between under-21 internationals, Italian full internationals, and non-Italian full internationals. However, the estimates are not precise enough for Wald tests to clearly differentiate these premia. The salary premia for international players are over and above increments earned by experience and performance shown by our control variables. The lowest wage premium for players with international status, of 32% from our point estimate in column 1, goes to those who achieve under-21 international recognition but go no further, in line with our prior expectation. This is nevertheless quite a substantial premium. Players selected for the full Italian national team in the period 1992 to 1995 received a higher salary premium of 41%. Players representing other national teams gained a yet higher salary premium of 51%, which reflects the restrictions imposed on player mobility in operation at the time.

The international categories are restricted to those who have serie A career goal-scoring rates of less than 0.2 to distinguish the returns to goal scoring. This means that midfielders and defenders are dominant in the international categories, though some forwards remain.[18] The international status effect may well be driven by some omitted performance variables for midfielders and defenders. To assess the role of international status, we present OLS estimates, with team fixed effects, for forwards only in column 2 of Table 3. These show a significant premium for the under-21 international status category, but not for full international status, for forwards, over and above goal scoring. Hence, forwards' salaries are determined significantly by career goal scoring but not additionally by international status. In contrast, in the full sample we do find significant roles for international status across the set of outfield players. Further data on defenders' and midfielders' performance measures are needed to separate impacts of performance from reputation influences captured by international status for these players.[19]

In column 3 of Table 3, superstars are delineated in bands of career goal-scoring rates. In preliminary estimation, we found no significant effect from goal-scoring rates of between 0.20 and 0.25 (one standard deviation away from the median). Players in this category are just not "special" enough to warrant a salary premium over and above measured experience and performance. But from the estimates in column 4, players who achieve career goal-scoring rates in serie A of 0.25 to 0.40 derive a respectable salary premium of 34%, equal to that for under-21 internationals. There are just six players with goal-scoring rates greater than 0.40, under the heading *SUPERSTAR 2*, in our sample. These players, who include the two highest-paid players in the sample, Roberto Baggio and Guiseppe Signori, jointly earn a salary premium of 67%. There is a suggestion here, from the point estimates, of convex returns to this elite group, although a Wald test of equality of coefficients of

SUPERSTAR 1 and *SUPERSTAR 2* rejects it with a *p* value of .23. Comparing the results in columns 1 and 3, we consider that the continuous measure of goal-scoring rate appears to give a more precise indication of convexity of returns.

Overall, from our preferred estimates in column 1 of Table 3, we have identified strong convexity of earnings in two performance measures, goal scoring and assists. Convexity is absent for midfielders' assists but is present for forwards' assists. Of course, it must be stressed here that the players we have categorized as superstars are not necessarily much more able, or even more important in team production, than their colleagues who play in defense or midfield. What can be said is that players who score goals gain higher profiles and recognition among fans and the media than players who do not. Superstar status is suggested by two dimensions of ability, goal scoring and assists, each of which converts to match-winning potential. The higher price attached to this ability is generated by superstar status, which in turn is imposed by fan and media attention. It is the large audiences, both from television broadcasts and from attendance at games, together with customer perceptions that other players are imperfect substitutes, which generate superstar status (Rosen, 1981).

CONCLUSIONS

This article has shown how superstar effects on pay, along the lines proposed by Rosen (1981), can be specified and estimated in professional sport, even where detailed individual performance measures are largely absent. In the empirical analysis, we have used individual data based on detailed information concerning Italian professional soccer players (serie A and B) in the 1995-1996 season. Our measure of pay is basic salary and excludes performance-related components such as incentive bonuses, which are prevalent in players' contracts (direct payments for team positions, appearances, goals scored, international recognition, etc.).

Our results capture plausible controls for player productivity grouped under the headings of experience, performance, and reputation. Our reputation variables help alleviate omitted variable bias that would arise from absence of finely detailed performance measures. We also control for team-specific influences on player salary using team fixed effects. OLS estimation of an augmented human capital earnings function from a sample of 533 outfield players points to the existence of a convex structure of rewards across a set of performance measures, with strong convexity in career goal-scoring rates and in assist rates. Clearly, further work is necessary to examine alternative measures of performance beyond those proposed here.

Our results are consistent with Rosen's (1981) theory of superstars, in which a relatively small number of performers dominate their industry and earn a disproportionate share of revenues. Industry characteristics cited by Rosen as likely to generate superstars are duplication of services at constant marginal cost and the perception by consumers that other performers, who might perform similar services, are highly imperfect substitutes. In professional soccer, each match is differ-

ent and consumers value the live performance (whether on television or at the stadium) far more than video replays. In the film industry, studios can create duplicate prints of movies at nearly constant marginal cost. Unlike movies, duplication of soccer matches is not possible. Each match, even if replayed between the same teams, has a different context and meaning for the audience. Hence, Rosen's argument that constant marginal cost of production is an important ingredient of superstar status may hold for movie stars (Nelson et al., 2001) and musical performers[20] but carries less force for soccer players or other sports stars.

These are strong counterarguments to the presence of superstar effects in soccer. There is the further problem that in a sports league, it is not clear which performance characteristic (if any) is valued by consumers in a way that leads to superstar effects in wage outcomes. Despite these obstacles, we have found evidence of highly convex returns for two particular performance measures, each associated with forward play. The high degree of convexity of earnings found for our two dimensions of attacking play demonstrates that superstar effects exist and that these are generated by consumer interest in forward play, in terms of creating or scoring goals.

In line with Rosen's (1981) original contribution, the role of technology is still relevant to superstar effects in sport but is limited to the provision of live broadcasts of performances. Live broadcasts permit duplication of the service at virtually zero marginal cost and allow soccer games to be transmitted to millions of viewers worldwide, whereas only a maximum of 75,000 spectators will be in a particular stadium for a given match. We are left with the conclusion that technology and imperfect substitution of player services as perceived by the audience are driving forces of convex returns to superstars in Italian soccer. It is the perceived importance of the superstar player, which will usually be bound together with the prestige of his team, that generates intense audience interest, imperfect substitutability of similar types of player, and a convex reward structure.

Italian soccer commands large audiences and has a large market size relative to most European soccer leagues. Only the English and Spanish Premier Leagues are comparable in size of team and league revenues. The best players, including superstars, are attracted to the teams and leagues with highest revenues. We would therefore not expect to find similar evidence of superstar effects in smaller European soccer leagues, and this is a proposition worthy of empirical investigation.

NOTES

1. An interesting discussion of the debate between the "social value of sports" and the economic motivation for paying high salaries to superstars is reported in Rosen and Sanderson (2001).

2. The combined effect of customers' agreement on player talent and preference for live performances that can reach a mass audience contribute to the skewness in the earnings distribution by stretching the far right (upper) tail of the distribution (see Figure 1).

3. We should stress that availability of data on sportsmen's earnings is much more limited in Europe relative to North America. To our knowledge, the only other European study to estimate an earnings function for players in team sports is by Lehmann and Weigand (1999), who analyze data on German soccer players in the top division in 1998 but do not address superstar effects. Because soccer is a more interactive team game with greater use of complementary player skills than, say, baseball or basketball, isolating superstar effects for European soccer is more challenging than for some North American sports.

4. Lack of data prohibits testing for superstar effects by direct estimation of players' marginal revenue products along the lines proposed for U.S. baseball and basketball by MacDonald and Reynolds (1994) and Hausman and Leonard (1997), respectively.

5. This is at variance with the structure of soccer in the United States (as well as other sports, such as American football, baseball, basketball, and hockey). Basically, in the United States, there is no system of promotion and relegation, and new entry of teams depends on franchise allocation by existing members and the payment of a substantial fee (Hoehn & Szymanski, 1999; Rosen & Sanderson, 2001).

6. Data are missing for players who do not appear in *Tuttocalcio 1998-99* (Nassi & Tofanelli, 1999). There are two main types of missing player: those who retire after 1995-1996 and those who emigrate after 1995-1996. There is no indication that the missing players have substantially different characteristics relative to those who are retained. We must caution, however, that players who retired and emigrated presumably did so on the basis of a comparison with the compensation they would have earned had they remained in the Italian league against alternatives. Their absence from the data may be correlated with the error term of the wage equation.

7. We did not wish to impose superstar status by casual impression. However, it would be useful to explore other methods of defining superstar, such as citations in reports of soccer matches, sales of named replica shirts, and questions about fans' views on players in fan surveys. These alternative methods were not available to us. Our use of an objective indicator to test for superstar effects follows Hamlen (1991), who considers a measure of voice quality (harmonic range) in the case of popular singers.

8. In England, detailed statistics on performances, by game, of Premiership soccer players are available from Carling OPTA (Carmichael, Thomas, & Ward, 2000), but salary information is not available.

9. There are 37 Italian internationals and 13 non-Italian internationals in our sample.

10. The Bosman ruling made illegal the payment of transfer fees for players who were out of contract and who wished to transfer clubs across EU boundaries. As a consequence, the soccer authorities reformed their transfer systems and made possible greater freedom of movement for players.

11. Data on club attendance for the 1994-1995 season were kindly provided by Umberto Lago of the University of Bologna.

12. Using data on records of Australian Rules football coaches spanning over 60 years, Borland and Lye (1996) find that the probability of coach-team separation decreases with the coaches' tenure and experience. In an analysis of German soccer, Hautsch, Frick, Lehmann, and Warning (2001) find that coaches' duration in a team varies positively with win percentage.

13. The sign of effect is ambiguous. A positive impact of coaching record on player salaries may occur where coaches with high points ratios can attract better quality, higher productivity players who are paid more, ceteris paribus, than other players. Also, coaches with a more successful track record of managing winning teams should be better able to raise player performance and so augment player salaries. Working in the opposite negative direction, though, is the possibility that coaches and players may be complements such that a player with a better coach would be paid less than an otherwise equivalent player with a worse coach because the former player's performance is due, in part, to the coach, not the player.

14. For the purposes of this test, the team-specific variables *(LOG ATTEND*, *COACH WIN A*, *COACH WIN B)* were included in the random effects specification.

15. To check for appropriateness of an ordinary least squares specification with fixed team effects, we extracted the fixed effects components and regressed the latter against right-hand-side variables in

Equation 1. The results clearly showed that the fixed effects were independent of the explanatory variables, as required for consistency of estimates.

16. The following variables were found to be insignificant in preliminary estimation and were deleted: *FOR ASSIST RATE 94A SQ*, *MID ASSIST RATE 94A SQ*, *FOR STRIKE RATE*, and *MID STRIKE RATE*. The remaining insignificant terms are included for comparison.

17. The absence of incentive bonuses may lead to underreporting of total compensation; however, casual observation indicates that bonuses are likely to be highly correlated to goals scored per game, hence suggesting, if anything, that ours might be a lower bound estimate of superstar effects.

18. It may seem paradoxical that forwards who are not prolific goal scorers should be selected for international teams, but this does sometimes happen if the coach values a forward who "holds the ball up" and can act as a foil for a more prolific goal scorer.

19. A fuller set of performance indicators for all types of player, including goalkeepers and defenders, is available for the 2000-2001 season (for serie A only). Further work will reexamine earnings functions with this richer data set.

20. However, an attempt to test for superstar effects among popular musicians did not find support for the hypothesis (Hamlen, 1991).

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