

Human Capital, Sport Performance, and Salary Determination of Professional Athletes

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Abstract

Thanks to the high availability of data, professional sport represents a unique laboratory in order to test labour market theories and predictions. In particular, one of the most important propositions concerns the role that human capital plays in shaping the life-cycle earnings patterns of workers. To the extent that sport can be considered as a type of human capital investment, human capital theory can help to understand, and empirically assess, how the professional sports labour market rewards performance attributes of players. On this purpose, this piece of work reviews the most important economic contributions focused on the wage determination of professional athletes with the aim of outlining both the emerging common features and the main issues. In so doing, a distinction between professional team-sports and professional single-player sports is done, where the former is represented by the most popular sports in North America and Europe, such as baseball, basketball, hockey and soccer, whereas the latter is primarily represented by professional golf in the US.

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1 Introduction

It is nearly ascertained that professional sports represents a unique laboratory for testing labour market theories. Thanks to the high availability of individual data, a growing body of research, from the 1950s, focuses on the characteristics of the sports business sector, as well as the sports labour market, with the aim of observing whether economic propositions at least have a chance of being true. One of these economic propositions particularly concerns the crucial role that human capital plays in shaping the life-cycle wage patterns of workers. As far as sport can be considered as a typology of human capital investment, human capital theory can help to understand, and empirically assess, how the sports labour market rewards performance attributes of athletes. The key question, therefore, is: can sport be considered as a form of human capital? According to Jacob Mincer, human capital can be defined as knowledge and skills accumulated through a time-consuming education activity (Mincer, 1958). Relying on this definition, the accumulation of playing skills through physical and on-the-field training can be considered a form of human capital. Human capital is also an investment in the sense that it involves expected returns and actual costs - the latter being represented by direct outlays and foregone consumption - in large measure implicit in the wage structure. In other words, the wage rate can be viewed as the rental price of a unit of human capital, and differences in accumulated human capital can account for a great deal of wage heterogeneity. Human capital theory deals with acquired abilities and capacities that are developed through formal and informal education at school and at home, and through training, experience and mobility in the labour market. Following the same intuition, sports athletes are individuals endowed with some particular physical, cognitive and psychomotor abilities. To the extent that the development of their skills generates, on the one side, earnings benefits and, on the other, opportunity costs, their activity qualifies as a capital asset in the same sense as physical capital even if it cannot be sold or bought, but just rented, and even though investments in such capital often involve non-market activities, such as training.

As an economic concept, human capital is at least four centuries old, but its inclusion into the mainstream economic analysis dates back to the late 1950s with the studies of the School of Chicago (Mincer, 1958; Becker, 1964; Schultz, 1963, 1975). Thanks to the availability of data on personal income distribution, the application of empirical economic research to the US labour market leads to the abolition of two simplifying assumptions: first, the restriction of the concept of capital to merely physical capital; second, the idea of homogeneity of labour input underlying both the concept of functional

income distribution and the measurement of labour in manhours. The main finding is that, at the microeconomic level, differences in individual human capital stocks are able to explain much of the observed variance in the wage structure of individuals. On this purpose, Jacob Mincer earnings function model (Mincer, 1958, 1970) represents a cornerstone of a large literature in empirical economics. As Heckman, Lochner, and Todd (2003) argue, in one equation this framework captures two distinct economic aspects: first, an hedonic wage function that shows how the labour market rewards production attributes like schooling and work experience; second, the rate of return to schooling that can be compared with the market interest rate in order to determine the optimal human capital investment choice. Under the specific condition of perfectly competitive labour market, the model specifies an earning function like the following:

$$\ln W = \alpha_0 + \alpha_1 s + \alpha_2 x + \alpha_3 x^2 + \epsilon \quad (1)$$

where W represents the individual wage rate, s the schooling level, x the work experience and ϵ a mean zero error term. The coefficient α_1 is the rate of return to schooling, i.e. the contribution of one additional year of schooling on the worker future earnings. Coefficients α_2 and α_3 represent the marginal impact of work experience on income, the sign of the latter expected to be negative as reflecting decreasing returns to specialization. In order to study how the wage of a worker is related to human skills, direct information on training and work performance attributes are needed. Since such a kind of data are not readily available, most empirical studies utilize education, working experience, age and family background as a proxy of individual productivity. What, instead, marks the sports sector out is the fact that it offers the opportunity to directly measure specific work performance on a narrow set of jobs or tasks. On this purpose, from the 1970s, labour economists concentrate on the estimation of the impact of human skills on individual earnings and team performance by making an extensive use of the human capital earning function approach. Aim of this short article is to briefly outline some common features and issues that, in the last three decades, have characterized the main contributions based on the wage determination of professional sports athletes. On this purpose, a distinction among professional team-sports and professional single-player sports will be done; in particular, the former will be further analyzed with reference to the most popular sports in North America and Europe, whereas the latter will be analyzed by referring to professional golf.

2 Assessing the impact of human skills on pay and performance of professional athletes: a look at the literature

2.1 The professional baseball labor market

Starting from the seminal contribution of Rottenberg (1956) on team sports leagues, professional baseball has represented one of the most exploited sectors by sports economists. Studies on this sector, in fact, range from analyses on property rights and risk sharing to the measurement of managerial ability and racial discrimination. The first contribution investigating the determinants of professional players' salary and performance is the article of Scully (1974), who draws up a way to impute marginal products in the sector of professional baseball in the US.

Aim of his work is to measure the economic loss that baseball players suffer because of the restrictions caused by the reserve clause by estimating the relationship between player predicted marginal revenue product and his predicted salary. Under the basic assumption that fans attend games in order to see the home-team win, the marginal revenue product is defined as the ability or performance that one player contributes to the team multiplied by the effect of that performance on team's gate receipts. In other terms, the player performance exerts a twofold effect on the team revenue: a direct effect on team victories that, in turn, raise gate receipts, and an indirect effect due to the fact that high-ability athletes are more attractive for fans, both at the stadium and on television. In order to accommodate these assumptions, Scully develops an empirical model that is characterized by the following peculiarities:

- (i) the unit of observation is the single player;
- (ii) the framework is a labour market where salaries are set according to an extensive bargaining process;
- (iii) marginal revenue products are explicitly estimated;
- (iv) the difference between the predicted salary and the predicted marginal revenue product approximates the rate of monopsonistic exploitation that the reserve clause affords team owners.

In the Scully's model, teams are engaged in the production of a constant number of games of a certain quality. The quality of the games is generally

measured by the team percent wins that, in turn, depends on two inputs: player skills and non-player skills such as managers' ability, coach experience, and team spirit. Team revenues are, thus, defined as:

$$R = p \cdot T \cdot [WIN(A_i, I_j)] + B \cdot [WIN(A_i, I_j), P_b] \quad (2)$$

where p is the ticket price, T is the number of tickets sold, WIN is the percent wins, function of a vector of players' skills A and a vector of non-player skills I . The terms B , P_g and P_b , represent, respectively, broadcast revenues, the number of individuals potentially attracted to the stadium and potential broadcast households.

In order to estimate the gross marginal revenue product of a player, Scully adopts a two-step equation approach. First, he estimates how various measures of player performance affect a team winning percentage; then, he estimates how team revenue is affected by winning percentage, along with other variables like the size of the labour market, arena capacity, the presence of black players within the team, and franchise characteristics. The marginal revenue product is the product of a player's contribution to percent win times the impact of winning on team revenue. Scully defines a linear relationship between percent win and a set of baseball performance variables. First of all, he divides hitters from pitchers. Then he considers the team slugging average and the team strikeout-to-walk ratio as a measure of the offensive and defensive attributes that most affect players' salaries. Along with these two variables, three dummies are further specified, two of them reflecting a measure of high and low team morale and the other one reflecting the fact of participating to the National League.

Team revenue is estimated as a linear equation which assumes the win percent and other market features as the main regressors. These latter consist of:

- (i) a measure of the magnitude of monopoly income that a team earns for the fact of signing a franchise contract on an exclusive local area;
- (ii) a measure of team-specific attendance at home;
- (iii) a measure of the stadium capacity and location;
- (iv) a measure of fan racial discrimination represented by the number of black players in the team.

Finally, in order to obtain *net* marginal revenue product, additional information on team costs is needed. On this purpose, firm specific training, player

development in addition to other four non-player average costs¹ variables are included in the analysis and subtracted to gross marginal product and team revenue.

Baseball players' salaries are determined by defining an earnings function in which the following set of human skills inputs are identified: hitting or pitching performance; the weight of players' contributions to team performance; players experience in the major league and the presence of stars and superstars who usually hold a higher bargaining power (Rosen, 1981). For hitters, the selected performance measure is the lifetime slugging average, while, for pitchers, lifetime strikeout-to-walk ratio, along with the lifetime average percentage of innings pitched out on total innings.

Using detailed data on 1968 and 1969 leagues, and comparing gross and net marginal revenue products with individual salary², Scully estimates that the average players, both hitters and pitchers, receive about 20 percent of their marginal contribution to team revenue while stars only about 15 percent. Only mediocre players seem to get a salary higher than their net marginal revenue product. Due to the substantial economic losses the reserve clause generates for players, the policy implications point in favour of a higher degree of competition in the professional players labour market, a suggestion that has been seized in 1975 when the traditional owner's interpretation of the reserve clause has been relaxed by Peter Seitz decision on the Andy Messersmith case and players have become free to negotiate their contracts.

Studies after 1975 utilize the previous model as a benchmark for analyzing the effects of the new contractual framework on players' salaries. Sommers and Quinton (1982) slightly modify Scully's exercise by considering that, after 1975, some baseball players have become free agents. Using the same two-step equation approach, the authors find that, even if average players may still be grossly underpaid, the first family of free agents receive a salary that is in line with their marginal revenue product. This finding is not only due to the competitive bidding, but also by the fact that players may threaten team owners to become free agents and demand a compensation comparable to what they would get on the free market.

In line with these results, Scully (1989) finds that, in the 1980s, star players

¹Scully obtains non-player cost information from previous studies, in particular on: (i) team costs including roster and team specific non-player salaries; (ii) game costs of transportation, equipment, stadium rentals; (iii) general administrative costs of front office personnel; (iv) sales costs.

²The rate of monopsonistic exploitation is viewed as an upper bound of player exploitation when considering gross marginal revenue product and a lower bound when considering net marginal revenue product.

are able to earn a higher percentage (between 30 and 45 percent) of their marginal revenue product than in the late 1960s, while Zimbalist (1992) finds that players who are not eligible to become free agents ³ suffer a higher monopsonistic exploitation (about 38 percent) than their eligible colleagues (18 percent).

2.2 The cases of hockey and basketball

The relationship between salary and marginal revenue product is investigated with respect to other professional sports and for answering other kind of research questions. Scott, Long, and Somppi (1985), for instance, analyze the professional basketball sector with the aim of estimating if players are overpaid. Using Scully's approach, they first define a linear production function in which the dependent variable is the percentage of winnings and the regressors are home and opponent team performance variables characteristic of the basketball game: goal shooting percentage, free throw shooting percentage, rebounds, assists and fouls. As a second step, they estimate team revenue with respect to the team win percent, usual market characteristics and other explanatory variables capturing the number of superstars in the team and racial discrimination. By comparing the estimation results with salary information from various newspapers, the authors find that, despite of their high salaries, players free to sell their services to the highest bidder are paid more nearly what they are worth, the opposite being true for those players who are not free agents. The athletes' exploitation, thus, depends on the professional sports labour market structure.

An interesting study on how skill differences determine the salary level of professional players is provided by Jones and Walsh (1988) who focus their attention on the North American National Hockey League (NHL). Using a data set on 300 hockey players in 1977-78, matched with salary data from reports in the press, they define an earnings function in which the natural logarithm of player salary is regressed against three kinds of variables:

- (i) offensive and defensive skills, and physical attributes of skaters and goaltenders;
- (ii) franchise characteristics aimed at capturing the monopolistic structure of the market, and

³In professional baseball, a player is eligible for free agency after three years of service in the league.

- (iii) racial discrimination variables, in this case between Anglophone and French Canadian players.

The OLS estimates reveal some interesting results: first, the market structure and franchise characteristics do not seem to be so important in affecting athletes' compensation; second, all performance skills appear to be highly significant and, thus, can be considered as prime determinants of salary in the NHL; third, no empirical support seems to emerge in favour of a racial discrimination effect against French Canadians.

A slightly different analysis on NHL is the one conducted by Idson and Kahane (2000), who examine the separate effects of individual and team productivity on salary determination. Starting from the recognition that human capital inputs are complementary in production, the general research question is whether individual skills are rewarded differently in different teams, or, in other words, if a team dynamic exists so to affect individual player salary and the rate at which individual skills are valued by the team. In order to distinguish the two effects, two classes of variables are defined: on the one side, individual player variables concerning experience, career performance, physical attributes, the status of superstar and the role played within the team. On the other, team/coach variables such as team revenues and coach experience and quality.

The main results point to three directions. First, the effect of human capital on player salary is decomposed as follows: an individual player performance generates a direct and an indirect effect on his salary, the latter being the positive effect that a good performance has first on the team performance. As well as individual skills, team attributes also affect player salary in a direct and an indirect way, where the latter is given by the effect of the interaction of team values and player attributes on his compensation. In particular, higher coaching quality seems to particularly affect player salaries, and part of the return to individual productive skills is due to the positive correlation between player productivity and coaching quality and experience. Second, a problem of omitted variables seems to emerge. If team variables were not included in the regression analysis, performance coefficient would be overestimated, as in the case of player experience and seniority, as proxied by total games played over his career, or in the case of scoring performance, as given by the career goals and assists per game. Third, it appears that players, on average, are complements in the production of professional hockey games, even if such a complementarity is not uniform across all productive attributes.

2.3 Team-sports labor markets outside North America: the case of European professional soccer

The bulk of studies on sports economics relies on the high availability of data and case studies on professional team-sports in the US. However, team-sports diffused outside North-America have been analysed with particular reference to European countries. Since the 1970s, particular attention has been devoted to professional football in countries like the United Kingdom and Italy. One of the first contributions on this field comes from Sloane (1971), who concentrates on designing the basic features of both professional soccer industry and soccer clubs as utility maximizer agents⁴.

More important for the purpose of this paper is the recent contribution by Lucifora and Simmons (2003), who investigate wage determination among professional soccer players appearing in the Italian major leagues. Starting from the widespread feeling on the very high level of Italian soccer players' earnings, they ask if the relationship between individual productivity and salary can lead to superstar effects. Following the empirical framework developed by Rosen (1981), it is possible to test for the existence of superstar effects on earnings by checking if individual wages are highly convex⁵ with respect to player quality and performance measures, after controlling for personal attributes and team fixed effects. Using performance data coming from many Italian and European soccer yearbooks along with salary data from Italian newspapers, the authors specify and estimate a human capital earnings equation which includes performance, experience, reputation and team quality variables on Italian players of *serie A* and *B*:

$$\ln W_i = \alpha_0 + \alpha_1 EXP_i + \alpha_2 PERF_i + \alpha_3 REP_i + \alpha_4 TEAMQ_j + \epsilon_i \quad (3)$$

where *EXP* represents player experience as proxied by age and appearances in the major leagues (*serie A* and *B*), *PERF* a vector of player positional categories, scoring performance and assists, *REP* accounts for higher appearances in international matches and leagues for best performing players and aims at reducing possible problems of omitted variables, and *TEAMQ* measures team-specific effects due to home attendance and coach quality. Superstar variables are calculated for players achieving more than a defined threshold rate of goals per game.

⁴An interesting update about the characteristics of the European, and in particular of the English, professional soccer industry is also in Szymanski and Smith (1997)

⁵Convex returns to salary means that each performance indicator x (i.e. career goals per game) must exhibit a positive second derivative with respect to the wage rate: $\partial^2 wage / \partial x^2 < 0$.

After controlling for team fixed effects, the results highlight a strong convexity of player salary across two performance measures: career goal scoring and the assist rate, particularly for forward and midfield players. This evidence is used to support the existence of superstar effects in the Italian soccer leagues, as primarily generated by consumer interest in forward play.

2.4 Sigle-player sports labor markets: the case of US professional golf

The impact of playing skills on individual salary is mainly investigated by referring to team-sports labour markets. Very few studies are oriented, instead, towards non-team, or single-player, sports. One exception is the paper by Shmanske (2000), who studies the 'skill-earnings' relationship by gender on the Professional Golfers' Association (PGA) 1999 Tour and on the Ladies Professional Golf Association (LPGA) official 1999 Tour. After identifying the main skills that affect professional golfers compensations, the regression equations for the PGA Tour and the LPGA Tour are first run separately and then combined. The main human capital variables concern the four types of strokes that characterize golf games. The first stroke is called 'the drive', and the two variables associated are the distance that the golfer averages on his/her drive and the percentage of the time the drive ends up in the fairway; the second is called the 'approach shot', and the variable which captures the relative skill is the percentage of time that the player achieves this result; the third is the 'bunker', and the skills measured is given by the percentage of times that the golfer is able to recover and make par. Finally, the last shot is the 'putting', and the total number of putts taken on the green during a round is the variable associated. Instead of traditional salary indicators, earnings per tournament are predicted on the previous five skill variables both for men and for women.

The results of the regressions stress two findings: first, it is possible to identify which specific skills are most valued for men and women respectively. In particular, 'putting' and 'driving distance' seem to be the most important for men, while 'putting' and 'approaching in regulation' for women. Second, professional golf industry seems to reward the absolute level of skill with no gender bias. In fact, by combining data on men and women, if, on the one side, it is true that the former are paid more in the PGA Tour than women, on the other side, it is also true that the latter are paid more in LPGA Tour than they would in the PGA Tour. In other words, once skill levels are accounted for, women are not underpaid compared to men.

3 Concluding remarks: strengths, trends and issues emerging from the literature

The analysis of the literature engaged in estimating the impact of human capital on sports athletes compensation leads to identify some common features and trends as well as some open questions and issues. Table 1 summarizes what follows.

Common traits can be sketched in four directions. The first concerns the *empirical framework* adopted. The use of the earnings function approach is one of the most exploited tools in labour economics. When applied to professional sports, it is particularly powerful in estimating the marginal impact of human capital variables on individual player salary. The identification of such variables depends on the knowledge of the rules of the sports involved in the analysis. In any case, professional sports represent a fruitful context where such an approach can be utilized since data on individual skills and wages are available and observable, the structure of the market is usually clear, and the production function (the game) of teams and players is well known and standardized.

The second line concerns the common *methodology* for the marginal revenue product estimation. In line with Scully (1974), a two-step equation approach is used under the basic assumption that fans are attracted to the stadium, or to watch TV, in order to see the home-team win. Assuming again perfect knowledge of the rules of the game, this approach consists in determining, at first, the impact that skills exert on team performance, and, at a second stage, the impact that team performance has on each player salary.

The *context* or the *field of application* is the third common feature. The major part of the literature, in fact, is focused on North American professional team-sports, such as baseball, basketball, and hockey, with few exceptions on golf and European soccer. North American major leagues are commonly characterized by:

- (i) the presence, up to 1975, of a high degree of monopsonistic exploitation due to a team owner-biased interpretation of the reserve clause;
- (ii) the progressive diffusion of free agent players after 1975;
- (iii) the strong stability of leagues due to a lack of teams turnover year after year; (iv) high availability of data on both performance and salary.

The fourth route is represented by *data*. Performance and human skills information usually come from statistical yearbooks and reports developed by sports associations and federations, while salary data are usually reported in reports from the press and newspapers, with a quite satisfactory level of detail.

Finally, the last route concerns *findings*. Four kinds of trends seem to characterize North American team sports:

- (i) the more the sports labour market is competitive, the lower is the degree of monopsonistic exploitation and the more players are paid what they capable to do;
- (ii) skills plays a crucial role both in shaping player salaries and performance and in reducing gender and racial discrimination;
- (iii) local market attributes do not seem to be so important in determining athletes wages, but they seem more important as control variables;
- (iv) results on gender bias and fan racial discrimination are not unambiguous, and crucially depends on white/black and men/women players relative skills.

The same approach can be used in order to underline the main issues and open questions. On the empirical framework adopted, the first issue concerns the nature and composition of player salary: in fact, almost all the contributions examined rely on gross annual salary data. However, players salary is usually determined by two or three components: a gross annual salary plus possible gross individual benefits coming from advertising or other initiatives and/or possible gross collective benefits. Even if data on these latter components are not easy to find, the inclusion of complementary forms of athletes compensation can have a threefold effect: first, it may offer the opportunity for a more complete and realistic analysis; second, since benefits greatly differ across players and teams, it may increase the degree of variance among player salaries; third, it may represent a direct and suitable measure for testing superstar effects.

Looking at salary again, another emerging issue is that some players can play for more than one team within a single year. Since salary data are not available for the player for each team he plays with, the comparison between multiple movers is tenuous and the information available on individual salary may be biased or may represent a much more 'stable' remunerative situation

than it really is.

On the methodological side, the main issue concerns the possibility to better measure players marginal revenue product. As noted by Kahn (2000), the findings on monopsonistic exploitation must be interpreted cautiously, since players are supposed to affect teams revenues only through their own playing statistics on winning percentage. Other effects are not captured by the revenues of the player's home team, such as the effects on attendance on away games, TV ratings and merchandise sales. In addition, a more complete and correct measure of athletes superstar status must be explored, for instance by considering players citations in reports of sports matches, sales of named replica shirts, the appearances and experience in international competitions and so on.

A third open question emerges with respect to the context of analysis. Actually the major part of the research effort is devoted to professional team-sports developed in North America, mainly in the US. However, at least three other fields of analysis still remains open for future research: first, team-sports in other countries, like, for instance, Europe, Latin America and Asia. This kind of studies may provide useful cross-country information, and can contribute to define and include 'country-specific' effects in the earnings function regressions developed by the mainstream approach. Second, single-player professional sports, in which no team-specific effects exist, like golf, tennis and boxing, or in which a team exists and plays as a support for the individual athlete performance, such as motor-racing and cycling. Third, non-professional or amateur sports, in which motivations other than profits and salary determine the people choice to practice sports activities.

Finally, the sources and the quality of data represent the last and major issue. Professional sports is ascertained to be a sector characterized by a high availability of data, both on performance and on salary. However, it is worth to underline that such availability on sportsmen's earnings is much more limited in Europe relative to North America. Soccer, for instance, that is the most popular sport in Europe, is a much more interactive game than baseball or basketball, so that isolating superstar effects for European soccer is a more challenging task than for some North American sports. In addition, salary data usually come from newspapers and press reports: however good and detailed this information can be, official statistical reports and/or surveys based on *ad-hoc* questionnaires and subjected to more accurate controls are needed. In addition, salary data on team training costs are particularly welcome, not only to improve the analyses on players marginal revenue product, but also for answering some questions on the employability of young players in the first team squads.

Table 1: Professional sports labor market analyses: strengths and issues

	Strengths/Common Features	Issues
Empirical Framework	<ul style="list-style-type: none"> (i) Human capital theory (ii) Earnings function approach for pay and performance determination 	<ul style="list-style-type: none"> (i) Only gross annual player salary. Missing individual and/or collective benefits from other activities (i.e. advertising) (ii) Multiple movers
Methodology	<p>Two-step equation approach:</p> <ul style="list-style-type: none"> (1) Effect of player performance on team percent win (2) Impact of percent win on team revenue <p>(1)*(2)=Marginal Revenue Product (MRP)</p>	<ul style="list-style-type: none"> (i) MRP: missing effects on away games, TV ratings, merchandising (ii) Superstar effect: missing variables (citation in the press, sales of named replica shirts, international experience, etc.)
Context of Analysis	<p>North American (US) professional team sports</p> <ul style="list-style-type: none"> (i) Up to 1975: high monopolistic exploitation (ii) After 1975: diffusion of free agency (iii) Stability of leagues (iv) High availability of data 	<ul style="list-style-type: none"> (i) Focus on other countries professional leagues (ii) Single-player professional sports (iii) Non-professional, amateur sports
Data	<p>Statistical yearbooks</p> <p>Reports in the press</p>	<ul style="list-style-type: none"> (i) Low availability of data for non-US sports (ii) Low quality, lack of control

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