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Identification of Factors Determining Market Value of the Most Valuable Football Players

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Abstract

Purpose: The problem of identifying the most important determinants of the market value of football players is quite well described in the literature. There are many works that try to identify these factors. Some of them are focused on variables to make a set complete and others are on models and methods. The aim of this article is to present the variables influencing the valuation and to build an econometric model valuing footballers playing on the forward position, taking into consideration the assumptions of the econometric modelling. Such an approach indicates managers as other sources for obtaining information.

Methodology: Econometric models were used to verify the hypothesis formulated in this research. The database was created on the basis of variables presented on the website www.transfermarkt.de that presents the values of the most valuable football players in the world playing on the forward position. The Gretl program was used in the research.

Findings: The literature review showed that there are many independent variables having an impact on the value of the player. There are also many different models used to valuate footballers' performance rights. The results of estimation of models in the research indicated that such factors as Canadian classification points adjusted the market value of the team and dummy variables describing "goodwill" (only for the best players) had an impact on the market value of footballers' performance rights.

Limitations/implications: Information about different factors having an impact on football players' market value could support the investment decision process of football managers.

Originality/value: The results were part of a study concerning economics of sport, particularly processes of management of football clubs and valuation of intangible assets.

Keywords: economics of sport, football, econometrics, intangible assets

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Introduction

The problem of financial investment in sport plays an important role in the economy. Such a situation is caused by two reasons, i.e., external and internal. The external request follows that different companies realize their own goals of investing money in football. The example of such an aim is to build a strong, international brand using non-profit relations with sport clubs (Majewski, 2015). On the other hand, there are internal reasons closely tied with sports activity, loyalty to the club and any emotional connections to the sport. Both these causes are directly connected to sport results of the sponsored discipline and wide environment of any sports activity.

This work focused on football as a source of strong emotional reactions of people engaged in a sports event, such as sport managers, sponsors and spectators. In 2005 after big financial troubles, German football club Borussia Dortmund (BVB) changed its Management Board and as a stock exchange company started to realize a new policy based on building its own brand. Despite that the IPO of BVB was in 2000, the real change took place five years later. Strong connections between the football club and the stock market resulted in some influences of non-economic factors and events on company's quotations. Over the last few years, it was verified that the factor with the strongest impact on rates of return was the value of footballer's performance rights. The spectacular transfers of Mario Goetze in 2013 and Robert Lewandowski in 2014 from BVB to FC Bayern Munich were reflected in the stock exchange investors' reactions (Majewski, 2014). The economic reasons for such a situation could be explained by the player's performance right being an intangible asset of the company (club).

The problem of the identification of the most important determinants of the market value of football players is quite well described in the literature (Wicker et al., 2013, Idson and Kahane, 2000, Kahn, 2000). There are many other works trying to identify these factors. Some of them are focused on variables to make a set complete and others are on models and methods. In the literature review, many different variables were found, such as the distance run by a player during the match or the nationality of a player (in different forms but represented by dummy variables). The literature review also revealed that there are some nationalities that are overvalued, especially in soccer (Szymanski and Kuper, 2009). The aim of this article is to present the variables influencing the valuation and to build an econometric model valuing footballers playing on the forward position, taking into consideration the assumptions of the econometric modelling. Such an approach indicates managers as other sources for obtaining information. The construction of an econometric model taking into account variables, such as goals, assists, team values or the country of origin, provides a new

perspective for the interpretation and management of intangible assets in a sports company.

The data used in this research was collected from www.transfermarkt.de website as of the end of April 2015. The data set contained all available information on sports activity, market value and the country of origin of 150 of the most valuable forward players in the world. Linear econometric models were used to price the hypothetical market value of footballers. In the econometric modelling of the footballers' performance rights, the work tried to eliminate all formal problems of estimation, such as normality of the residuals, linearity of the relationship and heteroscedasticity. The results were a new econometric model pricing the market values of the most valuable forward players using selected variables and a proper estimation method.

Selected Models of Performance Rights Valuation

A fundamental issue for accounting of a football club, which is an object of scientific research, is footballers' performance rights. It is counted as an intangible asset in the balance sheet. Footballers have different contracts but in most of them, there is a clause of payment for the renunciation of the contract. It means that if any club would like to employ such a footballer, it should pay to the current employer the quota described in the clause. Another point of view is that players' performance rights are a trade matter and their market value is more than two-times higher than the value of intangible assets in the balance sheet (using the example of BVB in 2014).

The first models used for the valuation of football players' performance rights appeared in 1999 in the Bulletin of Economic Research (Carmichael et al., 1999). It presented the value of players transfer as a function of measurable and non-measurable characteristics of the player and his productivity. The first model was as follow:

$$F_i = X_i\beta_i + Y_i\gamma_i + Z_i\delta_i + e_i$$

where the symbols used mean:
F_i – value of the transfer;
X_i – vector of measurable characteristics and player's productivity indicator;
Y_i – vector of non-measurable characteristics of a player.

The literature review gave general approaches to the estimation of such an intangible asset. There are, among others:

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- Proposition of Gerrard and Dobson (Gerrard and Dobson, 2000):

$$F_i = \alpha_0 + \alpha_1 X_i + \alpha_2 Y_i + \alpha_3 B_i + u_i$$

where B_i means the vector of characteristics of the selling player club.

- Model of player's performance rights valuation (Lucifora and Simmons, 2003):

$$\ln(F_i) = \alpha_0 + \alpha_1 X_{1i} + \alpha_2 X_{2i} + \alpha_3 X_{3i} + \alpha_4 Z_i + e_i$$

This model uses another set of variables:
$ln(F_i)$ – natural logarithm of revenues connected to the player's football performance;
X_{1i} – vector of characteristics describing game experience of the player;
X_{2i} – vector of characteristics describing game performance of the player;
X_{3i} – vector of characteristics describing game reputation of the player;
Z_i – vector of characteristics describing quality of the club selling the player.

- Trinomial tree and option pricing models as players' valuation tools (Turnau et al., 2005).

- Discounted cash flow model with the assumption that the value of the player is a function of the whole team (Trequattrini et al., 2012).

The recent models mostly concentrate on the analytical form of the function used. Majewski presents such an approach using a power function model (Majewski, 2014):

$$F_i = \alpha_0 \cdot X_{1i}^{\alpha_1} \cdot X_{2i}^{\alpha_2} \cdot X_{3i}^{\alpha_3} \cdot Z_i^{\alpha_4} \cdot e^{\zeta \cdot i}$$

The problem of the players' labour market is of great importance in the sport economics bibliography. Many authors have analyzed the situation of competitiveness in this field. The first problem is talent distribution. Kesenne focused on the league quality depending on talent investment and its allocation (Kesenne, 2015). He suggested that talent investment and talent allocation go in opposite directions in the case of profit-maximization goals of the league. At the same time, a group of authors took into account a problem of the effective management of sport contracts (Buriamo et al., 2015). They argued that a long-term contract is better both for the club and the player because it increases the effectiveness of the player, gives the opportunity to use a player in a team for increasing revenue, as well as reduces the likelihood of misplaced investment. In this work, one can find an econometric model describing football player performance

presented by Kicker's points. This is a system of grades for footballers awarded after the match by experts for each player. Such a system is a type of the valuation of a player's job that could be easily changed for money or could be verified for the market value of the player during the season. The model is presented by the equation:

$$\begin{aligned} Log\ GRADE_{it} &= \beta_0 + \beta_1 YEARS\ REMAINING_{it} + \beta_2 YEARS\ ELAPSED_{it} \\ &+ \beta_3 AGE_{it} + \beta_4 AGE\ SQUARED_{it} + \beta_5 GAMES_{it} \\ &+ \beta_6 EXPERIENCE_{it} + \beta_7 PREVIOUS\ CLUBS_{it} \\ &+ position\ effects + nationality\ effects + season\ effects + error \end{aligned}$$

where:
Log Grade – quality of performance of the player measured by Kicker grades[2];
Years Remaining – player's contract length remaining;
Years Elapsed – number of years into current contract of the player;
Games – number of games started in current season;
Experience – number of years of the contract in the first Bundesliga;
Previous club – number of years in previous Bundesliga clubs.

The authors also use dummy variables represented by position effects (forward, midfielder, defender and goalkeeper), season effects and nationality effects in the model. The last dummy variable is very crucial for this article. The authors divided players into groups of countries: South America, North America, Asia, Africa, Western and Eastern Europe with Germany as a base category.

Another type of the model was presented by Wicker et al. (2013). This model takes into account every problem of econometric modelling and enlarges the classical approach by new variables. The specification is as follow:

$$\begin{aligned} Log\ (F) &= \alpha_0 + \alpha_1 AGE + \alpha_2 AGE^2 + \alpha_3 GERMAN + \alpha_4 HIGH + \alpha_5 APPEAR \\ &+ \alpha_6 TRANSFER + \alpha_7 TIME\ CLUB + \alpha_8 SP + \alpha_9 EFFIC \\ &+ \alpha_{10} TACK + \alpha_{11} NAT + \alpha_{12} NAT\ TOP + \alpha_{13} RUN + \alpha_{14} RUN \\ &\cdot SP + \alpha_{15} RUN \cdot EFFIC + \alpha_{16} RUN \cdot TACK + \sum_{i=1}^{8} \alpha_i POSSITION \\ &+ \sum_{i=1}^{21} \alpha_i TEAM + \varepsilon \end{aligned}$$

[2] Player market valuations are available from Kicker magazine and these are useful salary proxies (Frick, 2011).

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where:
Log(F) –logarithm of the player's market value;
AGE – age of the player;
GERMAN – dummy variable (if GERMAN = 1);
HIGH – height of the player (in cm);
APPEAR – number of appear in half season;
TRANSFER – dummy variable (if transfer appears at the end of half season = 1);
TIME CLUB – time played for the club (in years);
SP – scoring performance (goals + assists) per minute;
EFFIC – efficiency (rate) of ball contacts ([flanks+ right passes+ shots]/ball contacts);
TACK – tackling rate (tackles won/all tackles);
NAT – dummy variable (if the footballer plays for the national team of the home country = 1);
NAT TOP – dummy variable (if the footballer plays for the national team of the home country of one of the top FIFA = 1);
RUN – average number of intensive runs per game (in km per hour);
POSSITION – dummy variable represented position of the player played in most of the games of one half season (central defense, left wing defense, right wing defense, defense midfield, right wing midfield, left wing midfield, offense midfield, attack);
TEAM – dummy variable representing teams.

The results of the fixed effects models obtained by the authors demonstrated mainly insignificant and partially negative effects of an effort on logged market values. Only the interaction between intensive runs and tackling rate had a significant positive impact on the market value (logarithm). The insignificant and negative effects of an effort on player values are a very interesting effect for sport economics. This work aims at the examination of the impact of effort on market values of footballers' performance rights and the authors set some limitations such as drug cheating, player's level or a short period of time.

Research Framework

The study proposition of the model includes fourteen independent variables describing performance of the player in four spheres: human capital (i.e., age or performance – number of appearances in the season); productivity (e.g., goals or assists); organizational (e.g., a team value or team position in the league table); and control. The verification of the model obtained will give some information about the analytical form, so first the linear approximation will be tested. It takes into consideration every factor

(presented below from X_1 to X_{14}) that is tested as an independent variable in the model and the statistical significance of the estimated parameter influencing the choice of variables in the model. According to econometric rules, every problem of estimation process will be solved by changes in the analytical form, the estimation method or transformation in the set of variables.

According to the formulated hypothesis, the data set includes market values of football players from the transfermarkt.de website as of the end of April 2015. The best 150 forward players were the subjects of the research. The base set of independent variables presented by Majewski (2014) was extended to 14 variables listed below:

X_1 – age (of the player in years);
X_2 – performance (the number of matches played by the footballer during the season);
X_3 –number of positions in the first line-up;
X_4 – goals scored (the number of goals scored during the season);
X_5 – assists (the number of first level assists during the season);
X_6 – number of red cards during the season;
X_7 – number of yellow cards during the season;
X_8 – number of double yellow cards during the season;
X_9 – substitutes in (the number of matches the player comes on the football pitch from the substitutes bench);
X_{10} – substitutes out (the number of matches the player exits the football pitch during the match);
X_{11} – total time on the pitch during whole season (in minutes);
X_{12} – team value (the total value of all players of the club in million euros);
X_{13} – team position in a league table (the rank of the club on the end of the season);
X_{14} – rank of national team in FIFA rating.

Variables 1–3, 9 and 10 are factors belonging to human capital, 4–8 to productivity and 11–14 to organizational capital. Dummy variables can be used as controls in econometric models. The last variable 14, rank of national team in FIFA rating, is an effect of the hypothesis proposed by Buriamo et al. (2015). In contrast to research of Buriamo (2015) and Wicker (2013), the ranking of FIFA is used not as a dummy but as an integer from 1 (the best national team) to 209 (the worst national team). There is an assumption that if the country of origin does not have any influence on the market value of the player, the regression coefficient standing by this variable will be insignificant. Thus if the coefficient is significant, having the knowledge that not every football player plays for the national team, it can be concluded with certainty that the country of origin is one of the important determinants of market values of footballers.

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There are various models proposed in the literature to estimate the player's performance rights. All these models represent different types of quantitative methods. In this research, only simple models were used because of the ease of interpretation, taking into account the quality of estimated models. Tables 1 and 2 present the results of estimation by OLS method using the Gretl program.

Table 1. Linear model of top 150 forward players' market value at end of April 2015

Variable	Coefficient	Standard Error	t-Student value	p-value	
X2	-0.26608	0.06284	-4.2342	0.00004	***
X4	0.81214	0.11891	6.8298	<0.00001	***
X5	1.19254	0.22396	5.3248	<0.00001	***
X12	0.05307	0.00507	10.4672	<0.00001	***
X14	-0.08320	0.04405	-1.8888	0.06092	*

Estimation characteristics

Average value of dependent variable	19.84667	Standard deviation of dependent variable	17.64337
Residuals square	13339.86	Standard error of residuals	9.591611
R-square coefficient	0.873515	Adjusted R-square	0.870025
F(5, 145)	200.2753	p-value of F test	3.08e-63
Likelihood logarithm	-549.4315	Akaike's criterion	1108.863
Schwarz's criterion	1123.916	Hannan-Quinn's criterion	1114.979
Normality test for the rest of the model			
Chi-square	10,505	p-value	0.0052
Heteroscedasticity test for the model (White test)			
TR-square	116.177	p-value	0.0000

Source: own calculations.

Obtained results indicated that both goals scored and assists have the strongest impact on the market value of the forward player's performance right and this influence is positive. The market value of a team where a forward plays has a positive but very small influence. Two variables (performance, rank of national team) have a negative

impact on the dependent variable. In the case of performance, this impact is significant (p-value is 0.00004) and quite strong. In the case of the X_{14} variable, the statistical significance is weak (p-value is near 0.06, meaning its importance is marginal). The adjusted R-square on the level of 87% is the sign of a good fitting of the estimated model. The last two tests in Table 4 concern the model's residuals. Unfortunately, the results indicate the problem of its normality and homoscedasticity. Such a problem could be fixed by using another estimation method (for example, weighted least squares) or by adjusting the observation matrix. Results for the model using weighted least squares method did not help as the distribution of the residuals was still not normal. After verification of the model's residuals, it was revealed that the biggest effects are obtained for five football players: Lionel Messi, Christiano Ronaldo, Neymar, Gareth Bale and Edinson Cavani. The author of this paper decided to enter a new variable to the model; this dummy variable assumes value "1" for the five most valuable players and value "0" for the others. The new estimation results are presented in Table 2.

Table 2. Linear model of top 150 forward players' market value at end of April 2015 with the dummy variable

Variable	Coefficient	Standard Error	t-Student value	p-value	
X4	0.37377	0.08743	4.2748	0,00003	***
X5	0.88855	0.16908	5.2553	<0,00001	***
X12	0.04301	0.00389	10.3029	<0,00001	***
X14	-0.08057	0.03324	-2.5619	0,01144	***
Dummy variable	40.4554	3.95437	10.2306	<0,00001	***

Estimation characteristics

Average value of dependent variable	19.92617		Standard deviation of dependent variable	17.67589
Residuals square	8675.602		Standard error of residuals	7.761909
R-square coefficient	0.917690		Adjusted R-square	0.915404
F(5, 144)	321.0966		p-value of F test	3.40e-76
Likelihood logarithm	-514.2140		Akaike's criterion	1038.428
Schwarz's criterion	1053.448		Hannan-Quinn's criterion	1044.530

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Normality test for the rest of the model				
Chi-square	2.14504		p-value	0.342144
Heteroscedasticity test for the model (White test)				
TR-square	89.6963		p-value	0.0000
LM test for nonlinearity (logarithm)				
LM	0.388598		p-value	0.533037

Source: own calculations.

The additional variable allows obtaining results free of the first problem seen in the previous model. The dummy variable means that there are some factors not included in the model determining the value of the dependent variable (the market value of the footballer). The author of this paper states that this variable could represent "goodwill" of the player. Compared to models presented in Tables 1 and 2, it should be noted that there is no variable X_2 (performance) in the final model. Values of the models' parameters are very similar and adjusted R-square is higher and equals 91.5%. The linear model shows that the most important variables in the modelling of the market value of the 150 most valuable footballers (playing in forward position) are the number of goals scored, number of assists, value of the club and position of national team of the player (the country of origin). It was also shown that there are some specific factors depending on the value of certain players that could be their "goodwill."

The obtained regression parameters mean that an increase by 1 goal scored translates into an increase of the market value of a footballer accounting for 0.37 million euros and for 1 assist an increase of 0.89 million euros (assuming that the other variables will not change). Additionally, the total value of the club has a positive impact on the individual value of the player. The increase of this variable by 1 million euros increases the player's value up to 0.04 million euros. The ranking of FIFA has a negative impact on the dependent variable. The fall of the country in ranking by 1 position decreases the value of footballer's rights (from this country) to 0.08 million euros. This situation is unusual because it relates to all football players, not only to those who play on the national team. A very interesting result was obtained for the dummy variable. In the case of the five players having a strong brand, the appearance of a new player with "goodwill" increases his value to 40.45 million euros.

The test LM for nonlinearity of residuals in the model verified that there is not any reason to use power or other nonlinear models in this research. Thus, the author decided to use the feasible generalized least square (FGLS) model with correction for

heteroscedasticity. For obtaining normal distribution for residuals in the model, new synthetic variables were used. The author defined new variables as the transformation of original variables X_4, X_5, X_{12}, X_{14} as follows:
X_{15} – Canadian classification points (the sum of goals scored and assists);
X_{16} – weighted team value:

$$X_{16} = X_{12} \cdot \frac{1}{X_{14}}$$

The weighted team value will be higher in the case of rich clubs employing players from countries from the top of FIFA ranking. It will be lower in the case of poor clubs employing footballers from the bottom of FIFA ranking. It means that the factor X_{14} will have a strong impact only on the best national teams in the valuation of the footballer's performance rights.

Such an approach should eliminate estimation problems without the elimination of important variables. Table 3 shows the results of FGLS estimation.

Table 3. FGLS model of top 150 forward players' market value at end of April 2015

Variable	Coefficient	Standard Error	t-Student value	p-value	
X15	0.814373	0.07826	10.4061	<0.00001	***
X16	0.105263	0.02057	5.1175	<0.00001	***
Dummy variable	38.832	7.56595	5.1325	<0.00001	***

Estimation characteristics

Average value of dependent variable	19.95270		Standard deviation of dependent variable	17.73293
Residuals square	1532.629		Standard error of residuals	3.251132
R-square coefficient	0.567143		Adjusted R-square	0.561172
F(5, 145)	63.32783		p-value of F test	3.15e-26
Likelihood logarithm	-382.9800		Akaike's criterion	771.9599
Schwarz's criterion	780.9516		Hannan-Quinn's criterion	775.6132
Normality test for the rests of the model				
Chi-square	4.58931		p-value	0.100796

Source: own calculations.

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The results obtained for the new variables and new estimation process, using the FGLS model with correction for heteroscedasticity, show that variables have quite a strong impact on the market value of football players. Table 3 shows the variables correlated with the market value of the forward player: Canadian classification, team market value weighted by the national team position in the FIFA ranking and the specific variable representing "goodwill" of five football players (Lionel Messi, Christiano Ronaldo, Neymar, Gareth Bale Edinson Cavani). The adjusted R-square coefficient of this model equals 0.56, which means that in 56%, the model shown in Table 6 describes the real values of footballers' performance rights. The fitting of the model is not as good as in the case of two other presented models, but shows that the variables used are statistically significant. If the value of the variable X_{15} grows by 1 point (one goal or one assist), the market value of the forward player grows by 0.81 million euro, assuming that all other variables do not change. If the value of the variable X_{15} (weighted value of the club) increases up by 1 million euros, the market value of the forward player will go up by 0.11 million euros, assuming that all other variables will not change. The most interesting variable is the last one: dummy variable for the specified five top players. In this case, the market value of their performance rights grows to 38.83 million euros from only the "goodwill" or "brand" of the player, assuming that all other variables will not change. It is crucial to emphasize that the difference between values of parameters for this variable in Tables 5 and 6 is small and amounts to 1.62 million euros.

It should also be noted that every variable used in the model has statistically significant impact on the footballers' performance rights (p-value is less than 0.00001) and the correlation coefficient between variables X15 and X16 amounts to 0.31 (it means the correlation is weak).

Conclusions and Remarks

The aim of this study was to present the factors having an influence on the market value of the football players being an intangible asset of the sports company by building an econometric model respecting the assumptions of econometric modelling. The first stage of the research was to identify variables having an impact on the market value of players; the logical choice was verified by statistical significance of the parameters. The second problem undertook in the study was to find the best approximation (a model and a method for its estimation) for the relation described in the article. Because the relation between dependent and independent variables has a linear character (LM test in Table 5), only one analytical form (linear) was taken into account. The

author tested three estimation methods to eliminate estimation problems (linearity and heteroscedasticity). Ordinary least square (OLS), generalized least square (GLS) and feasible generalized least square with correction for heteroscedasticity (FGLS) tests were used.

The research indicated the variables having the most important influences on the market value of forward players from the top 150 most valuable footballers in the world. Those variables are Canadian classification point (number of goals and number of assists), value of the club adjusted by the FIFA ranking points and the factor representing "goodwill" or "brand" of the specified players.

The best results were obtained for the feasible generalized least square (FGLS) method with new variables. The model obtained was characterized by quite a good fit; adjusted R-square equals 56% and all parameters were statistically significant. Otherwise in every model shown in Tables 1–3, variables are similar except variable X_2. Only in Table 1 is there a variable called performance describing the number of matches played by the footballer during the season. This variable disappeared by feeding a dummy variable to the model. In every case, the number of goals, assists, value of the whole team and FIFA ranking points had an impact on the market value of the player.

The last conclusion is the value of the adjusted R-square coefficient showed that there is a place for other factors determining the market value of footballers' performance rights. Although the value of the adjusted R-square coefficient is not so high to be used in forecasting, it plays a significant informational role for the analysis and diagnosis of factors being the market value determinants.

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