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Modelling of football companies' rates of return according to sport results and bookmakers' expectations on the example of serie A

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The main goal of this article is to investigate whether the rates of return on listed companies - football clubs can affect their athletic performance or bookmakers' market expectations. For this purpose 2001-2014 stock prices were collected of three companies - AS Roma, Juventus and SS Lazio - listed on the Milan Stock Exchange as well as their betting odds from the website www.betexplorer.com. The assumption that there are relationships between financial factors and results of sport events or bookmakers' expectation was posed after the study of the world literature in this field.

JEL Classifications: L83, G14, B23

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Introduction

Szymanski and Kuper write in their work (2009) that football (soccer) arouses extreme emotions. There are some statistics proving thesis that soccer catalyses fans' emotions to such extent that it could drive them to suicide or save their lives. The cause of such situation is huge interest of this sport discipline. The biggest audience in Europe have matches played in five national leagues: English, Spanish, French, German and Italian. Italy is also the country where people most often watch football matches on TV - approximately 7.8% of households in Italy watch football matches on TV. Total revenues of Italian football clubs from TOP20 in season 2012/2013 amounted 829.1 million euro while the popularity measured by the number of likes on Facebook reached 34.3 , and by the number of followers on Twitter - 3.3 million (Deloitte, 2014).

This article deals with the problem of the necessity of using individual econometric models to describe the relationship between the rates of returns of stocks and sport results and expectations of bookmakers' market - which means factors reflecting some emotional biases. The specificity of these factors makes it necessary to use individual approach to each case. The main goal of this research is to verify the hypothesis - the rates of returns should be modeled by econometric models of the ARCH(q) type using factors closely tied with a sport activity but different for every club (stock). The shares quotations of three Italian clubs listed on the Milan Stock Exchange were used in the research. They were AS Rome, Juventus Turin and Lazio Rome. The bookmakers' odds of the analyzed clubs' matches in the Italian Serie A were also used in this article. The analysis covered the period of time from 2001 to 2014. The chosen clubs are the components of Dow Jones Europe Football Index.

Football market in Italy in comparison with the European market

Italian Football Federation was founded in 1898 in Turin as an amateur association keeping rules of FIFA (IFF joined FIFA in 1905) (Baroncelli, Caruso, 2011). After the

First World War the Italian league was almost professional. The highest league - Serie A - was founded in 1929 and from 2004 twenty clubs play to win the Italian championship. A key decision for the Italian football was the recognition of Serie A as one of the three most important football leagues in Europe - four Italian clubs represent Serie A in Champions League, and two others play in less prestigious European League. These two forms are an additional source of revenues for clubs.

Italian clubs were organized as nonprofit organizations to 1981. Such situation was changed by the act 91/1981. This legal act allows to employ professional football players and to set up companies, but profits of these companies should be reinvested in sport activity. After fifteen years, in 1996, the new act allowed the public issue of sport companies and repealed the ban on payment of dividend, as it is in normal companies. There was only one restriction - about 10% of the operating income should be transferred to sport academies. Such situation resulted in the first sport clubs going public. The first Italian club listed on the Milan Stock Exchange was SS Lazio Rome in 1998, three years later followed by another one - Juventus Turin and four years later - by AS Rome.

The appearance of Italian clubs on stock exchange was a purely psychological trick, because of the fact that in none of the cases the percentage structure of ownership was not changed. Previous owners of these clubs still have a dominating role in managing the companies. For example, Exor owned by the Agnelli family still has 60% of the Juventus shares; Italtipetroli owned by the Sensi family has 67% of AS Rome and Claudio Lotito was an owner of 67% of SS Lazio shares. Such situation that some families control sport clubs is ordinary in Italy. Another problem is the ownership of sport stadiums. Most of them is owned by Italian municipalities and clubs often use long-term leasing (30-90 years) as an additional source of revenue. But the question remains if the long-term leasing agreement or ownership of stadiums are less risky assets than the players performance rights treated as intangible assets. Today the profitability of stadiums is an element of marketing-mix of football clubs. As stadiums are a venue of big sports events supported by media, entrepreneurs can get d in sponsoring activity. Such an activity is profitable not only in case of good sporting results but even during events such as a football match. A sponsor's trademark with information about their involvement is seen by thousands of spectators during a TV broadcast for much longer than a standard advertisement.

The structure of Italian clubs' revenues from Deloitte's TOP20 is presented in Table 1.

TABLE 1. THE STRUCTURE OF REVENUES OF LARGEST ITALIAN CLUBS
IN THE SEASONS OF 2011/2012 AND 2012/2013

Club	Season	TV Broadcasting	Commercials	Matchday
Juventus Turin	2012/2013	60.9%	25.1%	14.0%
	2011/2012	46.4%	37.4%	16.3%
AC Milan	2012/2013	53.5%	36.5%	10.0%
	2011/2012	49.2%	37.7%	13.2%
Internazionale	2012/2013	48.3%	40.2%	11.5%
	2011/2012	60.5%	27.1%	12.5%
AS Rome	2012/2013	53.1%	30.8%	16.2%
	2011/2012	55.6%	31.8%	12.7%

Source: Deloitte (2013, 2014).

It should be noted that their revenues from TV broadcasting generate over 50% of their total revenues (only in few cases this share is 1 or 4 percentage points lower than 50), which makes this group of clubs the largest. The group of revenues from commercials consists of contracts with sponsors and partners. The case of AC Milan is very interesting - two major contracts with Nike and Pirelli provide them about 40% of that kind of revenues. Italian clubs have the lowest share of revenues from tickets among all the

TOP20 clubs. Almost all of them obtain more than 22% of their total revenues from matchday activity.

Di Domizio (2010) described and verified the peculiarity of TV broadcasting of Serie A matches in Italy by means of econometric models. Similarly to the White Book of European Committee (2007) his results confirm the importance of a social role that football plays in Europe.

Bookmakers market

According to P. Bernstein (1997), the popularity of gambling led to scientific thinking about risk, particularly when it comes to its measuring. Nowadays it is possible to meet various forms of gambling: classic - casinos and gambling saloons, alternative, in two forms: materialized and virtual - legal bookmakers networks and illegal sports betting brokers. The possibility of investing in legal betting transactions and the lack of random sport events, where experience and knowledge can provide an advantage over other investors is the reason why they are called an alternative investment.

There are four segments of the bookmakers market (Jędraszka, Zatoń, 2011):

- ground - offering bets in their branches;
- internet - offering bets via internet;
- mixed - offering bets in branches and via internet;
- the segment of sports betting exchanges - the market of trading in probabilities, where a gambler has a possibility of betting on sporting events and to sell them.

There is one element common to all of these segments - betting odds called the probabilities of subjective forecasts (Ayton, 1997). Such understanding of probability is not congruent to the axioms of theory of probability. There are three basic standards of betting odds determination:

- decimal - betting odds are decimal fractions greater than 1 - in this case the probabilities are the inverse of betting odds;
- fractional - betting odds are common fractions;
- "moneyline" - betting odds are integral numbers with signs "+" or "-".

The decimal system of betting odds determination are prevailing in Europe, excluding Great Britain and Ireland. Such a system is more transparent and the access to information about betting odds is free - it is enough to multiply betting odds by amount.

All bookmakers earn on profit margins, and its level mainly depends on (Jędraszka, Zatoń, 2011):

- the rank of a sport event;
- the form of business;
- the country of taxation;
- the margin policy.

Betting odds taken from web sites of bookmakers firms were used in this research because of the accessibility and universality of the data - betting odds published in the internet give possibility to access the data even if an investor does not gamble. Such choice is also based on the supposition that the same group of investors joins both of these markets. This group of investors are traders - players, who treat the market as one of many places to make money. Traders on the both markets have the same systematic, professional approach to an investment - seeking market advantage in the information chaos to make a better investment decision than the other market participants. Unfortunately, this could be also an element of transmitting risk from one market to another - information in the form of the event probability could influence quotations of the football company's stock. Such studies have been conducted in Europe and they have shown that there are some statistically significant relations among sport results, betting odds (expected probabilities)

and the rates of return of football companies listed on the European exchanges (Majewski, 2014).

Methods of the research

Econometric models were often used in studies on the economics of sport to prove some statistical relations among variables or events. The most popular objects of research in last twenty years have been:

- Borussia Dortmund (2003, 2014);
- Clubs of Premiership (2003, 2009, 2010, 2010, 2012);
- Porto, Sporting Lisbon (2005);
- Beşiktaş, Fenerbahçe, Galatasaray (2006, 2011, 2013);
- National teams (2007, 2009);
- Components of Dow Jones Football Index (2009, 2010, 2013);
- Chile, Turkey, England, Spain (2012);
- Clubs of Serie A (2010);
- Clubs of Bundesliga (2014).

So far the following tools have been used to verify the quantitative hypotheses:

- linear and non-linear regression;
- panel regression;
- structural models;
- autoregressive models (ARCH, GARCH, EGARCH, GARCH-M);
- statistical tests;
- the cointegration and causality Granger test.

Autoregressive models are used in this research. There is an expectation that the time series of the rates of return on football companies' stocks - the components of DJFI - are explained by following variables:

W - winnings of the team;

D - losses of the team;

L - draws of the team;

MD - matchday;

HOW - probability of home winnings of the team;

HOD - probability of home draws of the team;

HOL - probability of home losses of the team;

AOW - probability of away winnings of the team;

AOD - probability of away draws of the team;

AOL - probability of away losses of the team;

TOW - probability of winnings of the team (home and away);

TOD - probability of draws of the team (home and away);

TOL - probability of losses of the team (home and away).

So, the time series is described by an equation:

$$y_t = \gamma_0 + \sum_{k=1}^n \gamma_k X_{kt} + \varepsilon_t, \quad (1)$$

The basic ARCH(q) model could be expressed as (Engle, 1982):

$$h_t = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2, \quad (2)$$

where: $\alpha_0 > 0, 0 \leq \alpha_i \leq 1, \varepsilon_t \sim N(0, h_t)$.

The ARCH process is treated as a special case of a more general model called GARCH. GARCH stands for the generalized autoregressive heteroskedasticity and it adds to the equation lags in values of variance. The GARCH is expressed as (Bollerslev, 1986):

$$h_t = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^p \beta_j h_{t-j}$$

The results of the estimation of econometric models parameters will be an answer to the question if factors characterized by sport results or bookmakers forecasts have a statistically significant influence on the analysed time series - the rates of return on Milan Stock Exchange. An important note is that information about betting odds is reflected in the emotional state of an investor who is a football fan. The estimation of parameters uses the maximum likelihood function and it is done by means of the GRETl program.

Empirical results

As it has been mentioned above, in this research the rates of return of the Italian football clubs listed on Milan Stock Exchange are the objects of econometric modelling. These companies are major components of the European football index DJFI. Daily data from the stock exchange and the betting odds from the web site <http://www.betexplorer.com/> from the period of 2001-2014 have been selected to verify the hypothesis.

According to recent bibliography, autoregressive econometric models were used to explain relationships among rates of return and any, even incidental, factors of different time-series. It was found that the best approximation of the analysed time-series were ARCH and GARCH models. Although the other models (EGARCH, TARCH) were also tested during the estimation, the results were not better than those presented in Table 2. The number of observations is also presented in this Table next to the name of the company. General results of the estimation process are presented in the table 2 (all results of estimation the best models for each stock are in appendix 1).

TABLE 2. THE RESULTS OF THE ESTIMATION PROCESS FOR ITALIAN CLUBS

Company	Model	Variables	Values of parameters	p-value	lnL	AIC
AS Rome N = 3591	GARCH(1,1)	D	-0.00393	0.01305	7786.719	-15561.44
	GARCH(1,1)	HOL	-0.03153	0.03026	7785.970	-15559.94
	GARCH(1,1)	AOL	0.01441	0.03228	7785.937	-15559.87
	ARCH(1)	MD	-0.00235	0.01305	7581.849	-15153.70
	GARCH(1,1)	D	-0.00779	<0.00001	7789.349	-15564.70
Juventus N = 3151		L	-0.01087	<0.00001		
	ARCH(1)	HOD	-0.02110	0.05071	7587.089	-15162.18
		HOL	-0.06221	0.00032		
	GARCH(1,1)	HOD	-0.02997	0.00201	7775.302	-15536.60
		HOL	-0.04989	0.00091		
	ARCH(1,1)	AOD	-0.03062	0.00002	7595.851	-15179.70
		AOL	-0.03824	<0.00001		
	GARCH(1,1)	AOD	-0.02161	0.00056	7775.833	-15537.67
		AOL	-0.02548	0.00131		
	GARCH(1)	TOD	-0.02534	<0.00001	7785.587	-15557.17
		TOL	-0.03149	<0.00001		
	ARCH(1)	D	-0.00709	0.05066	4826.204	-9642.407
	GARCH(1,1)	D	-0.00599	0.06406	4942.591	-9873.183

TABLE 2. THE RESULTS OF THE ESTIMATION PROCESS FOR ITALIAN CLUBS

Company	Model	Variables	Values of parameters	p-value	lnL	AIC
Lazio N = 2616	GARCH(1,1)	MD	-0.00388	0.03670	4943.059	-9874.118
	ARCH(1)	HOW	0.01363	0.03367	4832.527	-9653.054
		HOL	-0.04988	0.00077		
	GARCH(1,1)	HOW	0.01297	0.04485	4947.336	-9880.673
	ARCH(1)	HOL	-0.03882	0.00343		
		AOW	0.05086	0.00005	4839.240	-9666.479
	GARCH(1,1)	AOL	-0.02713	0.00039		
		AOW	0.03431	0.00309	4952.206	-9890.411
	ARCH(1,1)	AOL	-0.02493	0.00027		
		TOW	0.02061	0.00036	4844.520	-9675.039
		TOD	-0.01901	0.07777		
	GARCH(1,1)	TOL	-0.03264	<0.00001		
		TOW	0.01719	0.00280	4958.332	-9900.664
		TOD	-0.01687	0.08466		
		TOL	-0.02839	<0.00001		

Source: Own studies.

It can be concluded from the table that it was easy to find any relations among data of SS Lazio Rome, where nine different econometric models with significant parameters were applied. The best approximation was obtained for the GARCH(1,1) model with the regressors: *TOW*, *TOD*, *TOL*. These variables represent bookmakers' expectations by subjective probabilities of match results. There is a positive relation between the rates of return and the probability of winnings for SS Lazio (home and away) and there are negative relations between the rates of return and the probabilities of losses and draws of SS Lazio in Serie A.

Seven models with significant parameters were obtained for Juventus' Turin. The GARCH(1,1) model was the best one also in this case, but there are some differences:

- there is no significant relation between the probabilities and the rates of return;
- there is no relation between the winnings and the rates of return;
- there is a significant relation among draws, losses and the rates of return.

There were some problems to find relations among the AS Rome's data. Three GARCH(1,1) models were obtained. There were three individual regressors: draws, the probability of home losses and the probability of away losses of AS Rome. A very interesting situation was observed concerning the probabilities of away losses - it is difficult to explain that, but the away losses of this team caused the increase in the rates of return of AS Rome's stocks. The best model in this group was the GARCH model with draws as an independent variable. We may say that every draw of this team causes a decrease in the rates of return.

The conclusion is that there is no possibility to indicate one universal way of building econometric models for any Italian club listed on Milan Stock Exchange. The author suggests that individual models need to be built for every club. Models for this group of clubs are totally different. The only one final model uses bookmakers' expectations to explain the rates of return.

Conclusion

The analysed case study showed very clearly that there are relationships among financial variables (rates of return) and the variables representing results of a sport event and bookmakers' expectations. On the other hand there is no rational reason for an authoritarian indication of proper variables to explain this variable. In this case it was

found that draws and the probabilities of home draws, away losses, any winnings, losses and draws are significantly related to rates of return.

Taking into consideration the Italian clubs listed on the Milan Stock Exchange and representing the Italian football league, i.e. Serie A, it could be summarized that individual approach needs to be applied. It means that the selection of a proper set of independent variables which could cause the causal or coexistence relationships for a dependent variable for the joint group of clubs is doubtful. Further, the indication of one company reacting more intensively to the appearance of betting odds (representing the expectation of the market), lead to the conclusion that these stocks could be an interesting instrument for traders (as it has been mentioned before). But there is also a possibility to interpret this situation as a phenomenon an emotional reaction of investors closely tied to SS Lazio Rome. A lot of these investors could be recruited from the very powerful environment of football ultra-fans called Irreducibili (irreducible).

The obtained results are the starting point for further study on the rates of return of football clubs listed on stock exchanges. It could be also a step to better valuation of these companies.

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Appendix 1

MODEL GARCH(1,1) FOR AS ROMA'S RATES OF RETURN (N = 3591).

	<i>coefficient</i>	<i>Standard error</i>	<i>z</i>	<i>p-value</i>	
const.	0,00131897	0,000410438	3,2136	0,00131	***
D	-0,00392951	0,00158298	-2,4823	0,01305	**
alpha(0)	0,000121351	1,33221e-05	9,1090	<0,00001	***
alpha(1)	0,268413	0,0241964	11,0931	<0,00001	***
beta(1)	0,639507	0,0276164	23,1568	<0,00001	***
Mean dependent variable	0,000441	S.D. dependent variable	0,034403		
Likelihood logarithm	7786,719	Akaike criterion	-15561,44		
Schwarz criterion	-15524,32	Hannan-Quinn	-15548,21		

Note: Unconditional error variance = 0,000966518

MODEL GARCH(1,1) FOR JUVENTUS' RATES OF RETURN (N = 3151)

	<i>coefficient</i>	<i>Standard error</i>	<i>z</i>	<i>p-value</i>	
const	-0,000138009	0,000321586	-0,4292	0,66781	
D	-0,00778692	0,00159019	-4,8969	<0,00001	***
L	-0,0108703	0,00204979	-5,3032	<0,00001	***
alpha(0)	6,9865e-05	7,71501e-06	9,0557	<0,00001	***
alpha(1)	0,33245	0,0279958	11,8750	<0,00001	***
beta(1)	0,595264	0,030504	19,5143	<0,00001	***
Mean dependent variable	-0,000847	S.D. dependent variable	0,028914		
Likelihood logarithm	7789,349	Akaike criterion	-15564,70		
Schwarz criterion	-15522,31	Hannan-Quinn	-15549,49		

Note: Unconditional error variance = 0,00131789

MODEL GARCH(1,1) FOR LAZIO'S RATES OF RETURN (N = 2616)

	<i>coefficient</i>	<i>Standard error</i>	<i>z</i>	<i>p-value</i>	
const	-0,000108909	0,000718326	-0,1516	0,87949	
TOW	0,0171854	0,0057493	2,9891	0,00280	***
TOD	-0,0168701	0,0097841	-1,7242	0,08466	*
TOL	-0,0283872	0,00615016	-4,6157	<0,00001	***
alpha(0)	0,000260849	3,27765e-05	7,9584	<0,00001	***
alpha(1)	0,138165	0,0195097	7,0819	<0,00001	***
beta(1)	0,699194	0,0340374	20,5419	<0,00001	***
Mean dependent variable	-0,000093	S.D. dependent variable	0,041230		
Likelihood logarithm	4958,332	Akaike criterion	-9900,664		
Schwarz criterion	-9853,709	Hannan-Quinn	-9883,656		

Note: Unconditional error variance = 0,00160384