University of Warsaw
Faculty of Economic Sciences

Working Papers
No. 35/2020 (341)

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Warsaw 2020

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The impact of the results of football matches on the stock prices of soccer clubs

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Abstract: The aim of this paper is to study the relationship between sport results and stock prices of European football clubs. To show that connection, we use two econometric models. Firstly, we conduct an event study analysis around the dates of football games to look for existence of abnormal returns. Secondly, we use OLS regression to test what effect the unexpected part of the result has. Based on 2239 observations of football matches results played between 01/08/2016 and 02/03/2020, we find significant relationship between sport results and financial performance. Significant negative abnormal returns are observed around defeats and draws, while for wins the impact is unclear. Using second model, we find positive values for coefficients related to unexpected number of points, which can be an additional evidence of a link between football results and stock prices. Finally, we see the potential for systematic trading strategy on soccer stocks based on the presented results. Such algo strategy with market neutral characteristic should beat the market regardless of market conditions.

Keywords: soccer stock returns, event study analysis, algorithmic investment strategies, market neutral strategy, sports efficiency

JEL codes: C4, C14, C45, C53, C58, G13

Acknowledgements: The views presented in this text are those of the authors and do not necessarily represent those of Labyrinth HF project.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

1. Introduction

Football is one of the most popular sports in the world. Over the past few decades, the sport industry has changed significantly, increasingly resembling typical, profit-oriented commercial companies. According to the Deloitte Football Money League (2020) report, the 20 biggest football clubs generated a total sum of a record 9.3 billion euros in revenue. With the quite obvious link between clubs' investments and their sporting performance, it isn't a surprise, that clubs seek additional sources of funding. One such way is to become publicly traded company. At the time of writing this paper, 22 clubs decided to do so, 19 of which were used in this study.

Emotions connected with sports performance have a strong influence on supporters' moods, which can influence their behaviour. Some of these supporters may be potential investors, which means that the outcome of a match can influence the behaviour of these investors and, consequently, the share price of the clubs listed on the stock exchange. The aim of this paper was to study this relationship. Furthermore, sports results are a very good example of signals, because matches are usually played when markets are closed and occur frequently. Most clubs play the matches every weekend and the information reaches everyone interested at the same, known in advance, time, and no one has access to it before. In addition, we have various betting or statistical services that provide information about the expected outcome of the game, so we can separate the expected part from the unexpected.

All these features make sport results almost perfect for testing the semi-strong efficient market hypothesis that current market prices contain all publicly available information. So, we expect the results of the games to be information affecting the stock price of the clubs. More precisely, in this paper we will try to verify the following hypotheses:

H1 - The results of football matches are price-sensitive information.

H2 - Positive results have a stronger impact on prices after matches played away than after matches played at home and negative results have a stronger effect after home games than away games.

H3 – Results in European competitions have a stronger impact on stock prices than league matches results.

H4 - The presented results allow for the construction of a systematic investment strategy with an algorithm built based on the results of this study.

Using the database containing match information and financial data for the period 01/08/2016-02/03/2020, the above problem was analysed. To this end, two approaches were used: the first was an event study analysis looking at the abnormal returns around match days, and the second was a linear model estimating the impact of an unexpected part of the result on returns of clubs' stocks.

In the first case, we expect that good results (wins) will have a positive impact on the share price, and bad results (losses and draws) will have a negative impact. Moreover, we expect a stronger impact of positive results achieved in away matches than in home matches and the opposite in the case of negative results. In the second model, our expectations are similar, although in this case we also distinguish types of games: league (domestic) and European, which are divided into Champions League and Europa League matches. At the same time, we expect the impact of European matches, especially those in the Champions League, to be stronger than that of the league matches, given the high money prizes linked directly to match results occurring in these competitions.

The rest of this work is structured as follows. Chapter 2 presents the literature dealing with the subject of this work. Chapter 3 introduces the reader to the football competitions system and describes the data and methodology used in the study. Chapter 4 presents our findings. The conclusion summarizes and closes the paper.

2. Literature Review

One of the first papers studying the relationship between sport performance and returns on investment in football clubs' stocks was published by Renneboog and Vanbrabant (2000). The authors of this study used data for 17 British clubs between 1995 and 1998 and found positive abnormal returns of around 1% on the first trading day after a win. After draws and losses they observed negative abnormal returns of 0.6% and 1.4%, respectively. In addition, their research showed that after higher-stakes matches, such as European matches or those that had a significant impact on avoiding relegation from the league, the abnormal returns were at a higher level. A similar study, but using data for clubs from various European countries, was carried out by Benkraiem et al. (2009). Their analysis confirmed the conclusions of the work of Renneboog and Vanbrabant (2000) on defeats and draws for which they found significant negative abnormal returns on the first trading day after the game. They did not find, however, a significant reaction to

wins. In their opinion, it may result from the bias of supporter-investors who expect their team to win the match, and therefore do not reward wins and only react negatively to defeats (Edmans et al., 2007). This also explains the fact that they found differences in reaction depending on the venue of the match. In addition, they found evidence that trading volume increased before and after matches.

Using a methodology similar to that used by Renneboog and Vanbrabant (2000), Bell et al. (2012) also found a significant response to match results. In addition, the results of their research indicate a significant impact of unexpected results on share prices, which may confirm that football matches are price-sensitive information, and the market reacts in a manner consistent with the semi-strong efficiency hypothesis. The effect of the unexpected part of the result was also investigated by Stadtmann (2006), who looked at the shares of the German club Borussia Dortmund. Using betting odds and simple econometric methods, he found a positive relation between the unexpected number of points gained by this team and the price of their shares. Additionally, he showed that results in European matches may have a stronger impact on share prices than league games. Scholtens and Peenstra (2009) also studied the impact of football matches on share prices. Similarly to the previous paper, they also found evidence that the results could have an impact on clubs' stocks. This work divides matches into league and European matches and takes into account expectations. The market seems to react stronger to international matches after which unexpected results have a greater impact. Interestingly, this effect does not occur for league matches.

The impact of football matches on clubs' stocks returns was also found by Demir and Danis (2011), who studied Turkish clubs. Their research shows that match results have an impact on abnormal returns in a manner similar to the previously mentioned papers. Interestingly, for clubs from this country, wins in European competitions don't have a significant impact on share prices. They also found a negative market reaction to defeats, whether they are expected or not. The same clubs were investigated by Sarac and Zeren (2013), who also found a relationship between sport performance and stock prices.

In order to investigate the relationship between sport and financial performance, the ARCH family models were also used. Using these models, the relationship between matches and share prices was shown by Duque and Ferreira (2005), who performed an analysis based on data for two Portuguese clubs: Sporting Lisbon and FC Porto. They found positive market reactions to wins and

negative ones to draws and defeats for Sporting, while for Porto a significant reaction was only recorded after draws. They also introduced an additional variable called "RPV" which measures the distance in the table between the club and its rival in the championship fight. Their research shows that this is another factor that may have a significant impact on the returns on clubs' shares. Using models from the same family, Majewski (2014) also demonstrates the existence of a relationship between rates of return and football results. He investigated three Italian clubs: Lazio, Juventus and AS Roma. The author of this study, however, suggests that the conclusions drawn from the models for individual clubs differ and suggests that an individual approach should be used for each of them. This is confirmed by Floros (2014), who analysed data for 4 European clubs and showed that the reactions to different results may be different. Contrary to most of the previous work on this topic, he received a positive reaction after draws in the case of Ajax and Benfica. For Juventus Turin, he found the negative impact of draws and losses. Those results are in line with previously mentioned studies

Demirhan (2013) looked at this problem somewhat more broadly, looking for a relationship between the returns on the Turkish BIST-100 index and the results of the Turkish national team in the period from January 4, 1988 to May 25, 2011. Using the GARCH model, he found evidence that the defeats of the national team could negatively affect returns on the stock market index. In the case of wins, this effect was not recorded. A similar study was carried out by Škrinjarić and Barišić (2019) for the Croatian stock exchange, although for this country they did not find a significant relationship between the results of the national team and returns from the stock exchange index.

Yet another approach was used by Demir and Rigoni (2014), who examined the impact of rivalry between two Italian clubs, Lazio and Roma, on the prices of their shares. Not only did they find a link between team performance and share price, but they also showed that unexpected rivals' results can have a direct impact. The effect of the results of the team competing with the tested one was also shown by Stadtmann (2006). He received a significant, negative value for the estimator for the variable describing the unexpected number of points gained by Bayern Munich, the main domestic opponent of Borussia Dortmund.

To sum up, the impact of football results on club stock prices is not a new topic. Since the beginning of the 21st century, it has been tested many times. The conclusions drawn from various

studies, using different research methods, are usually unanimous and show that the market does react to the results of football matches, which can be treated as price-sensitive information.

3. Methodology and data

3.1. The system of football games

To conduct this study, it is necessary to use data for two types of football games: league (domestic) and European. Domestic competitions can take a variety of formats. The classic system assumes that teams from the same league play against each other twice during the season - once as the home team and once as the away team. Each team gets 3 points for a win, 1 for a draw and 0 for a loss. After the last match, the team with the highest position in the league becomes the national champion and the teams from the bottom of the table are relegated to the lower league. Such a system is used in 9 out of 10 leagues that are included in this study. The exception is the Danish Superligaen, which, after the end of the main round, is divided into two groups: the 6 teams occupying the highest position in the table compete for the title and the other teams are fighting to remain in the league.

The European competitions are divided into the Champions League and the Europa League. The Champions League is considered the most prestigious football competition in the world. Only the best teams from the best leagues qualifies to it directly (based on the positions in the table in the previous season and the coefficients determining how many teams from a given league can qualify), teams from weaker leagues must not only take a sufficiently high place in the league table, but also go through several qualifying rounds. If a team makes it to the Champions League, it plays first in the group stage, where 32 teams, divided into 8 groups of 4 each, compete to advance to the knockout stage. All teams in the group play against each other twice, and the best two will advance, while the third will advance to the Europa League. The next phase is played in a knockout system, and the teams from each pair play twice - at home and away. The Europa League matches work in the same way, but are played by clubs that placed lower in the league or were eliminated in the Champions League qualifying rounds.

Contrary to league competitions, which pay out cash prizes only after the end of the season, in European competitions, clubs receive payouts after each group match depending on its result and additional bonuses for promotion to each subsequent round. For example, in the 2019/20 season, UEFA (the organizer of the tournament) paid 2.7 million euros for each match won in the

Champions League and 900,000 euros for each match drawn. Additionally, for qualifying to the group stage alone, the clubs received 15 million euros. In the case of the Europa League, it was 570,000 euros for a win, 190,000 euros for a draw and 2.92 million euros for qualifying to the group stage. Therefore, we expect the results in this competition to have a greater impact on the clubs' shares as they have a direct impact on the teams' finances.

2.2. Data

The source of sport data is a database coming from the data.fivethirtyeight.com[1] website, which in addition to typical match information, such as results, venue of the match or type of the competition, also contains the probabilities of each result, which are necessary in the second model. FiveThirtyEight is a service that uses statistical methods to generate forecasts and polls, mainly focusing on US politics. With the development of the website, their area of interest has expanded, and since 2017 they have been publishing forecasts for football matches. These forecasts are based on the Soccer Power Index (SPI) ranking, which estimates the strength of individual teams based on previous games. This ranking is regularly updated after each match. The process of calculating the probabilities of individual outcomes is a three-stage process. First, the expected number of goals is calculated for each participating team. For this purpose, SPI components are used, describing the offensive and defensive strength of a given team. These predictions are then adjusted according to the place of the match, the league and the importance of the match for each team.[2] Next, assuming that goal scoring follows the Poisson process, two Poisson distributions are generated around the previously received expected results. This gives the probabilities of each team to score a certain number of goals. Finally, based on the received distributions, a matrix of all possible match results is created. On this basis, the probability of winning, drawing and losing for each team is calculated.

Table 1 shows the breakdown of match data by clubs used in this study. In total, the database contains observations for 2239 matches played between 01/08/2016 and 02/03/2020. The dominant results are wins, the number of which is 1271 in the entire database. The number of draws and defeats is at a similar level – 510 and 458 respectively. Moreover, we have 244 observations for

[1] https://data.fivethirtyeight.com/#soccer-spi; detailed description of the methodology: https://fivethirtyeight.com/methodology/how-our-club-soccer-predictions-work/

[2] For example, a match at the end of the season between the team fighting for the title and the mid-table team isn't equally important for both teams.

the Champions League games, 146 for the Europa League games, and the remaining 1849 observations are league matches.

Table 1. Match Data

Team	Country	Index	Wins	Losses	Draws	HW	AW	HL	AL	HD	AD	CL	EL	Total
Borussia Dortmund	Germany	SDAX	84	36	41	54	30	10	26	17	24	31	4	161
Manchester United	England	NYA[3]	87	38	43	48	39	12	26	24	19	18	8	168
Juventus	Italy	FTSE MIB	130	23	26	72	58	6	17	11	15	40	0	179
Ajax	Netherland	ASCX	80	19	13	44	36	8	11	5	8	18	2	112
AS Roma	Italy	FTSE MIB	95	38	35	55	40	15	23	14	21	20	8	168
Lazio	Italy	FTSE MIB	90	45	31	49	41	18	27	17	14	0	26	166
Benfica	Portugal	BVLGR	82	27	16	44	38	11	16	8	8	26	8	125
FC Porto	Portugal	BVLGR	89	20	16	51	38	8	12	3	13	26	8	125
Sporting CP	Portugal	BVLGR	74	32	18	45	29	10	22	7	11	12	22	124
Lyon	France	CACS	88	43	41	47	41	17	26	22	19	21	10	172
Trabzonspor	Turkey	XUTUM	47	24	26	30	17	13	11	7	19	0	6	97
Galatasaray	Turkey	XUTUM	59	25	22	39	20	5	20	10	12	12	2	106
Fernerbahce	Turkey	XUTUM	46	24	30	29	17	6	18	14	16	0	8	100
Besiktas	Turkey	XUTUM	60	31	27	36	24	9	22	14	13	14	12	118
Brondby	Denmark	OMXCSCPI	28	23	9	15	13	10	13	6	3	0	0	60
FC Copenhagen	Denmark	OMXCSCPI	50	19	18	29	21	6	13	8	10	6	22	87
AGF Aarhus	Denmark	OMXCSCPI	26	16	16	14	12	7	9	8	8	0	0	58
AIK	Sweden	OMXSPI	54	12	24	28	26	5	7	12	12	0	0	90
Silkeborg	Denmark	OMXCSCPI	2	15	6	1	1	8	7	2	4	0	0	23
Total			1271	510	458	730	541	184	326	209	249	244	146	2239

Note: HW – Home wins; AW – Away wins; HL – Home losses; AL – Away losses; HD – Home draws; AD – Away draws; CL – Champions League matches; EL – Europa League matches.

Then, in order to analyse the relationship between clubs' shares and sport results, a variable representing the returns on club shares after matches was created. A simple logarithmic formula was used for this purpose:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)*100 \qquad [1]$$

where:

[3] The club is listed on the NYSE, despite coming from England

P_t – the closing price of the club's shares on day t, i.e. the first trading day following the match,

P_{t-1} – the last closing price before the match; if the match took place on a business day, it is the closing price on that day, if the match was played on a non-business day, it is the closing price on the last business day.

The same was done in the case of stock exchange indices corresponding to the given markets. The financial data on clubs' stock prices, index quotations and bond yields used in this paper come from investing.com website.

2.3. Model I

The first model used is an event study analysis. This model examines abnormal returns around dates of football matches. To make this study possible, apart from real rates of return calculated according to formula (1), it was also necessary to determine the expected rate of return. For this purpose, the CAPM model was used, described by the equation:

$$ER_{i,t} = Rf_{m,t} + \beta_i * (R_{m,t} - Rf_{m,t}) \quad [2]$$

where:

$ER_{i,t}$ – the expected rate of return of the club i on day t,

$Rf_{m,t}$ – the risk-free rate of return for a given market m on day t; 3-month government bond yields of a given country were used in this study[4],

$R_{m,t}$ – the expected rate of return from the market index m on day t; we used average rate of return from the previous 252 trading days,

β_i – beta coefficient calculated by the formula $\frac{Cov(r_i,r_m)}{Var(r_m)}$, where r_i is the return on the shares of club i, and r_m is the return on the corresponding index; the calculations were made on the basis of the previous 252 trading days.

Then the abnormal rates of return were calculated:

[4] For Turkey, annual bond yield was used.

$$AR_{i,t} = R_{i,t} - ER_{i,t} \quad [3]$$

where:

$AR_{i,t}$ – the abnormal rate of return for the club i on day t,

$R_{i,t}$ – the rate of return for the club i on day t,

$ER_{i,t}$ – the expected rate of return for the club i on day t.

The last stage of this study was the use of the T test to check the significance of the obtained results. The study distinguishes 3 levels of significance: 10%, 5% and 1%.

The impact of football matches on share prices was searched for 2 days before and 2 days after the match. This study was divided into two stages. In the first place, we only look at the results, not taking into account the place where the match was played. We expect positive results to have a positive impact on rates of return, and negative ones a negative. In the second stage, matches are divided into away and home. We expect negative results in home games to have a stronger negative impact than in away games. In the case of positive results, we expect a stronger impact of the away matches.

2.4. Model II

The second model looks for the relationship between the returns from a given club's shares and unexpected sport results. In this case, it was necessary to separate the expected part of the result from the unexpected one. In the literature bookmaker odds were used for this purpose (Stadtmann, 2006), but in this study the probabilities given in the mentioned database were used. The expected number of points was calculated as follows:

$$EP = 3*Win\_prob+1*Draw\_prob \quad [4]$$

where:

EP – the expected number of points,

Win_prob – the win probability,

Draw_prob – the draw probability.

In order to calculate the unexpected number of points, this value was subtracted from the actual number of points gained.[5] Then, the following OLS model was estimated:

$$\text{Model 2.1: } \text{Club\_return}_t = \beta_0 + \beta_1 * \text{Index\_return}_t + \beta_2 * \text{Unexp\_points}_t + \varepsilon_t \quad [5]$$

where:

Club_return_t – the return on club's shares after match t,

Index_return_t – the return on index after match t,

Unexp_points_t – the number of unexpected points gained in the match t.

The model was first estimated on the entire sample, and then on sub-samples divided by the competitions. This procedure was carried out in order to detect the effects for each competition.

Table 2. RESET Test

	Model 2.1.1.	Model 2.1.2.	Model 2.1.3.	Model 2.1.4.	Model 2.2.1.	Model 2.2.2.	Model 2.2.3.	Model 2.2.4.
Test statistics	7,172	4,823	0,363	3,712	1,526	1,172	2,853	0,868
P-Value	0,001	0,008	0,696	0,027	0,218	0,310	0,060	0,422

Note: H_0 - correct functional form of the model, H_1 - incorrect functional form of the model; Models for the entire sample and for the sub-samples were estimated according to the functional form presented in equation (5) and (6). Models 2.1.1. and 2.2.1. covered the entire sample of 2,239 observations, Models 2.1.2. and 2.2.2. included only league matches, Models 2.1.3. and 2.2.3. only included Champions League matches and Models 2.1.4. and 2.2.4. only Europa League matches.

The model in the original specification in the case of models 2.1.1., 2.1.2. and 2.1.4 rejected the null hypothesis of the RESET test, which states that the functional form is correct. In order to solve this problem, the model presented by formula (6) was estimated, taking into account the non-linear relationship between returns on clubs shares and returns on the corresponding stock indices.

$$\text{Model 2.2: } \text{Club\_Return}_t = \beta_0 + \beta_1 \text{Index\_Return}_t + \beta_2 (\text{Index\_Return}_t)^2 + \beta_3 (\text{Index\_Return}_t)^3 + \beta_4 \text{Unexp\_Points}_t + \varepsilon_t \quad [6]$$

[5] We use a certain simplification, assigning 3 points to wins in the knockout stage and 1 points to draws, although in reality there are no points in this phase.

where:

Club_return_t – the return on club's shares after match t,

Index_return_t – the return on index after match t,

Unexp_points_t – the number of unexpected points gained in the match t.

Model 2.2.1 is the version of Model 2.2 for all observations, Model 2.2.2. for league matches, Model 2.2.3. for Champions League matches, and Model 2.2.4. for Europa League matches. The values of the test statistics for the RESET test for the model in its final form are presented in Table 2.

Another problem identified was heteroscedasticity, which was detected with the Breusch-Pagan test. This problem was solved by using the White estimator (White, 1980). It is the most popular heteroscedasticity-consistent estimator of the variance and covariance matrix. Using this estimator, it is possible to make statistical inference without the need to estimate the model for variance and covariance. The OLS is still used to estimate the model, but standard errors are estimated without homoscedasticity assumption. The use of this method has been described in more detail by, inter alia, Long and Ervin (2000) and Hayes and Cai (2007).

Heteroscedasticity was present in the model for the entire sample and for the league games. In order to obtain consistent, comparable results, robust variance and covariance matrix were used for all models. The values of the test statistics for individual sub-samples are presented in Table 3. The models were also tested for the presence of autocorrelation, but on the basis of the Breusch-Godfrey test, no such phenomenon was found, as shown in Table 4. A significance level of 5% was used for all tests.

Table 3. Breusch-Pagan Test

	Model 2.2.1.	Model 2.2.2.	Model 2.2.3.	Model 2.2.4.
Test statistics	10,062	12,403	5,190	1,105
P-Value	0,039	0,015	0,268	0,893

Note: H_0 – homoscedasticity, H_1 – heteroscedasticity.

We expect the relationship between unexpected points and club returns to be positive. Moreover, we expect that the estimates on the sub-samples will give different results, and the value of the

estimator for the European games will be greater than for the league games.**Table 4. Breusch-Godfrey Test**

	Model 2.2.1.	Model 2.2.2.	Model 2.2.3.	Model 2.2.4.
Test statistics	0,912	3,387	0,307	1,001
P-Value	0,340	0,066	0,580	0,317

Note: H_0 – no autocorrelation, H_1 – autocorrelation.

4. Results

4.1. Model I

The results obtained using the first model, without taking into account the venue, are presented in Table 5.

Table 5. Abnormal returns around match dates, without dividing by the venue

Day	Wins (n=1271)	Draws (n=458)	Losses (n=510)
-2	-0,368	-0,552	-0,440
-1	-0,036*	-0,428**	-0,200
1	0,138***	-1,334***	-1,961***
2	-0,222***	-0,759***	-0,535
[1;2]	-0,085***	-2,092***	-2,496***
[-2;2]	-0,488***	-3,072***	-3,135***

Note: P-Value: * - p<0,1; ** - p<0,05; *** - p<0,01; on the basis of the T test; [1;2] – total abnormal returns for two consecutive days after the match combined; [-2;2] – total abnormal returns for 4 consecutive days around matches combined.

The conclusions are quite surprising for the wins. Statistically significant changes in share prices were observed the day before the match and in the first two days after the event. On the trading day preceding wins, abnormal returns of -0.04% were recorded. However, the value is close to zero and its statistical significance is low. On the first trading day after the game, abnormal returns of 0.14% were observed, which may indicate that investors are treating the winnings as positive news. However, this information is not strong enough as the market adjustment in the form of price drops was observed already on the next day, and -0.22% abnormal returns were recorded in this case. Therefore, the negative impact of winning on the second day after the game seems to be greater than the positive effect on the first day. This is confirmed by looking at both these days

together, where we saw a total fall in prices of 0.09%. Looking at the entire test period, we see a drop in prices by 0.49%. This result is significant at 1% level. Thus, it is difficult to determine the unequivocal impact of wins on stock prices after the match but we can notice that combined effect for 4 consecutive days around matches is significantly negative.

This situation is more clear for the other two sport results. The market reacted particularly negatively to the draws, for which significant price drops were observed in three consecutive trading days. The day before the game, significant at 5% level price drops of 0.43% appeared. This effect persisted also in the following days, resulting in further price drops in the following days, by 1.33% and 0.76%, respectively. In total, in the first two trading days after the match, prices fell by an average of 2.09%, and in all four test days by 3.07%. These drops are significant at 1% level. Such a strong aversion to draws may result from the growing uncertainty that arises during the matches of two teams of similar strength.

Interestingly, looking at individual days, the market reaction to defeats was only found on the first day after the lost game. However, it is stronger than in the case of the other results, and the observed abnormal returns after losses were of -1.96%. The significant impact of the losses was also detected for the first two trading days following the lost match and for the entire period. The abnormal returns in question are -2.5% and -3.14%, respectively. As in the case of draws, the obtained results are characterized by a high level of significance. So, losses seem to be a strong negative shock.

Table 6. Abnormal returns around match dates, including venue

Day	Wins at home (n=730)	Win away (n=541)	Draws at home (n=209)	Draws away (n=249)	Losses at home (n=184)	Losses away (n=326)
-2	-0,359	-0,379	-0,642	-0,476	-0,715	-0,285
-1	0,058**	-0,162	-0,177	-0,639**	-0,081	-0,266
1	-0,066***	0,413***	-1,675***	-1,047*	-2,706***	-1,540***
2	-0,338	-0,067**	-0,863**	-0,671	-0,589	-0,505
[1;2]	-0,404***	0,346***	-2,538***	-1,719*	-3,295***	-2,045***
[-2;2]	-0,706***	-0,195***	-3,357***	-2,834**	-4,091***	-2,596

Note: P-Value: * - p<0,1; ** - p<0,05; *** - p<0,01; on the basis of the T test; [1;2] – total abnormal returns for two consecutive days after the match; [-2;2] – total abnormal returns for 4 consecutive days around matches.

In order to deepen the analysis, the matches were then divided into home and away matches, and the results of this study are presented in Table 6. The day before the home win, prices rose by 0.06% and the day after the match fell by 0.07%. This may indicate that, in the case of home matches, wins are expected by the market and therefore are not rewarded after they occur. This can be explained by the allegiance bias of supporter-investors for whom home wins are "obvious" (Edmans et al., 2007). However, given the low values of these effects, one should not draw too far-reaching conclusions. If we look at the first two days after the meeting, we will see significant price drops by 0.4%. Thus, this is a result that is contrary to our expectations, although it may still result from the already mentioned bias. Similar conclusions can be drawn from the observation of all 4 days in total, for which a price change of -0.71% was found.

It looks different if the win happened in an away game. Immediately after the match, the abnormal returns amount to 0.41%, which shows that the venue can really matter and the away wins, unlike the home winnings, are rewarded by the market. However, this reaction may be too strong, as indicated by a slight fall in prices the following day. In total, however, in the first two days after the win, the prices increase by 0.35%. Throughout the whole testing period, we again see a drop in prices, this time by 0.2%. In both cases, the results are significant at 1%.

Other market reactions depending on the venue were also found for draws. In the days leading up to a home draw, no significant impact was found for such matches. This may be because the draws at home are somewhat unexpected and therefore an earlier reaction is not possible. It may also be another proof of the bias of supporter-investors who do not expect their team to lose points on their own pitch. On the other hand, drops in prices were observed on two consecutive days, and the abnormal returns were of -1.68% and -0.86%, respectively. Therefore, we can see that on the first day after the tied game, the market reacts in a significant, negative way, and this trend continues on the next day. In those 2 days combined, we observed price drops of 2.54% and in the entire testing window of 3.56%. The results were significant at 1%.

As with wins, things are different when the match is played in an opponent's stadium. In such cases, price drops of 0.64% start already a day earlier, which may show that there is some uncertainty about the upcoming event. The day after the game was tied, we still see the negative impact of the football game. However, not only is the observed value lower than for home matches at -1.05%, but also its statistical significance is at a lower level of 10%. The situation is similar for

the first two trading days combined, which may indicate a greater discrepancy in investors' behaviour depending on their individual expectations as to the outcome of the game. For the entire period, we still observe significant abnormal returns.

Looking at losses, the conclusions are quite clear. Again, there was no market preparation for negative news. Again, this could be confirmation of the bias of supporter-investors. Differences in the strength of reactions to home and away matches were also found. Home defeats are by far the biggest shock observed in this study, with price drops on the first day following them by 2.7%. In the first two days after the meeting, prices fell by 3.3% in total, and by 4.09% in the entire test window. Losses away also had a negative impact on club stock prices, but the market response was weaker than after home games. The abnormal returns received on the first day after such meeting were of -1.54%, and in the first two days of -2.05%. Thus, these values are lower than in the case of home defeats, which may confirm that the market treat the venue as important information. All the discussed results obtained for losses were significant at the 1% level.

One of the most intriguing result coming from Table 5 and Table 6 is that regardless of the result of the match the winning strategy was to sell stocks of the playing team exactly two days before the match and buy them back two days after the match. The trade should be hedged by buying the main stock index from the home country of the football team in order to make it market-neutral strategy. In such a way investor would be able to construct profitable investment strategy (with positive average results in every of six scenarios described in Table 6) which detailed results could be the issue of further research.

4.2. Model II

The results obtained by estimating Model 2 are presented in Table 7. Model 2.2.1. included the entire sample of 2,239 observations. The obtained value of the estimator for the variable determining the effect of unexpected number of points is, as expected, positive and significantly different from zero. It amounts to 0.862, which means that one unexpected point translated into 0.862% change in the price of the club stock, ceteris paribus. The adjusted R^2 value for this model is 0.121. Next model has the number 2.2.2. and only considers matches played in national leagues. The values of individual estimators are similar to those obtained in model 2.2.1, which is to some extent expected, as league matches constitute the vast majority of observations. In this case, the estimator for the number of unexpected points is 0.823. It is significant at the 1% level.

The next two models took into account two European competitions. Model 2.2.3. looked at the impact of results in the Champions League, and Model 2.2.4. in the Europa League. The value of the coefficient describing the impact of the number of unexpected points gained in the Champions League is 1.435. The estimator is significant at 1%, and the adjusted R^2 for this model is 0.179. So as expected, it has a positive sign, is significantly different from zero, and moreover, its value is greater than the value of the coefficient for league games. Therefore, this may, to some extent, confirm the hypothesis (H3) that games in this competition have a greater impact on club's stock prices. This is also logical, as the results in these competitions are directly related to the financial rewards. In the case of Model 2.2.4, which includes only Europa League matches, the observed value of the estimator we are interested in was 0.500. It was therefore smaller than in the case of league games, which may be surprising at first sight. It should be noted, however, that this is less prestigious competition than the Champions League, and the cash prizes in it are smaller. As a result, they are often disregarded by both the biggest clubs and their fans. Also, the significance of this estimator is at a lower 10% level. However, it is still statistically significant, so we can't omit these games in our analysis.

Table 7. Model II estimation results in subsamples

	Model 2.2.1.	Model 2.2.2.	Model 2.2.3.	Model 2.2.4.
Index_Return	0,667***	0,658***	0,953**	0,724*
Index_Return^2	-0,082***	-0,079*	-0,409**	-0,245
Index_Return^3	-0,009**	-0,008***	-0,051**	-0,023
Unexp_Points	0,862***	0,823***	1,435***	0,500*
Constant	-0,228***	-0,161**	-0,732***	-0,023
Observations	2,239	1,849	244	146
R^2	0,123	0,121	0,192	0,117
Adjusted R^2	0,121	0,119	0,179	0,092

Note: P-Value: *p<0.1; **p<0.05; ***p<0.01; Model 2.2.1. included the entire sample of 2239 observations, Model 2.2.2. included only league matches, Model 2.2.3. only Champions League matches and Model 2.2.4. only Europa League matches.

In conclusion, using the event study analysis and linear regression, we have shown the existence of a relationship between football results and stock prices. The first model showed a strong and consistent market reaction to negative results, i.e. draws and losses. In the case of wins, this effect was not that strong and clear. After dividing the games by venue, we showed that this could be additional information affecting the share price. As expected, positive results in away matches were rewarded more than in home meetings. Similar conclusions can be drawn from the observation of negative information, which resulted in greater drops if the match was played on the pitch of the tested club. Based on the presented results we were able to refer to H4 and suggest the logic of profitable investment strategy based on market neutral transactions on football stocks and market index.

The second model examined the effect of unexpected points on the returns on clubs' shares. The obtained estimators support the hypotheses about the impact of the results on share prices (H1), but also about the different strength of the reaction in each competition (H3) showing the highest importance of Championship League matches. In addition to the linear, significant impact of the number of unexpected points, a significant, but non-linear relationship was also found between club returns and the corresponding indices. However, taking into account this non-linearity and varying significance of this relationship for individual models, we do not undertake the interpretation of this variable.

5. Conclusions

Football has evolved over the past decades into a profit-driven commercial business. The main source of profit for football clubs is success on the pitch. It attracts a greater number of fans, wealthier sponsors and gives the opportunity to participate in prestigious competitions such as the Champions League, generating additional income. However, to achieve sport successes, financial resources are required and one of the ways to obtain additional funds may be to go public. Performance-related emotions have a strong influence on supporters' mood, which may further influence the behaviour of potential supporter-investors. This means that the result of the match may have a direct impact on the share price of the clubs that are listed on the stock exchange.

In the existing literature, this topic has been discussed many times, usually finding confirmation of the relationship between these two aspects of the clubs' operation. Similar conclusions can also be drawn from this paper in which we tried to verify four research hypotheses

posed at the beginning. The first one (H1) said that football results are price-sensitive information. The second (H2) assumed a different impact of the results achieved in home and away games, the third (H3) connected the strength of the market reaction to the type of football competition, and the fourth (H4) assumed that the results of the study would allow the construction of a systematic investment strategy. We expected that after wins we would see positive abnormal returns, and negative ones after draws and losses. Moreover, we assumed that the positive effects would be stronger for away games and negative ones for home games. In the second model, we expected to obtain positive, significantly different from zero coefficients showing the impact of the number of unexpected points on the share price after the match. We also expected that the impact of European matches, especially in the Champions League, would be greater than the impact of the league games.

The results obtained using both models were mostly in line with our expectations. In the event study analysis, we did not obtain a clear effect for wins (the combined 4 days effect was even significantly negative), but the impact of negative results and draws was fully in line with expectations (H1). Such results of the football matches translated into significant drops in share prices after the lost games, and in the case of draws also before. After dividing the matches into home and away, we got the results supporting the H2 hypothesis. We found a positive (after match) impact of the games won away, contrary to the games won at home, while in the case of negative results, the market reaction on the first day after the match was stronger in case of home games than in away games. Using the second model, we found a positive, significant relationship between unexpected points and clubs' stock prices. In addition, the results for individual competitions differed, which may be a proof of the dependence of investors' reactions on the type of competition and supports the H3 hypothesis. Taking into account the conclusions from both models, we can say that we have found evidence supporting the H1 hypothesis. Another interesting conclusion is the possibility of constructing an investment strategy in which, regardless of the result of the meeting, we would sell shares (hedged with the stock exchange index) 2 days before an important match, and then close this transaction 2 days after the event. The exact results of the abnormal returns presented in Tables 5 and 6 show that regardless of the outcome of the match, the above strategy would generate positive abnormal returns, recording the highest values in draws and defeats of our team, especially in the event that such a situation happened in a home match.

In summary, this paper, like the existing literature, shows the existence of a relationship between sport performance and financial performance of football clubs listed on the stock exchange. In order to deepen further analysis of this problem, it would be advisable to use a database with more observations and analyse the impact of the results individually for each team. However, this can be problematic, especially if one is interested in the impact of competitions like the Champions League, as the number of matches in these competitions is limited. The second research extension could focus on designing an algorithmic trading strategy based on the result of this paper. Such algo strategy with market neutral characteristic should beat the market regardless of market conditions.

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