EXPLAINING SHARE PRICE PERFORMANCE OF FOOTBALL CLUBS LISTED ON THE EURONEXT LISBON

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Explaining share price performance of football clubs listed on the Euronext Lisbon

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Abstract

The literature concerning the effects of sporting performance on football shares is scarce. Football clubs used to be non-profit organisations and their members had different rights and views from those which affect today's shareholders' perspectives and analysis. We were particularly concerned with sporting performance and how it impacts on share price returns for football clubs.

Using the football shares quoted in Euronext Lisbon Stock Exchange and the ARCH and GARCH methodology we found a positive relationship between stock price returns and sporting performance. Therefore, we could provide empirical evidence for immediate impact of victories, draws or defeats on price returns. We also found that impact to be related to the approach of the end of the season. This is in line with previous research on the topic, although using a different methodology. When we look at volatility, apart from showing strong clustering signs, a critical variable seems to be the trading volume around the stock that comes with the end of the season.

Key Words: Economics of sports, Soccer club valuation, Share price reactions.

JEL Classifications: G1, G14

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1. Introduction

Sport industry has changed dramatically in the last twenty years. All over Europe, football clubs have been transformed into profit oriented, public and listed companies. The same phenomena happened in Portugal. In 1997 two of the major Portuguese football clubs (Sporting Clube de Portugal - from now on called Sporting, and Futebol Clube do Porto – from now on called Porto), created public companies independent from the original club. Today they are floated companies with shares traded on the Euronext Lisbon Stock Exchange. Nevertheless, the original clubs own 50% of their shares and in each case the public companies have been turned into one of the clubs' affiliated companies. The idea was to transfer to the new companies some of the assets, such as the claims over football players, gate receipts and merchandising related to football, leaving to the old clubs the property of the stadiums and other related assets, as well as the management of the remaining sport activities.

Shares of football companies have the interesting characteristic of being traded based on two possible reasons: the irrational esteem of their supporters and on the economic rationale of any investment[1]. We will assume, following a study of Brown and Hartzell (2001) that, although irrational factors may well be "in the field" the economic rationale dominates trading volume and prices throughout the market. We base this assumption on the hypothesis that emotional investors are less significant in the market, being the free-float in a market secured by institutional investors and other economically sound agents. Therefore it is a researchable question to understand the factors that may govern stock prices settled in exchanges.

Using data from 1998 to 2002 and analysing not only the entire sample, but also four different time windows (each corresponding to a football season), we provide some evidence that positive sporting results in football are generally associated with good share price performances on the Stock Exchange, while a negative sporting performance is associated with negative stock price returns.

The study proceeds as follows. The second section describes the literature review and the explanations given by researchers for the relations between sporting performance and share price reactions on the Stock Exchange. The third section is dedicated to the methodology and data analysis. In section four we present the results after testing the model for returns and volatility behaviour and in section five we present the final conclusions.

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[1] Whilst finishing this document a crisis has just arisen involving one of the leading football clubs of the world: Manchester United. Rumours of an apparently interesting bid for the shares (considered from the financial perspective) by an American-based investor, made some of the English supporters and fan investors furious.

2. Literature Review

What do we know about the influence of football performance on the corresponding football companies? Until recently, when Renneboog and Vanbrabant (2000) from one side and Ribeiro (2001) from another, published their results, there was no literature on the topic. However, only recently have a significant number of clubs turned into public companies, bringing the topic under the spotlight, thereby creating the motivation for this research and allowing for construction of statistically significant datasets.

Until now the related literature was concerned with other sports or covered dependent variables other than stock price returns.

However, recently football firms have become a source of interest and several references may be found in the literature to support the economic behaviour of these corporations. Paxson (2001) argues that the major sources of income for actual football clubs are gate receipts, TV rights, merchandising revenues, compensation and transfer fees and refers to these firms as being a major field where real as well as financial options theory is applicable.

Realising that audience is an important factor when explaining the economic performance of sport clubs, Bird (1982) tried to estimate a regression equation in order to explain total attendance for the four divisions of the English Football League. He used 92 clubs and data from 1948 until 1980. In general he found that ticket prices, the number of goals scored during the season, as well the number of goals scored during the previous season were the major factors to explain the number of spectators attending games. Additionally, he found variables such as the possibility of hooliganism, or the weather conditions irrelevant when explaining game attendance.

Domaslicky and Kerr (1990), studying the same variable of attendance in the American Baseball League from 1968 to 1980 found several variables with explanatory power, such as: the population living in the region, the average ticket price, the income per capita, the wealth of the team, the total number of baseball teams in the region, the number of wins, the number of games observed, the score, the number of players in the team, the physical conditions of the stadium where games take place, and the division in which the team is playing. They excluded victory in the previous league as a sensitive variable.

Burkitt and Cameron (1992) also studied attendance at sport events, but observing instead the English Rugby League and using 30 clubs from 1966 to 1990. They found that the position in the ranking is a key factor in explaining the number of spectators.

Irani (1997) also found that variables such as the ticket price, the income per capita, the population in the region where the stadium is located, and the actual number of victories are relevant to explain the demand for baseball in America for the time period considered (from 1972 to 1991).

A second major variable that is presented in the literature as an explanatory variable for the understanding of the economic success of sport clubs is income, and one of the major sources of income is gate receipts. They equal the number of spectators (already covered) times the ticket price. Atkinson, Stanley and Tschirhart (1988) found the increase in the price of the tickets was directly dependent on the previous year's sporting results. On average, they observed that a club raises its average ticket price by US$12 after having won the previous championship.

Scully (1974) found that the performance of the team (measured by the difference between victories and losses), the number of inhabitants of the region where the stadium is located and the physical conditions of the stadium were the variables with statistical significance when studying the income of the clubs in the American Baseball League.

A third source of sport clubs' wealth is based on the value of its assets, namely the contractual claims on their players. Players are not only good agents when exercising within their speciality, but they also acting as "stars" attracting fans to watch them. For instance, Hausman and Leonard (1997) showed that the television audience was directly related to the presence of "basketball stars" in NBA games, turning the TV pay-per-view system the main source of income of basketball clubs. "Stars" increase the income of both teams: their own team and the opposition team that gets the benefit from having "stars" playing, without having the obligation of paying their salaries. And, of course, "stars" also increase the success of merchandising sales.

A very interesting and particular issue that characterises football firms is that weekends are time periods when a significant amount of price sensitive information may arrive, and differently from the well-documented weekend effect that for other listed firms may be related to behavioural anomalies affecting stock prices, for football companies the weekend effect may have both phenomena. In fact, the football games are most commonly played at weekends (in Portugal from Friday evening to Sunday evening). As stock exchanges close during these time periods, price discovery is only clearly seen on Mondays. There is, therefore, a “double weekend” effect to consider in this analysis.

The pioneering study on weekend effects for stock prices of common firms was developed by Fields (1931) when he examined the Dow Jones Industrial Average Index behaviour from 1915 to 1930. Fields (1931) concluded that share prices tend to increase on Saturdays[2], as a result of closing down stock positions before the weekend. The climate of instability which existed at Wall Street would not allow advised middlemen and financial agents to keep their positions exposed during weekends. The weekend effect also got the attention of French (1980) who tested the "calendar team hypothesis" stating that Monday to Friday returns should be three times larger than any other day’s estimated return. This was an attempt to show the linear relationship between average stock price returns and the time period of investment. However, the most classic reference for the weekend effect was described by Gibbons and Hess (1981). In their study with a sample of the daily S&P500 returns they showed that compared with other weekdays, Monday returns were significantly negative, possibly as a result of a biased human reaction to overcome weekends.

Brown and Hartzell (2001) started by observing that, differently from ordinary firms for which investors need to get financial accounts and reports of research in order to readjust expectations for price formation, listed companies that manage basketball teams are largely exposed to information release. Investors can open the newspaper at least 82

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[2] The American Stock Exchange was opened on Saturdays during this period

times and check how the investment is going during an 82-game season. But is the market sensitive to these signals? They also confess to foreseeing some investors buying these shares basing their decisions on irrational passion for their teams and wanting to own a "slice" of the team. However, they assume that this is an insignificant number of investors and, therefore, stock prices formed in the exchange may reflect the rational expectations of informed investors.

They developed their research based on two sources of data. First they considered income and cash-flow and concluded that there is a positive and significant relationship between the number of victories and cash-flow. Secondly they considered market data and concluded that stock price return was correlated with the sporting performance. However, volatility and trading volume were not. They also observed an increase either in terms of volatility or in terms of trading volume when studying sporting season periods.

Renneboog and Vanbrabant (2000) were the only researchers to specifically investigate whether the sporting results had direct impact on football share price returns. Analysing the clubs quoted on the London Stock Exchange, and on the Alternative Investment Market (AIM), the authors concluded that share prices were indeed influenced by sporting results. «Event studies corrected for thin Bayesian updating reveal that at the first day of trading after a game, positive abnormal returns of almost 1% can be expected following a soccer victory. In contrast, defeats or draws are penalised, respectively, by negative abnormal returns of 1,4% and 0,6%».

The other reference specifically related to our research topic is Ribeiro (2001). The author also studied the two Portuguese clubs quoted in the Portuguese stock exchange, using the ordinary least squares (OLS) method to explain share price reactions of the Portuguese clubs to test the stock price reaction to sporting performance. Taking into consideration victories, defeats, and draws, as well as a fourth variable called relative points to victory (which expresses the difference in terms of points between the leader and the following team in relative to the available points remaining to the end of the tournament), the author concluded that there was no relation between sporting performance and stock price returns: «Within the period under analysis (two years), sporting results of Sporting and Porto rarely originated a raise or a fall in stock prices, except […] on Monday, 15th May 2000, when Sporting shares observed a 22,5% raise hitting their maximum high. The cause of such a movement seemed to be the reaction to the conquest of the national soccer championship on May, 14th […] Victories, defeats and draws don't seem to have any explanatory power, unless teams turn out to be champions. However, the relative points to victory variable seems to have some explanatory power». This study had, however, severe shortcomings, namely the small sample size (only two years of data were available at that time), and this may well be one considerable reason for the weak econometrical findings.

In summary, the literature on studying the effects of sporting performance on sport company shares has been generated using a wide variety of other variables other than stock price returns, namely attendance at stadiums, gate receipts, cash flows, net profits and even the impact of the recruitment of "stars". However, stock price returns were widely forgotten and particularly those of football company shares. Soccer being a major, popular sport in

Europe it is time to test whether Portuguese investors do react to sporting results when pricing football company shares.

3. Methodology and Data Analysis

As we presented earlier only two studies have directly covered the topic under our consideration: Ribeiro (2001) who covered the Portuguese football stock market and Renneboog and Vanbrabant (2000) who covered football club share prices quoted on the London Stock Exchange, and on the Alternative Investment Market (AIM). Both studies intend to inquire to what extent sporting performance impacts on stock price returns settled on the stock exchange.

We aim to extend their knowledge in terms of data sample size (in comparison to Ribeiro, 2001) or in using a different and supposedly stronger methodology to cover two different aspects of stock price behaviour: returns and volatility.

3.1 Methodology

As empirical financial literature abundantly proved, stock price volatility is not constant, tending to show clustering patterns along time, that is, high volatility periods tend to be followed by high volatility periods, while low volatility periods tend to be followed by low volatility periods (see for instance Bollerslev, Chou and Kroner (1992), Bollerslev, Engle and Nelson (1994) or Kroner and Ng, 1998). The Portuguese market specifically seems to follow similar patterns to those documented in Caiado (2004). We also empirically observed that the constant hypothesis is rejected for the collected time series of the Portuguese football share price returns (Sporting and Porto). Therefore, the use of the ARCH-Autoregressive Conditional Heteroskedasticity family models methodology for modelling purposes seems appropriate. This allows us to estimate more robust models for time series modelling, as opposed to using models that assume constant volatility hypothesis along the time.

As Harvey and Huang (1991) showed with the release of central bank news on interest rates, volatility may significantly change its path as a result of the incorporation of relevant price sensitive information. As a result, when we think of football shares, for which the weekend can be significantly relevant when matches occur, we hypothesised a significant impact of sporting performance on volatility behaviour. Having assumed that, we could increase our confidence in ARCH family models should being more appropriate than constant volatility models for our research purposes.

Hence, the use of ARCH family models combined with an extended database will be a significant improvement compared with Ribeiro (2001).

3.2 Data Sources and Variable Definition

The database collected in this study is composed of Sporting SAD and F.C. Porto SAD share prices, quoted in the Second Market of the Euronext Lisbon Stock Exchange from 2nd June 1998 to 30th July 2003 (1347 observations each). Prices were collected from Bloomberg and the summer time observations were excluded from the sample for off-season reasons. We have only taken into consideration the sporting results observed when games were played as part of the national championship, leaving out any other results that may have been observed, such as those resulting from the European competitions, as well as those from the Portuguese Football Cup.

As we have said previously, the time period under analysis is a significant improvement compared to Ribeiro's (2001) study. Instead of a two-year database we more than doubled it to a five-year period. It is important to note that extended time period allowed the inclusion of data from one season in which neither of the firms with listed shares won the national championship.

Daily continuously compounded stock price returns were computed, that is:

$$y_{i,t} = \ln\left(\frac{S_{i,t}}{S_{i,t-1}}\right)$$

where $S_{i,t}$ stands for the share price of firm *i* on trading day *t*.

We started by computing the average, volatility (given by the standard deviation), kurtosis and skewness of stock price returns for each group of observations.

Econometric and any other statistical analysis was carried out by using the software E-Views version 3.0.

As our aim was to study the impact of football performance on stock price returns we started by assigning one out of the three possible outcomes for a football game (victory, draw and defeat) to dummy explanatory variables. For example, the dummy variable "victory", assumes "1", when the club wins and zero otherwise. It is important to underline that, as we are considering daily data, we can use three dummy variables (victory, draw and defeat), without running the risk of incurring a dummy trap. This is because we have some days with no games, when all these dummies assume the value zero.

As football games always have to end in one of the three possible outcomes (victory, draw or defeat), we added a fourth dummy variable. This dummy was called «game», being assigned "1" when a club played a game, and zero otherwise. This fourth dummy variable was used to test whether on the day or on the eve of the match, share prices showed signs of abnormal volatility.

Other variables were additionally taken into consideration as a consequence of the literature review, in order to explain the daily returns: trading volume, PSI-20 return (the index benchmark for the Portuguese stock market), the lagged daily stock price returns and the so-called "relative points to victory ratio" (RPV). This ratio was successfully introduced by Ribeiro (2001) when the reaction of football shares to football performance in Portugal was first explained.

We started by hypothesising that daily volume could be a relevant variable for this study, mainly because football shares are thinly traded on the Euronext Lisbon. This is easily detected when comparing their trading volumes with the trading volume recorded by other companies in the Portuguese market. In order to get a rough idea of how thin the market is we must state that there were days in our database with not more than 30 shares as total daily trading volume. Deloitte (2004), the consultancy company, states in its study: «The soccer market has a reduced liquidity. For instance, Porto and the Sporting trade in a month less than Portugal Telecom (the most liquid asset in the Portuguese Stock Exchange) trades in a day». Additionally, Nicolau (1999), in a study where ARCH methodology is used in order to explain the course and the correlation between PSI-20 and Dow Jones, refers to the fact that the specification of the conditioned variance is substantially better when the variable daily volume is added to the model. «It is natural: larger daily volumes, translated into larger variability of share prices and, therefore, in a larger volatility».

The use of a market benchmark like the PSI-20 index is obvious. It may overcome the need for estimating the systematic risk of stock price returns, and takes into consideration the abnormal return effect into the model. For instance, Renneboog and Vanbrabant (2000) used the Sharpe-Lintner-Treynor CAPM (Capital Asset Pricing Model) to estimate the abnormal stock price return in order to study the football performance impact on share price behaviour for football clubs listed in the UK market[3].

The concept of "relative points to victory" ratio (RPV) is not new. It was first introduced and tested with positive results by Ribeiro (2001). It expresses the idea that one victory in a match and the consequent three points obtained for ranking purposes does not mean the same when we are six points as when we are thirty points from the end of the tournament. Therefore, if the firm's team is leading the championship, the difference in terms of points between the firm under analysis and its most direct competitor should be taken in relative terms, reflecting the number of points that are still under dispute up to the end of the tournament. Hence, the "the relative points to victory" ratio ($RPV_{i,t}$) of firm *i* at moment *t*, is the difference expressed in points, between the firm and the leader (or between the firm and the challenger, if the firm leads the tournament), relative to the number of points still under dispute up to the end of the tournament. Its analytical definition is:

$$RPV_{i,t} = \frac{N_{i,t} - N_{j,t}}{3K_t} \qquad \textbf{eq. 1}$$

where: $N_{i,t}$ is the number of points of the team *i*, at time *t*;

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[3] They estimated the abnormal return as $R_{i,t} - E[R_{i,t}]$ where Ri,t stands for the observed price return of stock *i* on day *t*, and $E[Ri,t] = E[Rf,t] + \beta_i [E[Rm,t] - E[Rf,t]]$.

$N_{j,t}$ represents the number of points obtained by the challenger (second place in the table) if firm *i* leads the championship at time *t*, or represents the number of points obtained by the leader if firm *i* is not leading the championship at time *t*.

K_t is the number of matches still to play up to the end of the championship.

The RPV ratio is positive when the firm leads the championship, being negative whenever the firm chases the leadership of the tournament. When the RPV ratio is null it means that the team under scope shares the lead of the championship table with another team. Therefore, the larger and positive the RPV ratio is, the greater the probability of team *i* to win the championship.

3.3 Data Analysis

We started with some data mining in order to extract a first look at the dataset and to infer some economic intuition as well as some plausible implications concerning research design.

From Figures 1 and 2 a constant trend for price declines over all of the period under scope seems evident, although once in a while some sharp upward movements are clearly noticed. These irregular positive shocks, as we will see later in this study, are associated with the sporting success of the teams. Sporting share prices are an illustrative example of what has been said. Along the time series, the club won the championship twice (during the 1999/2000 and the 2001/2002 seasons). This is clearly signalled in the chart with two sharp peaks. FC Porto won the national championship title in the 2002/2003 season, that is, at the end of the time series. The chart shows that, at the end of the time series, Porto SAD prices rose significantly, although with an unexpected break during the last days of the sample. However, we speculate that this may be the result of some profit taking movement in the market, because it would be difficult to replicate in the near future what the team had just achieved, which was wining the national championship ("Superliga"), the UEFA Cup and the Portuguese Cup.

Figure 1: Sporting Share Prices
(2nd June 1998 – 30th July 2003)

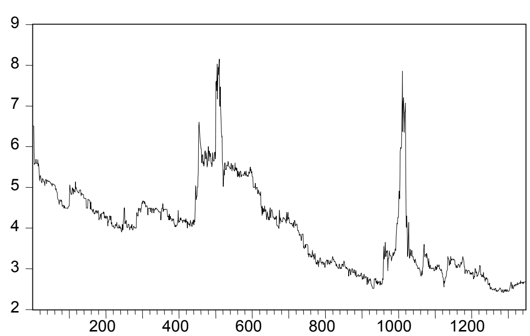
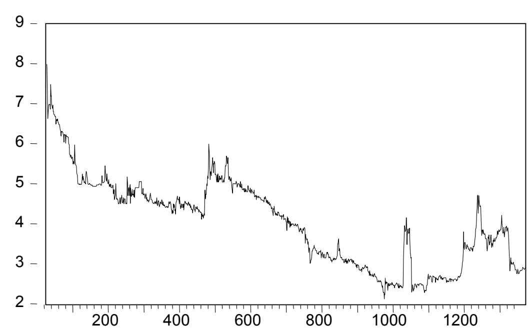


Figure 2: Porto Share Prices
(2nd June 1998 – 30th July 2003)



We will define $y_{scp,t}$ and $y_{fcp,t}$ as the daily returns of share prices for Sporting and Porto, respectively, measured by the differences in log-prices.

In Figures 3 and 4, we plot daily returns for Sporting and Porto share prices. One interesting and relevant issue is that Sporting share prices seem more volatile during the seasons when they won the championship. However, Porto share prices did not seem to suffer the same phenomenon. The highest volatility happened during the 2001/2002 season, when they fought with Benfica up to the last day of the tournament for the third place in the ranking table of the championship. This was important because for that particular season, the third place in the final competition ranking gave direct access to the UEFA Cup. At end of their successful 2002/2003 season, daily stock returns did not evidence high volatility, probably because the market soon anticipated their conquest of the championship. In fact four months before the end of the competition, Porto already had a significant advantage of 10 points over its most direct competitor.

Figure 3: Sporting stock returns (2nd June 1998 – 30th July 2003)

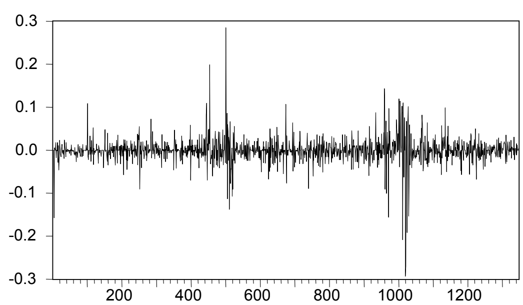
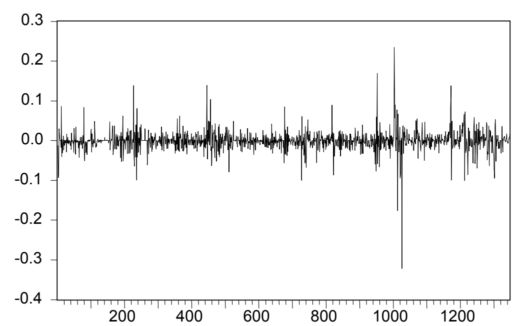


Figure 4: Porto stock returns (2nd June 1998 – 30th July 2003)



Figures 3 and 4 confirm what we have stated before and are indeed representative of the volatility clusters: strong (weak) variations are more likely to be followed by strong (weak) variations and vice-versa. In these circumstances, assuming constant volatility may be seriously misleading.

One of the commonly admitted assumptions in Finance is the normal distribution of stock prices returns ($y_t \sim N(\mu;\sigma^2)$). While this may be a reasonable assumption for long horizon returns (more than one year), for short horizons, the literature has been abundant in showing non-normality of stock price returns. Since Mandelbrot (1963), confirmed by Fama (1965), we collect evidence of non-normality of stock returns. Smith (1981), Gray and French (1990), Peiró (1994), Praetz (1972), Blattberg and Gonedes (1974), Kon (1984), Harris and Küçüközmen (2001), McDonald and Xu (1995), Theodossiou (1998), McDonald and Newey (1988) or Gettinby *et al.* (2004) are examples of papers where alternative distributions are tested to fit empirical stock price returns. Their results show that the moments of the empirical distributions strongly differ from what we expect of a normal distribution.

When we calculated kurtosis[4] and skewness[5] from daily returns of Sporting and Porto, we found what previous empirical evidence has shown: both samples strongly differ from the skewness and kurtosis expected in a normal distribution. In Table 1 kurtosis shows much larger values than 3 for both share price returns, which means heavier tails than

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[4] Is given by: $K_y = \frac{1}{n}\sum_{t=1}^{n}\frac{(y_t-\mu)^4}{\sigma^4}$. It measures the peak or flatness of the distribution of the series. The kurtosis of a normal distribution is 3. If the kurtosis exceeds 3, the distribution is peaked (leptokurtic) relative to the normal; if the kurtosis is less than 3, the distribution is flat (platykurtic) relative to the normal.

[5] Is given by: $SK_y = \frac{1}{n}\sum_{t=1}^{n}\frac{(y_t-\mu)^3}{\sigma^3}$. It measures the asymmetry of the distribution of the series around its mean. The skewness of a symmetric distribution, such as the normal distribution, is zero. Positive skewness means that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail.

normal distribution for both stocks. In other words, extreme value observations are observed more frequently than in a normal distribution. The skewness statistic helps us to show that the distributions are non-symmetric with extreme negative returns more pronounced and frequent than extreme positive returns. For normal distributions, this statistic is zero. In Table 1, the skewness statistics show negative values meaning that the left tail of the distribution is heavier than its right tail.

Table 1 - Sporting and Porto daily stock return statistics for the entire sample

	Mean	Variance	Maximum	Minimum	Kurtosis	Skewness
$Y_{SportingSAD}$	-0.000691	0.000975	0.285047	-0.293830	22.085	-0.714503
$Y_{PortoSAD}$	-0.000741	0.000712	0.234461	-0.322020	26.2331	-0.647077

Another important aspect that with which we are concerned is the volatility clustering of the time series. If present, it would be a strong signal for the appropriateness of ARCH models in our research. This can be easily identified in Figures 5 and 6 where y_t is plotted against y_{t-1}.

Figure 5: Stock Return Clustering - Sporting SAD

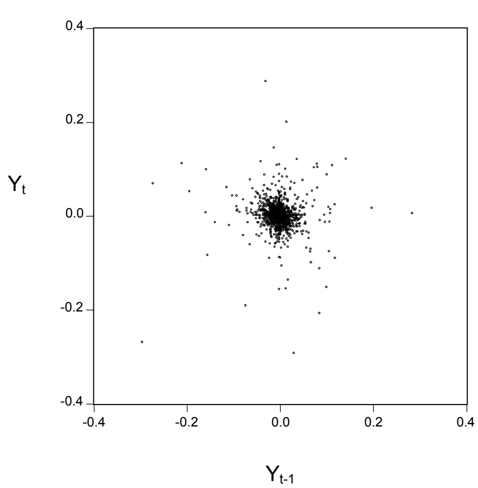
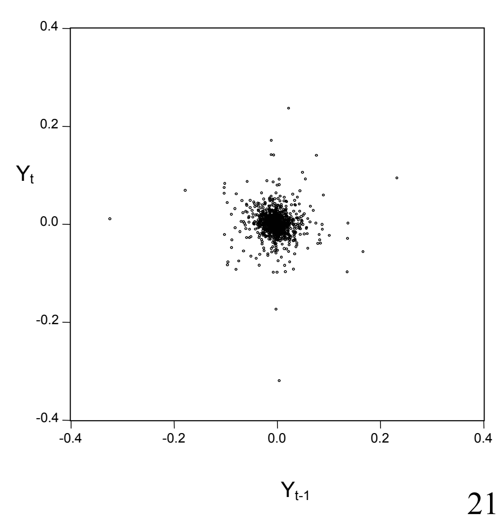


Figure 6: Stock Return Clustering - FC Porto SAD



As a consequence of such empirical patterns from our database it seems that the most appropriate means for modelling and testing the phenomena under scope are non-linear modelling. As Franses and van Dijk (2000) state: «Needless to say, such asymmetries should be incorporated in a time series model used for description and out-of-sample forecasting, otherwise one may obtain forecasts that are always too low or too high. We will call such time series models, which allow for an explicit description of asymmetries, nonlinear time series models».

Apart from previous research in the topic, a first statistical analysis with our stock price returns data sample led us to suspect that some association could be observed between them and sporting performance. When the statistical analysis previously undertaken by firm was repeated by firm and season, it became clear that football share prices tended to experience larger valuations when their teams won the national championship. This was true for FC Porto shares in 1998/1999 and 2002/2003 and for Sporting shares in 1999/2000 and 2001/2002. In 2000/2001, the season in which none of the teams won the championship (Boavista won it) prices fell for both companies (with average negative stock returns). As we can observe in Table 2, the mean daily return is larger when the club wins the national championship.

Table 2 - Sporting and Porto daily stock return statistics taken by season

	Season	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003
	National Champion	FC Porto	Sporting	Boavista	Sporting	FC Porto
$Y_{SportingSAD}$	**Mean**	-0.12%	0.24%	-0.24%	0.07%	-0.08%
	St. Deviation	1.11%	3.71%	2.27%	5.30%	2.02%
$Y_{SportingSAD}$	**Mean**	0.10%	0.06%	-0.21%	-0.13%	0.06%
	St. Deviation	0%	2.39%	1.89%	4.11%	2.89%

But it seems that volatility also suffers from the national championship effect. In fact, when companies' teams win the national football championship not only do they seem to evidence higher average stock returns, they also experience an increase in volatility.

4. Empirical Results for Stock Returns and Volatility

As previously stated, the purpose of the paper is to test the effect of sporting performance on stock market behaviour. We will test this by using the effects on stock price returns as well as on stock price volatility. Our preceding analysis showed that the process for football share returns ($y_{scp,t}; y_{fcp,t}$) could be well modelled by a multivariate AR+GARCH model, although other models could also be considered. We start by assuming that stock price returns can follow a path return given by:

$$y_t = \mu_t + u_t \qquad \textbf{eq. 2}$$

where, $y_t = \left[y_{scp,t} \quad y_{fcp,t} \right]$; $\mu_t = \left[\mu_{scp,t} \quad \mu_{fcp,t} \right]$ and $u_t = \left[u_{scp,t} \quad u_{fcp,t} \right]$. We will take $\mu_{scp,t}$ and $\mu_{fcp,t}$ as the conditional expectations for $y_{scp,t}$ and for $y_{fcp,t}$, while u_t is the error terms vector with a generic distribution $\wp$ with zero mean.

The variance-covariance matrix Ω_t (matrix 2x2), is given by:

$$E\left[u_t u_t^{'} \middle| f_{t-1} \right] = \Omega_t = \begin{bmatrix} \sigma^2{}_{scp,t} & \sigma_{scp,fcp,t} \\ \sigma_{fcp,scp,t} & \sigma^2{}_{fcp,t} \end{bmatrix} \qquad \textbf{eq. 3}$$

where f_{t-1} is all the available information up to time *t-1* (or the σ-algebra generated b *y* up to time *t-1*). The conditional averages describe the dynamics of stock returns while Ω_t describes the dynamics of volatility. We will assume a linear specification for daily returns, on which *y* depends, based not only upon their past figures, but also on exogenous variables.

Therefore, if the price return dynamics depend exclusively upon conditional averages, the model can be stated as follows:

$$\begin{bmatrix} y_{scp,t} \\ y_{fcp,t} \end{bmatrix} = \begin{bmatrix} c_{scp} \\ c_{fcp} \end{bmatrix} + \begin{bmatrix} \beta_{scp,1} & \beta_{scp,2} & \beta_{scp,3} \\ \beta_{fcp,1} & \beta_{fcp,2} & \beta_{fcp,3} \end{bmatrix} \begin{bmatrix} Wn_i \\ Dr_i \\ Df_i \end{bmatrix} + $$

$$+ \begin{bmatrix} \gamma_{1,scp} & \gamma_{2,scp} & \cdots\cdots & \gamma_{n,scp} \\ \gamma_{1,fcp} & \gamma_{2,fcp} & \cdots\cdots & \gamma_{n,fcp} \end{bmatrix} \begin{bmatrix} y_{i,t-1} \\ y_{i,t-2} \\ \cdots\cdot \\ y_{i,t-n} \end{bmatrix} + \qquad \textbf{eq. 4}$$

$$+ \begin{bmatrix} \phi_{0,scp} & \phi_{1,scp} & \cdots\cdots & \phi_{n,scp} \\ \phi_{0,fcp} & \phi_{1,fcp} & \cdots\cdots & \phi_{n,fcp} \end{bmatrix} \begin{bmatrix} y_{j,t} \\ y_{j,t-1} \\ \cdots\cdot \\ y_{j,t-n} \end{bmatrix} + BW_t$$

In equation 4 c_i represents the constant term characteristic of stock *i*, Wn_i, Dr_i and Df_i stand for the dummy variables (win, draw and defeat) of stock *i*, and matrix W_t represents the exogenous variables not yet considered, such as PSI-20 daily returns, daily volume, risk free interest rates, and the “relative points to victory” variable (RPV), taken at time *t*. Solving the model we get:

$$
\begin{cases}
y_{scp,t} = c_{scp} + \beta_{scp,1}Wn_{scp} + \beta_{scp,2}Dr_{scp} + \beta_{scp,3}Df_{scp} + \\
\qquad + \gamma_{scp,i}\sum_{i=1}^{n} y_{scp,t-i} + \phi_{scp,j}\sum_{j=0}^{n} y_{fcp,t-j} + B_{scp}W_{scp} \\
y_{fcp,t} = c_{fcp} + \beta_{fcp,1}Wn_{fcp} + \beta_{fcp,2}Dr_{fcp} + \beta_{fcp,3}Df_{fcp} + \\
\qquad + \gamma_{fcp,i}\sum_{i=1}^{n} y_{fcp,t-i} + \phi_{fcp,j}\sum_{j=0}^{n} y_{scp,t-j} + B_{fcp}W_{fcp}
\end{cases}
\qquad \textbf{eq. 5}
$$

Concerning Ω_t we will assume a multivariate GARCH(1,1) specification, that is:

$$
\begin{bmatrix} \sigma^2_{scp,t} \\ \sigma^2_{fcp,t} \end{bmatrix} = \begin{bmatrix} c_{scp} \\ c_{fcp} \end{bmatrix} + \begin{bmatrix} a_1 & a_2 \\ b_1 & b_2 \end{bmatrix} \begin{bmatrix} u^2_{scp,t-1} \\ u^2_{fcp,t-1} \end{bmatrix} + \begin{bmatrix} \alpha_1 & \alpha_2 \\ \beta_1 & \beta_2 \end{bmatrix} \begin{bmatrix} \sigma^2_{scp,t-1} \\ \sigma^2_{fcp,t-1} \end{bmatrix} + CZ_t \qquad \textbf{eq. 6}
$$

where Z_t is a four times one matrix for the exogenous variables and C is the matrix for the exogenous variables parameters.

According to Nicolau (1999) «multivariate GARCH specifications with lags superior to 1 are untreatable from the estimation point of view, unless they are considered appropriate restrictions of the parameters». Franses and Dijk (2000) state that «even though the general GARCH(p,q) model might be of theoretical interest, the GARCH(1,1) model often appears adequate in practice».

The results of applying our database to equation 5 and equation 6 are shown in Tables 3 to 6.

Table 3: Results of Regression Equation 5 (Sporting)

Dependent Variable: y_{scp} Method: ARCH				
	Coefficient	St. Error	Z-statistic	p-value
c	0.00399	0.00061	6.58600	0.00000
Wn	0.01470	0.00164	8.96546	0.00000
Dr	-0.01326	0.00393	-3.37028	0.00080
Df	-0.00997	0.00272	3.66113	0.00030
$y_{scp}(-1)$	-0.09770	0.03174	-3.07846	0.00210
$y_{scp}(-2)$	-0.12604	0.02899	-4.34796	0.00000
y_{fcp}	0.38125	0.02040	18.68499	0.00000
y_{psi}	0.13726	0.04770	2.87737	0.00400

Table 4: Results of Regression Equation 5 (FC Porto)

Dependent Variable: y_{fcp} Method: ARCH				
	Coefficient	St. Error	Z-statistic	p-value
c	-0.00146	0.00047	-3.07985	0.00210
Dr	-0.01248	0.00200	-6.23087	0.00000
$y_{fcp}(-1)$	-0.26070	0.03009	-8.66302	0.00000
$y_{fcp}(-2)$	-0.15188	0.01681	-9.03471	0.00000
y_{scp}	0.07103	0.01769	4.01570	0.00001

Table 5: Results of Regression Equation 6 (Sporting)

Dependent Variable: σ^2_{scp} Method: ARCH				
	Coefficient	St. Error	Z-statistic	p-value
c	0.00005	0.00002	2.99734	0.00270
ARCH(1)	0.14997	0.02282	6.57154	0.00000
GARCH(1)	0.59996	0.01928	31.11418	0.00000
Vol	0.00002	0.00000	12.94266	0.00000

Table 6: Results of Regression Equation 6 (FC Porto)

Dependent Variable: σ^2_{fcp} Method: ARCH				
	Coefficient	St. Error	Z-statistic	p-value
c	0.00013	0.00001	19.31980	0.00000
ARCH(1)	0.11703	0.02376	4.92520	0.00000
Vol	0.00001	0.00000	18.72496	0.00000

Where vol_{scp} and vol_{fcp} represent 1/100 of the daily trading volume for Sporting and Porto shares.

Starting with the Sporting returns regression equation, we conclude that share price reaction for the positive sporting results seems to be positive. Sporting share price tends to increase, on average, 1.5% immediately after winning a match. On the other hand, defeats and draws have a negative impact on share price, the draws apparently being more negative in terms of price punishment than defeats. It seems that the market had already anticipated defeats, at least partially. When the team draws, share prices tend to depreciate, on average, 1.3% while, when it loses, returns only fall by about 1%.

The other variables that seem significant are lagged stock returns (showing a negative dependence), Porto share returns and PSI20 index return. The positive relation between Sporting and Porto shares may seems strange, taking into account their rivalry in the field. However, this may be a result of some industry effect that should be considered. Finally, the positive association of Sporting shares with the PSI20 index may result from its systematic risk.

Porto shares differ somehow from results shown by Sporting shares. For instance, win and defeat dummies seem to have no effect on stock returns. However, similar to what was found for Sporting shares, draws show a negative effect. When the team draws, shares tend to depreciate 1.2% on the day after. On top of this, lagged returns and the industry effect, also observed in the Sporting returns equation, also seem significant variables for Porto shares.

These results are somehow surprising when compared with those found by Renneboog and Vanbrabant (2000) where positive sporting results seem to exert a significant positive effect on the entire sample. As we have observed, our results do not permit such a conclusion to be extended to the entire sample. The same somehow surprising findings happen with the analysis of defeats, and particularly when we compare them with the results for draws. In our findings the draw effect tends to be very significant and applicable to the entire sample. This may be a result of a profound confidence of investors in extreme sporting results, only showing a systematic surprise when teams draw matches.

Concerning the effects of sporting performance on stock price volatility, we observe that ARCH(1) and GARCH(1,1) models seem to be appropriate for modelling the effects of Porto and Sporting share volatility, respectively. But on top of the standard ARCH / GARCH model variables, daily trading volume should also be considered as a significant variable for explaining volatility. For both equations trading volume has a positive and significant impact when explaining volatility. As we were expecting, the increase in trading volume seem to bring new agents to the market with a corresponding increase in volatility.

We started by hypothesising that the RPV variable («relative points to victory») should play an explanatory role when modelling football returns and volatility. However, differently from Ribeiro (2001) we could find no such effect for either company. However, due to its structure, we suspected that it could be difficult find any significant effect of RPV on stock returns. In fact, RPV is a ratio that stays stuck from one match up to moment of the next match. Then, new points are deducted from the denominator of the ratio, and sometimes some points are added to the numerator of the ratio. For the majority of the days (when playing with daily data), the ratio does not change and, therefore, we may be biasing the equation regression with a substantial amount of spurious data. There are two methods to avoid this: either by calculating weekly returns (as in Ribeiro, 2001) and assuming that no other significant effects play a role in explaining weekly returns; or exclude the daily returns which were not immediately subsequent to a match (which is the same as to say that we would only consider one daily return per week, which would be the one that immediately followed a game).

The inconvenience of this methodology is that the number of observations falls significantly. As a soccer season has only 34 matches, in order to take more information out of the data set and assuming that there are no reasons to suspect that firms would react differently, we decided on a panel data model with fixed effects running the same equations with both companies in it:

$$y_{i,t} = \alpha_{i,t} + \beta_{i,t} RPV_{i,t} + \varepsilon_{i,t} \qquad \textbf{eq. 7}$$

The regression equation results are presented in Table 7:

Table 7: Results of Regression Equation 7

Season	FCP_C Coefficient	SCP_C Coefficient	RPV Coefficient	RPV p-value
1998/1999	-0.003160	-0.004660	-0.019316	0.0053
1999/2000	0.006492	0.009004	0.073444	0.2482
2000/2001	-0.005550	-0.004590	0.000627	0.7127
2001/2002	-0.010500	0.007620	-0.036633	0.4141
2002/2003	0.001504	-0.011820	-0.002704	0.4488

In spite of our attempt to improve the research method we still registered no statistical significance for the RPV variable. However, as we may observe from Figures 7 and 8, these insignificant results may still be a consequence of the way in which the variable was defined.

Figure 7: RPV of Sporting

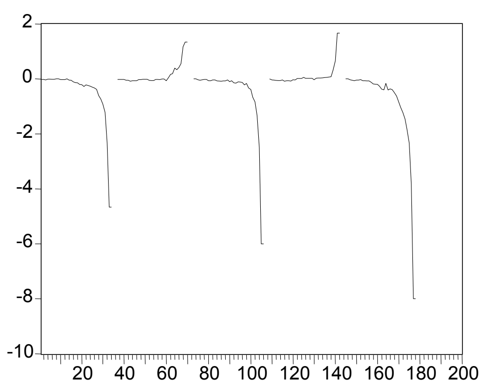
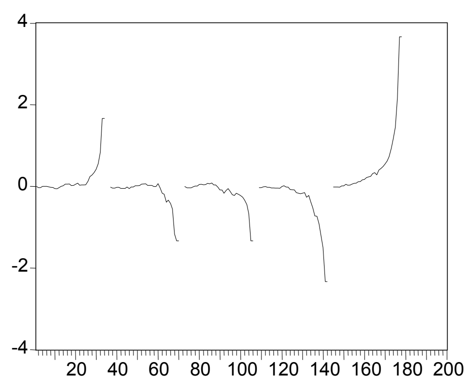


Figure 8: RPV of Porto



The RPV variable suffers a significant increase (or decrease) in the last matches of a season and is clearly non-linear. When the team is leading the tournament and wins the championship, the RPV variable suffers a dramatic increase in the last weeks of the season.

That was the case of Porto for the 1998/1999 and 2002/2003 seasons and the case of Sporting in the 1999/2000 and 2001/2002seasons. However, when the team is not leading the championship, the approach of the end of the season means an abrupt fall of the variable.

In order to correct this effect we did a simple transformation in the variable, replacing it by the first difference between two consecutive RPV values (the difference between the RPV in week *t* and the RPV variable in week *t*-1). This procedure corrects the abrupt increases and decreases in the variable, smoothing its path.

$$VRPV_t = RPV_t - RPV_{t-1} \qquad \textbf{eq. 8}$$

When VRPV (the variation in RPV ratio) is positive it means good news. As the denominator of RPV decreases with the approach of the season's end, the team maintains an unimpeachable distance between itself and its closest opponent, expressed in terms of points. When VRPV is negative this means a loss in terms of points relative to its most direct opponent and the market can read it as bad news.

Replacing this new variable in the dataset we got the following testable regression equation:

$$y_{i,t} = \alpha_{i,t} + \beta_{i,t} VRPV_{i,t} + \varepsilon_{i,t} \qquad \textbf{eq. 9}$$

The results for equation 9 are summarized in Table 4.

Table 8: Results of Regression Equation 9

Season	VRPV Coefficient	VRPV p-value	FCP_C Coefficient	SCP_C Coefficient	Winner of the Championship
1998/1999	-0.014870	0.0573	-0.004190	-0.000810	FC Porto
1999/2000	0.126285	0.0058	-0.000180	0.003220	Sporting CP
2000/2001	-0.011650	0.1785	-0.005660	-0.005450	Boavista FC
2001/2002	0.161435	0.0407	0.002571	0.010230	Sporting CP
2002/2003	0.110438	0.0348	0.001100	-0.008450	FC Porto

As expected, apart from those years when the VRPV coefficient is insignificant, we find that in general there is a positive relationship between stock price returns and VRPV. During the first season, and as a result of the IPO returns, it behaved in an apparently strange way. However, this negative behaviour for both stocks is simply the result of the well-documented IPO overpricing. This overpricing was also documented for the Portuguese market (see Almeida and Duque, 2000). Moreover, the VRPV coefficient is statistically insignificant at a 95% confidence level, which leads us to discard it from our analysis. In general VRPV is positive and statistically significant. There is another exception: during the third season of the sample, the VRPV is also statistically insignificant, but this happened when none of the company teams won the national championship. For the rest of the seasons, there seems to be a positive relationship between the daily stock price returns after the match and the change in the relative points to victory. This positive sign of the VRPV parameter means that whenever the firm approaches the leader or, if it is the leader already, it increases its difference in points between it and the most direct competitor, stock prices seem to react positively.

Comparing the independent parameters of both firms, they also tend to differ from each other. In fact the winner of the championship tends to show a premium with an independent parameter greater than the corresponding parameter of the non-winner, and when Boavista won the national championship the independent parameter of both firms (Sporting and Porto) were negative!

5. Conclusion

This paper investigates whether share prices of two soccer clubs listed on the Portuguese Stock Exchange (Sporting and Porto) are influenced by the soccer team's weekly sporting performances. Following the same research topic as Renneboog and Vanbrabant (2000), we used a different methodology for testing the impact on stock price returns and extended the analysis to volatility. In particularly we introduced a new methodology and a new variable in order to explain returns and volatility of football shares.

We started by observing price charts and we concluded that for the last 5 seasons (1998-2003), it seems obvious that there is some visual association between prices and end of the season victories in the national championship. Other price return characteristics such as kurtosis and skewness are in line with the findings for other stocks and, therefore, football shares do not seem to differ from them. Moreover, they also show some signs of clustering leading us to admit that an ARCH-family model could be appropriate for testing football share behaviour.

Additionally we found that whenever the team wins the national championship share prices always presented a positive mean return, and the opposite when not winning the tournament. This rule has no exception for the time period under analysis.

Then, using the ARCH family methodology and the same dataset composed of 5 seasons' prices and sporting results, we provide some evidence that positive sporting performance in football firms is positively associated with good share price performances in the Stock Exchange, while negative sporting performances (defeats and draws) are associated with negative stock price returns. In particular, Sporting shares react positively to victories and negatively to defeats and draws. For Porto, we only found statistical significance for draws. These results are in line with Renneboog and Vanbrabant (2000) results for other markets, using a different methodology.

We also found other variables with a significant impact on stock price returns such as the previous day stock price return (the exhibiting of a negative dependence reinforces the volatility clustering hypothesis) and an "industry effect" within the Portuguese market for football shares.

In addition, we introduced a new variable in order to measure sporting success. We hypothesised that a victory in a game at the start of the season should have a different (weaker) effect on stock prices than a victory when the season is almost over and the company is leading or chasing the leader (stronger effect). Therefore, we introduced the measure of "relative points to victory" (RPV) that measures the difference calculated in terms of number of points from the firm to its follower (if the firm leads the tournament) or the difference from the firm to the leader (if the firm is chasing the leader). We proved that stock returns are sensitive to changes in RPV, tending to increase when the difference in RVP rises and decreasing when the difference in RVP falls.

Concerning volatility we found that apart from the significant effects of unexpected news that are incorporated via price returns, it seems that daily trading volume also has an important influence on volatility. As in previous studies on volatility, we also found high trading volumes positively associated with high volatility.

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