Sporting Performances and the Volatility of Listed English Football Clubs

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Abstract:

This study investigates the effect of sporting performances on the volatility of listed English football clubs. The theoretical background is based on the importance of intangible assets in the football industry and the difficulty in evaluating them. This results in the hypothesis that sporting results affect the volatility of share prices. The empirical analysis is based on the family of ARCH models and relates to a sample of English football clubs listed on the on AIM and included in the Dow-Jones STOXX Football index. The findings show that sporting performances have a significant impact on the stock market valuation of football clubs. The magnitude of the stock market reaction also depends on the nature of the result (defeat, draw or win) and on the match venue (home or away). Defeats at home produce the most volatility, raising the question of shareholder motivations of football clubs.

EFM classification: 350

Key-words: Stock market valuation, football, competition, volatility, sporting results, sport management.

1. INTRODUCTION

Since Tottenham opened the door in 1983, several football clubs are now listed on the English stock market. Other European clubs have followed, such as Ajax of Amsterdam, Lazio of Rome and FC Kopenhagen. Most large clubs today have a stock exchange listing, which provides them with financing. Despite the fact that the listings are large, this issue has prompted paradoxically few academic studies. Moreover, the limited previous research on this topic has mostly relied on event studies and focused on the relationship between sporting results and the presence of abnormal returns (Allouche and Soulez, 2005; Benkraiem et al. 2009; Berument et al., 2006; Renneboog and Vanbrabant, 2000; Stadtmann, 2006; Palomino et al., 2009). As far as we know, no study has investigated the effect of sporting performances on the volatility of listed football clubs.

This paper aims to fill this gap. The theoretical background is based on professional football industry specificities (Frick, 2007; Frick and Simmons, 2008; Haugen and Hervik, 2002; Torgler and Schmidt, 2007; Vrooman, 2007). In particular, it rests on the importance of intangible assets (the players) and on the difficulty of evaluating the fair value of these assets. This uncertainty may create commercial and financial risks. However, it can be restricted by good results during sporting competitions, which provide investors with precious information about the future values of football teams. Thus, this reasoning leads to the hypothesis that there is a close and strong link between sporting performances and the volatility of listed football clubs.

We test this hypothesis on the dates of 408 matches of English football clubs listed on the on AIM and included in the Dow-Jones STOXX Football index during the 2006/2007 sporting season. In order to estimate volatility, we base our research on the exponential GARCH modeling (EGARCH) suggested by Nelson (1991). The findings show that sporting

performances have, as predicted, a significant impact on the stock market valuation of football clubs. The magnitude of the stock market reaction also depends on the nature of the result (defeat, draw or win) and on the match venue (home or away). Defeats at home produce the most volatility, raising the question of shareholder motivations of football clubs.

The rest of the paper is structured as follows. Section 2 presents the theoretical background. Section 3 specifies the methodology and data selection. Sections 4 and 5 report and discuss the empirical results. The last section concludes.

2. THEORETICAL BACKGROUND

There is already a body of research that tries to highlight the evolution and specificities of the football industry (Frick, 2007; Frick and Simmons, 2008; Haugen and Hervik, 2002; Torgler and Schmidt, 2007; Vrooman, 2007). One of the most important aspects is the importance of intangible assets, which are primarily constituted by the individual values of football players.

The value of a professional football club's intangible assets exceeds the value of its tangible assets, where tangible assets generally include team stadiums and other sporting equipment (Frick, 2007). Even if intangible assets such as players can be estimated, they are transferred between football clubs, and there is a valuation problem. The value is not only volatile but may depreciate quickly. This variability can be explained by the fact that football is a contact sport, which may cause injuries whose frequency and gravity are difficult to predict. Moreover, even if football players do not suffer from injuries, they may suffer from other physical or psychological problems, decreasing their output during matches. In support of this concern, the data shows that it is rare for a player to be distinguished during several consecutive years. In the history of the "Ballon d'Or", often referred to as the European

Footballer of the Year award, in only a few cases was this trophy allotted to the same player in several years. However, it is common for a "Ballon d'Or" winner to have a difficult season subsequent to his award, bringing him back to quasi-anonymity.

Covering the risk of depreciation would require the club equity to cover all intangible assets. However, for large professional football teams, the equity value is generally lower than the value of intangible assets. The European professional football generates strong variability in intangible assets. This variability is not covered by a sufficient amount of equity. Consequently, there is strong uncertainty regarding the overall value of the club, which is reinforced by the fact that outputs of intangible assets, i.e., the future performances of team players, are very difficult to anticipate.

The *ex ante* evaluation of future performances of professional football teams is difficult for several reasons:

- A player's individual performance in future seasons is difficult to predict (Torgler and Schmidt, 2007). The possibility of injuries and physical or psychological problems due to the fact that professional football is highly competition and high contact are unforeseeable by nature. The more a player has been injured in the past, the more he is likely to be injured in the future. However, this relationship is not systematic. A player injured in the past can have a better season than a footballer that was not injured. Thus, it is impossible to predict the number of injured players and the longevity of their absence. At the same time, it is difficult to anticipate their future performances upon their return.
- In addition, the collective outputs of the teams are difficult to forecast (Brady et al., 2008; Espitia-Escuer and García-Cebrián, 2006), which can be explained by several factors. There is an uncertainty surrounding which players will compose the team throughout a season. Also, the passage from individual to collective football talent is a dubious exercise (Brady et al., 2008). It depends on the coach's capacity to define suitable tactics for each

match and on the players' discipline in adopting and applying the tactics (Frick and Simmons, 2008). In addition, players are divided between cooperation and internal team competition (Laios and Tzetzis, 2005). In other words, players may find it beneficial to cooperate with others in order to allow their team to realize the best possible results. However, they may also work towards individual recognition. Footballers of the same club compete internally the entire season. They are in competition to be transferred to the best clubs and thus obtain the best wages. They are in competition to reach the national selections and to gain in notoriety and remuneration. Thus, it is important to understand risks of conflict (Laios and Tzetzis, 2005).

- The referee decisions may create additional uncertainty. In a direct elimination competition, football performances depend on referee decisions directly, which may be unlucky for a club. From Hunt's controversial goal, which led to the victory of England over Germany in the 1966 World Cup finale, to the goal at the hand of Maradona ("the hand of god"), which led to the victory of Argentina over England, there are many examples of referee errors affecting match results. For a team, referee bad appreciations and errors are certainly a question of luck.

Several sources of uncertainty characterize professional football and make sporting performances very dubious (Vrooman, 2007). As a result of this vagueness, clubs run two types of dependent risks: commercial and financial risks. The commercial risk is due to the fact that the team turnover depends on sporting performances. First, these results determine direct receipts, which are mainly entries to the club stadium. Stadium entries are increasingly important when one club is a competitor. This reasoning is especially true for competitions settled by direct elimination: the more a team gains, the more it plays against increasingly prestigious adversaries and, therefore, increases entries to its stadium. Conversely, stadium entries decline the more a club loses. In this case, the fall of entries is *a priori* without end,

since each year a club can go down and play in quasi-anonymous leagues. Second, sporting performances determine the indirect receipts. These include sponsoring (Chadwick and Thwaites, 2005), TV rights and the rights of all the derived products (Callejo and Forcadell, 2006; Vrooman, 2007). Hence, TV rights matter more if a club is successful, especially in competitions by direct elimination. In Europe, it is thus particularly important for large clubs to pass the first stage in the Champion's League, as this leads to remunerative TV rights (Vrooman, 2007). Television exposure allows football clubs to increase sales of their derived products such as team t-shirts (Callejo, and Forcadell, 2006). In the event of successive bad performance in competitions by direct elimination, team receipts can decrease rapidly and the club may face financial difficulty. As football clubs generally do not have sufficient equity to cover engaged investments, a club with bad results can fall into deficit quickly. The sudden financial problems known by very prestigious football clubs in Europe can be explained by this strong sensitivity to performance.

The sporting results should thus contain decisive information for investors. In the academic field of management sciences, relatively few studies have focused on the financial and market implications of the sporting performances of these clubs. One of the precursor studies in this area was done by Renneboog and Vanbrabant (2000). In that paper, the authors study the influence of sporting performances on the stock returns. Their study focuses on a sample of 17 British football clubs listed on the LSE and the AIM during the seasons from 1995 to 1998. Using an event study, the authors find abnormal positive returns of 1% on the first trading day after a win. Conversely, they find negative abnormal returns of 1.4% and 0.6% after a defeat or a draw, respectively. They examine these abnormal returns using sample partitions. For instance, they measure the impact of Europe Cup defeats, national cup draws and championship wins. Overall, despite certain spreads in the abnormal returns, this additional examination confirms and gives more credit to their initial results. Allouche and

Soulez (2005) analyze the stock market implications of the sporting performances of 21 football clubs listed in UK during 2001. Consistent with Renneboog and Vanbrabant (2000), the main conclusion of this study is that sporting results imply a market reaction. This impact is positive for wins, qualifications and trophy victories, but is negative for defeats and eliminations. Stadtmann (2006) studies this research question in the German context. The author examines only the stock market data for Borussia Dortmund GmbH & Co. The findings confirm those presented above and show a strong relationship between sporting results and stock market returns. More recently, Edmans et al. (2007), starting from a sample of international football matches played by 39 countries, note a significant drop in stock markets one day after defeats. In particular, they find that the market index is 38 points lower than average one day after a defeat in a major international sporting event (for example, the World Cup). Nevertheless, they do not observe any statistically significant effects after wins.

We therefore expect a change in the market value of the club and high volatility during the trading day following the matches.

Assumption 1: The sporting matches cause high volatility in the price index related to the football clubs during the trading day following the date of matches.

A winning club reassures investors of its future results. From this point of view, the value of the share should increase following a victory.

Assumption 2: A club's victory causes high volatility the trading day following the match.

The value of this share should increase around victories taking place on the ground of the adversary, in particular, since the ground is supposed to grant an advantage. Winning away is sign of the team's strong sporting value.

Assumption 3: A club's victory away causes higher volatility than a victory at home during the trading day following the match.

Conversely, a losing club worries investors. The defeat reveals difficulties to overcome in order to win future matches.

Assumption 4: A football club's defeat causes high volatility during the trading day following the matches.

This bad news is all the more negative if the defeat occurs at home. Indeed, it means that the team lost despite its home advantage, which indicates a low value of the team by reports to the other clubs in competition.

Assumption 5: A football club's defeat at home produces higher volatility than a defeat away during the trading day following the match.

The effect of a victory and the effect of a defeat should not be symmetric. Indeed, the shareholders expect a priori victories of the team in which they invest. A victory reassures their choices, but in some sense just constitutes the norm. On the other hand, an investor should react strongly to the defeat. It is unlikely that an investor takes action when he anticipates a descent in the league in the following year, as well as a complete failure in the competitions. It should therefore be very sensitive to defeat as sign of future losses, heralding commercial difficulties and, consequently, financial difficulties.

Assumption 6: A football club's defeat produces higher volatility than a victory during the trading day following the match.

3. METHODOLOGY

3.1 THE EGARCH MODEL

The clustering pattern of volatility is a well-known phenomenon in the financial literature. In fact, several empirical studies show that volatility time series are characterized

by the presence of conditional heteroskedasticity. The family of ARCH[1] models accounts for the volatility persistence effect and tries to capture conditional heteroskedasticity patterns. In theses models, the current idiosyncratic variance depends on its past levels and past innovations. In this study, we propose using the EGARCH (exponential general auto regressive conditional heteroskedasticity) model proposed by Nelson (1991). The EARCH (1,1) can be presented as follows :

$$r_t = \mu + \varepsilon_t \qquad (1)$$

$$Log\left(Var\left[\varepsilon_t \middle| \varepsilon_{t-1}\right]\right) = Log\left(\delta_t^2\right) = Log\left(h_t\right)$$

And

$$Z_{t-1} = \frac{\varepsilon_{t-1}}{\delta_{t-1}}$$

$$Log\left(h_t\right) = \omega + \gamma Z_{t-1} + \alpha\left(\left|Z_{t-1}\right| - \sqrt{\frac{2}{\pi}}\right) + \beta Log\left(h_{t-1}\right) \qquad (2)$$

Where r_t the index is return at the trading day t and μ is a constant. The errors (innovations) ε_t are assumed to be identically and independently distributed. In order to account for this constraint, we compute the variance-covariance matrix using the algorithm of Bollerslev and Wooldridge[2] (1992). In this case, our estimate will be robust even if returns are not normally distributed. Expression (2) is the equation of the conditional volatility h_t. The model supposes that the volatility of the current period depends upon the conditional volatility of the former period h_{t-1} and innovation ε_{t-1}.

[1] For more details about these models, see Engle (1982) and Bollerslev (1986).
[2] This method uses then quasi-maximum likelihood algorithm to calculate the variance- covariance matrix.

3.2. THE RESEARCH MODEL

To test the impact of sporting results on the price volatility, we introduce an informational variable ($N_{i,t}$) in the conditional variance equation. This variable represents the number of matches played during each period i, relative to returns calculated during the trading day t. The index i indicates an observation windows. The index i equals 1 during the pre-announcement period (i.e., the trading day preceding the matches). The post-announcement period (i=2) concerns the trading day just after the date of the matches. The coefficient of the variable $N_{1,t}$ allows us to estimate the volatility level just before the matches. However, the coefficient of the variable $N_{2,t}$ accounts for the reaction of the market after the matches. If the coefficient $\lambda_{i,t}$ of the variable $N_{i,t}$ is significant, we can conclude that the sporting results have an impact on the price volatility. This means that matches have information content as they provoke a change in the market valuation of the club and determine the investors' anticipations.

The model to test the impact of sporting results on price volatility can be presented as follows:

$$r_t = \mu_t + \varepsilon_t \qquad (3)$$

$$Log(h_t) = \omega + \gamma Z_{t-1} + \alpha(|Z_{t-1}| - \sqrt{\frac{2}{\pi}}) + \beta Log(h_{t-1}) + \sum_{i=1}^{2} \lambda_{i,t} N_{i,t}$$

Finally, we study the market reaction, accounting for both the match's result and the venue. First, we distinguish between three sub-groups according to the nature of the match's result (defeat, draw or win). To take the analysis further, we break our sample into six sub-groups according to the nature of the sporting result and the venue of the match (defeat at home or away, draw at home or away and win at home or away). We estimate the model (3)

of each type of event. The goal of this analysis is to determine the types of events that have strong effects on volatility.

2.3. DATA

This study aims to understand the impact of sporting results on the price volatility. The UK market is the market that contains the greatest number of listed football clubs. During our period of study, 11 UK clubs were listed on the market. Of the 11 clubs, eight are listed on the segment AIM (Alternative Stock Market) of the London Stock Exchange (LSE), a segment of small firms. These eight clubs also belong to the Dow Jones STOXX Football, which is dedicated to listed football clubs.

Our study concerns the sample of UK clubs listed on the AIM and included in the Down Jones STOXX Football index. This requires two types of information: information concerning the dates of matches and the information relating to the prices of the Dow Jones STOXX Football index. Information on the matches comes from the Soccer Association's database. This database collects match-related data (dates, scores, referees, administrative sanctions) from the national sport associations that regulate competitions. The stock market data used in this paper comes from the Reuters database. From the Soccer Association's database, we extract the dates of 408 matches of clubs included in our sample. The matches took place between July 2006 and June 2007. We distributed this sample first into three sub-groups according to the match's result (defeat, draw or win). In order to take the analysis further, we then broke our sample into six sub-groups according to both the sporting result and the venue (defeat at home or away, draw at home or away and win at home or away). Table 1 presents the sample repartition.

[Take in Table I]

4. RESULTS

Table 2 allows us to shed light on the impact of the introduction of our information variable (number of matches) on the price volatility. The results show that the introduction of the informational variable ($N_{i,t}$) significantly reduced the level of persistence in volatility as measured by the coefficient β. In fact, before the introduction of the informational variable, the persistence of volatility is very high (about 0.95) and close to the constraint ensuring the stationarity of the model (β<1). The introduction of the informational variable ($N_{i,t}$) in the model, reduces the persistence from 0.95 to 0.40. These findings highlight the significant information content of sporting results and confirm the thesis of Lamoureux and Lastrapes (1990), which attributed the high level of persistence of volatility to the absence of informational variables in the equation for conditional volatility.

Moreover, we note that the coefficient λ_2 is significantly positive, while λ_1 is insignificant. This means that the price volatility rises significantly during the trading day following the dates of matches. The increase in volatility after the event shows that the sporting results have information content and influence the market valuations of the clubs. Therefore, the market reaction can be explained by the changes in investors' beliefs and the revision of their portfolios in response to changes in market value of the club. The insignificance of the coefficient λ_2 shows the absence of a reaction before the event and reflects the difficulty in anticipating sporting results. These findings validate our first hypothesis.

[Take in Table II]

In the following analysis, we propose to study the market reaction taking into account the match result: defeat, draw and victory. Table 3 summarizes the results of the estimation of

model 3 for the three types of event. These results confirm the findings detailed above. Indeed, introducing the informational variable (number of matches) significantly reduces the persistence of volatility, except in the model estimated with the draw matches (β=0.94). Moreover, the coefficient λ_2 is positive and significant around the defeats and victories. This shows the presence of abnormally high volatility during the period following these types of events. This confirms hypotheses 2 and 4. We do not detect any significant reaction around draws. Finally, the coefficient λ_1 is insignificant for the three types of events, indicating the absence of significant activity before the matches.

[Take in Table III]

To take the analysis further, we broke our sample into six sub-groups according to both the nature of the sporting result and the venue of the played match. The goal of this analysis is to determine which type of event produces the strongest effect on volatility.

Table 4 summarizes the results of the six sub-samples (win at home, win away, defeat at home, defeat away, draw at home and draw away). We note that according to assumptions 5 and 6, the defeats and defeats at home, in particular, produce the most volatility during the trading day following the matches. Indeed, the coefficient of our informational variable is 0.48 (significant at 5%) for this type of event. Table 4 shows that the wins at home lead to abnormally high volatility after the match. The coefficient λ_2 for this type of event is about 0.27. All matches played away and whatever the sporting result (defeat, draw or victory) are not accompanied by an abnormal market activity. Moreover, the persistence of volatility is quite high and the coefficient λ_2 is insignificant for this type of event. These findings reject hypothesis 3.

[Take in Table IV]

5. DISCUSSION OF RESULTS

The results are essentially in line with our hypothesis, which validates the theoretical model of this research. This model is based on the specifics of football Industry (Frick, 2007; Frick and Simmons, 2008; Haugen and Hervik, 2002; Torgler and Schmidt, 2007; Vrooman, 2007). It focuses on the importance of intangible assets (the players) and the investors' difficulty in evaluating the value of these assets. High uncertainty induces a high financial risk to football clubs. The sporting results of the club, which is essential information for the investors, can reduce this uncertainty. Therefore, there is a close and direct link between the sporting performance of the club and the volatility of its share price.

The results confirm this model by showing an increase in volatility around the dates of matches. Indeed, investors revise their portfolios after the matches, causing a strong variation of prices and a change in the market valuation of the club. More specifically, the validity of hypothesis 1 confirms the results of event studies that detect abnormal returns during the trading day following the matches (Allouche and Soulez, 2005; Benkraiem et al. 2009; Renneboog and Vanbrabant, 2000). The validation of hypothesis 2 shows that the victory of a professional football club causes high volatility during the trading day following the match. Similarly, the validity of assumption 4 demonstrates that the defeat of a professional football club causes abnormally high volatility the trading day following the match. These findings prove that defeats and victories have significant informational content and influence the market valuations of football clubs.

The validity of hypothesis 5 highlights the notion that defeats at home cause higher volatility than defeats away. Losing at home is considered to be an important determinant of the club's market value. If a club is unable to win despite the advantage of playing at home,,

its ability to win in the future is called into question. These results are consistent with those obtained by Allouche and Soulez (2005) and Benkraiem et al. (2009).

The validity of hypothesis 6 shows that that the magnitude of the market reaction is twice as important in the case of bad news (defeats) than in the case of good news (wins). This finding is consistent with the results of the event study of Renneboog and Vanbrabant (2000). A priori, the shareholders believe their club will win. From this reference point, they are surprised by defeats. Therefore, a defeat increases financial risk and incites investors to reconsider their position in the club.

The only result that does not conform to the assumptions is the rejection of hypothesis 3. It is surprising that defeats at home cause high volatility, while there is no reaction around victories away. In fact, winning away is good news and means that the club is able to win despite the disadvantage of playing away. This type of event raises the probability that the club wins future matches and should therefore increase the market value of the club. However, our results reject this intuition.

One possible explanation is that victories at home take place in front of supporters, which can also be, in part, shareholders (Edmans et al., 2007). Attending the match involves the supporter-shareholders much more than if they do not attend the match. A victory at home, in which they are physically and emotionally involved in a positive way, can incite them to react more to a victory away that they did not attend. In the same vein, a defeat at home, if experienced by supporter-shareholders, can feel like a real betrayal. The emotional attachment to the team leads supporter-shareholders to reject defeat, especially at home. This phenomenon is qualified as "allegiance bias" by Edmans et al. (2007) and would lead supporter-shareholders to over-react following a defeat at home compared to a defeat away. Our results seem to underline a difference in the stock market behavior between traditional

investors animated by economic rationality and supporter investors animated by affective rationality.

This intuition should be tested in future research. Indeed, our theoretical framework supposes that investors are animated by economic rationality. This does not account for the affective or emotional dimensions that link the supporter-shareholder to his club. Future research should focus on the impact of this emotional dimension.

In conclusion, the objectives of a shareholder of a football club are still poorly understood. If the goal of shareholders of a listed company is to maximize return on investment, is it the same for professional listed football club? This question is open to institutional investors, individual investors and supporter-shareholders who hold shares of their favorite club. For example, what motivated the Russian billionaire Roman Abramovich to buy Chelsea FC in 2003 for 200 million Euros, before injecting 700 million Euros? Is this an investment based on economic rationality or a simple pleasure? The motivations of the owners of clubs and their consequences on their investment choices are still unclear and require further examination.

6. CONCLUSION

Of all professional sports in Europe, football reigns supreme. Several football teams are now listed on the stock exchange market in order to meet their financing needs (Tottenham, Juventus, Ajax Amsterdam, Borussia Dortmund, Olympique Lyonnais). This football market involves substantial financial stakes. Nonetheless, unlike industrial and commercial companies, the stock market valuation of listed football teams may depend on other types of information, especially sporting performances. Relatively few research studies have focused on this issue. Accordingly, this work aims to study the impact of sporting results on the stock

market valuation of UK listed football teams. Unlike the existing literature which has relies largely on event studies, we focus on the family of ARCH models to study the impact of sporting results on the volatility of stock prices. Our study reveals several results. First, the sporting performance of football teams has a significant impact on stock market valuation of listed clubs. Second, the magnitude of the market reaction depends on the result of the match (defeat, draw or victory) and on the venue (home or away). Third, our results show a difference in the stock market behavior between traditional investors animated by economic rationality and supporter investors animated by affective rationality. Theses findings raise the question of the motivations of football clubs' shareholders. Future research should focus on theses motivations and analyze their implications for stock market behavior.

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Table 1: Sample repartition

Club	TD^t	TD^w	TW^n	D^tH	D^tA	D^wH	D^wA	W^nH	W^nA	Total
Birmingham City FC	14	9	30	5	9	6	3	17	13	53
Celtic FC	10	8	34	2	8	3	5	21	13	52
Millwall FC	20	11	23	5	15	9	2	14	9	54
Preston North End FC	18	8	24	5	13	4	4	16	8	50
Sheffield United FC	22	8	11	8	14	6	2	8	3	41
Southampton FC	16	12	25	5	11	6	6	14	11	53
Tottenham Hotspur FC	15	13	31	5	10	5	8	20	11	59
Watford FC	21	15	10	8	13	11	4	6	4	46
Total	136	84	188	43	93	50	34	116	72	408

TD^t: Total defeats; TD^w: Total Draw matches; TW^n: Total wins; D^tH: defeat at home; D^tA: defeat away; D^wH: Draw match at home; D^wH: Draw match away; W^nH: Win at home and W^nA: Win away.

Table 2: Estimation results I

Specifications	μ	ω	γ	α	β	λ_1	λ_2
Panel A : Without event	0.001***	-0.480**	-0.026	0.142**	0.951***	--	--
Panel B : All matches	0.001***	-6.400**	0.012	0.299**	0.404**	0.054	0.088*

This table presents the results of the estimation of the following EGARCH (1,1) model :

$$r_t = \mu_t + \varepsilon_t$$

$$Log(h_t) = \omega + \gamma Z_{t-1} + \alpha(|Z_{t-1}| - \sqrt{\frac{2}{\pi}}) + \beta Log(h_{t-1}) + \sum_{i=1}^{2} \lambda_{i,t} N_{i,t}$$

r_t and h_t are respectively the return and the conditional volatility of the index at the trading day t. This model is first estimated without any exogenous variables in the variance equation (panel A). Then we introduce an informational variable ($N_{i,t}$) in the conditional variance equation. This variable represents the number of matches played during each period i, relative to returns calculated during the trading day t. The index i indicates an observation windows. The index i equals to 1 during the pre-announcement period i.e. the trading day preceding the matches. The post-announcement period (i=2) concerns the trading day just after the date of the matches. The significance at 10% level is marked by (*), 5% level by (**) and 1% level by (***).

Table 3: Estimation results II

Specifications	μ	ω	γ	α	β	λ_1	λ_2
Panel A : Defeat	0.001***	-6.591***	-0.031	0.273**	0.374*	0.117	0.186*
Panel B : Draw	0.001**	-0.453***	-0.122	0.094**	0.940**	-0.116	-0.066
Panel C : Win	0.001***	-6.464***	0.039	0.331***	0.401**	0.140	0.184**

This table presents the results of the estimation of the following EGARCH (1,1) model :

$$r_t = \mu_t + \varepsilon_t$$

$$Log(h_t) = \omega + \gamma Z_{t-1} + \alpha(|Z_{t-1}| - \sqrt{\frac{2}{\pi}}) + \beta Log(h_{t-1}) + \sum_{i=1}^{2} \lambda_{i,t} N_{i,t}$$

r_t and h_t are respectively the return and the conditional volatility of the index at the trading day t. This model is first estimated without any exogenous variables in the variance equation (panel A). Then we introduce an informational variable ($N_{i,t}$) in the conditional variance equation. This variable represents the number of matches played during each period i, relative to returns calculated during the trading day t. The index i indicates an observation windows. The index i equals to 1 during the pre-announcement period i.e. the trading day preceding the matches. The post-announcement period (i=2) concerns the trading day just after the date of the matches. we distinguish three sub-groups according to the nature of the match's result (defeat, draw or win). We estimate the above model of each type of event. The significance at 10% level is marked by (*), 5% level by (**) and 1% level by (***).

Table 4: Estimation results III

Specifications	μ	ω	γ	α	β	λ_1	λ_2
Panel A : Defeat at home	0.001***	-7.872***	-0.113	0.360***	0.238	0.192	0.478**
Panel B : Defeat away	0.001**	-5.913***	0.019	0.252**	0.439**	0.127	0.217
Panel C : Draw at home	0.001***	-0.152	-0.084	0.048	0.972***	-0.075	-0.207
Panel D : Draw away	0.001***	-0.667***	-0.073	0.148***	0.925***	-0.716***	0.394
Panel E : Win at home	0.001***	-6.82***	-0.035	0.344**	0.354*	0.146	0.265*
Panel F : Win away	0.001**	-0.388*	0.043	0.155**	0.970***	0.139	-0.009

This table presents the results of the estimation of the following EGARCH (1,1) model :

$r_t = \mu_t + \varepsilon_t$

$$Log(h_t) = \omega + \gamma Z_{t-1} + \alpha(|Z_{t-1}| - \sqrt{\frac{2}{\pi}}) + \beta Log(h_{t-1}) + \sum_{i=1}^{2} \lambda_{i,t} N_{i,t}$$

r_t and h_t are respectively the return and the conditional volatility of the index at the trading day t. This model is first estimated without any exogenous variables in the variance equation (panel A). Then we introduce an informational variable ($N_{i,t}$) in the conditional variance equation. This variable represents the number of matches played during each period i, relative to returns calculated during the trading day t. The index i indicates an observation windows. The index i equals to 1 during the pre-announcement period i.e. the trading day preceding the matches. The post-announcement period (i=2) concerns the trading day just after the date of the matches. We broke our sample down into six sub-groups according to both the nature of the sporting result and the venue of the played match (defeat at home or away, draw at home or away and win at home or away). We estimate the above model of each type of event. The significance at 10% level is marked by (*), 5% level by (**) and 1% level by (***).