Louvain School of Management

Analyzing how Ownership Structure Influences Football Stock Market Reactions to Sporting Outcome

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Foreword

First of all, I would like to thank everyone who supported me throughout my time at the Université Catholique de Louvain, from my bachelor's years to my master's degree.

I am especially grateful to my supervisor, Professor Leonardo Iania, for his availability, valuable feedback, and guidance at every stage of this work. His expertise, patience, and critical eye helped me approach this research with both clarity and rigor.

Last but not least, my deepest thanks go to my parents, who gave me the opportunity to pursue higher education and supported me every step of the way throughout these five years. Their belief in me has been a constant source of motivation. Beyond their support in my academic journey, I also want to thank them for always being there for me in every part and stage of my life. They have played a key role in shaping who I am today, and for that I am truly grateful.

— Rachel Rottiers.

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1. Introduction

Over the past decades, football has evolved from a primarily sporting and cultural activity into a global, multi-billion-euro industry (Union of European Football Associations [UEFA], 2023). Several leading European football clubs, such as Juventus, Borussia Dortmund or AFC Ajax, are no longer only sporting institutions but also publicly listed companies whose shares are traded on stock exchanges. As a result, football clubs have become owned and traded by a broad range of investors, from emotionally attached fans to professional institutional investors. Hence, this creates a tension between the emotional foundations of sport and the principles of rational financial markets.

For a traditional finance investor, listed football clubs appear as an unconventional asset, but potentially an attractive one. According to Modern Portfolio Theory (Markowitz, 1952), the inclusion of niche assets can enhance portfolio diversification when their returns are weakly correlated with the broader stock market. In this context, football stocks have attracted attention because their performance has historically largely been shaped by sporting outcomes rather than by financial or macroeconomic news (Palomino et al., 2009; Renneboog & Vanbrabant, 2000). However, limited market correlation does not necessarily imply rational valuation. Insights from behavioral finance suggest that stocks are heavily influenced by investor sentiment (Baker & Wurgler, 2006), media coverage and collective mood (Barber & Odean, 2008) with football stock's prices reacting strongly to match results (Edmans et al., 2007), often overshadowing fundamental factors such as cash flows or long-term profitability.

In recent years, the ownership structure of professional football clubs has begun to evolve. Beyond retail investors and fan-shareholders, an increasing number of institutional investors - including private equity funds, sovereign wealth funds and other professional investment vehicles - have entered the football industry (Ma, 2025). Their growing presence reflects a broader trend toward the financialization of professional sports and raises important questions about whether football clubs are gradually transitioning from sentiment-driven assets toward more rationally priced financial instruments. (Buchholz & Lopatta, 2017; Weimar & Fox, 2021)

The objective of this thesis is to investigate how the growing presence of institutional investors affects the stock market behavior and performance of listed European football clubs. More specifically, this study aims to examine whether clubs with higher institutional ownership exhibit weaker stock market reactions to match outcomes compared to clubs predominantly held by retail investors, often assumed to be fans. This is measured through cumulative abnormal returns within an event-study framework. By doing so, this research seeks to assess whether institutional investors contribute to more rational pricing and improved financial outcomes in an asset class traditionally characterized by strong emotional biases.

Previous academic studies have extensively analyzed the relationship between sporting performance and stock market reactions. Early work by Renneboog and Vanbrabant (2000) shows that match outcomes significantly affect the stock prices of listed football clubs, with losses triggering stronger negative reactions than the positive effects of wins. Later studies found similar results in other countries and competitions, showing that investor sentiment and attention play an important role (Dobson & Goddard, 2011; Palomino et al., 2009). Other studies also found that football stocks tend to react more strongly to bad news than to good news, which suggests that investor emotions play a big role in how these stocks behave. (Floros, 2014; Palomino et al., 2009).

Despite this growing literature, an important research gap remains. A lot of the existing work looks at how match results or market movements affect football stock prices but who actually owns those stocks has received much less attention. In particular, there is little research on whether clubs with more institutional investors behave differently in the market. Given how much institutional involvement in football has grown in recent years, this seems like a gap worth exploring.

This thesis introduces ownership structure as a variable into the analysis of football club stock behavior. Using a quantitative approach, the study compares stock market reactions to match outcomes, volatility patterns and returns across clubs with different levels of institutional ownership. The study covers fourteen seasons of data, spanning from the 2010/2011 season to the 2023/2024 season for the following clubs: Amsterdamsche Football Club Ajax, Ballspielverein Borussia 09 e. V. Dortmund, Celtic Football Club and Juventus Football Club (respectively later referred as AFC Ajax, Borussia Dortmund, Celtic and Juventus). By bridging insights from Market Efficiency Theory and Behavioral Finance, the research provides a more nuanced understanding of whether football stocks are evolving from sentiment-driven assets into more rationally priced financial instruments.

The paper begins with an overview of the theoretical and empirical scientific literature on portfolio diversification, investor sentiment, football stock market behavior and institutional ownership. It will then dive more into details of the methodology applied and data used to carry out this research. The next Chapter will present the results and findings of the research as well as the interpretation of these. The following Chapter will discuss the limitations of the research carried out. Lastly there will be a final Chapter summarizing the main findings of this thesis.

2. Literature review

This Chapter will explore the studies that have already been carried out, looking in particular at the theoretical foundations of asset pricing and market efficiency, the role of behavioral biases and investor sentiment, the specific characteristics of football stocks as sentiment-driven assets, and finally the influence of ownership structure on price efficiency.

2.1 Foundations of Asset Pricing and Market Efficiency

Modern Portfolio Theory, introduced by Markowitz (1952), is a key concept in finance: by diversifying, meaning combining assets that do not move exactly in the same way, investors can lower portfolio risk. In this context, the risk-return trade-off depends not only on each asset individually, but also on how the assets move together within the portfolio This logic was later extended by asset pricing models such as the Capital Asset Pricing Model (Sharpe, 1964) and the Fama–French three-factor model (Fama & French, 1993). Those models further explain that expected returns mainly come from exposure to systematic risk factors, while firm-specific risk can generally be reduced through diversification.

Within this theoretical framework, the Efficient Market Hypothesis (Fama, 1970) plays an important role. It states that financial markets are efficient in the sense that asset prices quickly reflect all available information. In its semi-strong form, this means that public information such as company announcements or, for football clubs, match results, should be rapidly incorporated into stock prices.

This theoretical framework has also led to the development of empirical methods used to measure how markets react to new information. Event study methodology has become a standard approach in financial economics. As explained by MacKinlay (1997), event studies measure the impact of specific events on stock prices through abnormal returns, computed by the difference between actual returns and expected returns which is based on an asset pricing model. A short event window helps filter out unrelated market noise, making it easier to observe the speed and efficiency with which prices adjust to new information.

All the frameworks discussed above share the following assumption: prices in efficient markets adjust quickly and accurately to new information. However, this assumption starts to be challenged. Indeed, a significant body of research documents systematic deviations from these theoretical predictions. This is even more true in settings where psychological biases and emotional reactions influence how investors interpret information and make decisions. This motivates the examination of behavioral finance and investor sentiment, which are discussed in the following Section.

2.2 Limits to Market Efficiency: Behavioral Finance and Investor Sentiment

Behavioral finance provides an alternative framework to classical theory, in which market outcomes are also shaped by psychological biases and cognitive limitations.

A foundational contribution to this literature is Prospect Theory, developed by Kahneman and Tversky (1979). Prospect Theory suggests that people evaluate outcomes based on a reference point rather than in absolute terms. In practice, losses usually feel more significant than gains of the same size feel satisfying. Because of this, individuals often become more cautious when they are ahead, but more willing to take risks when they are trying to recover from losses. Kahneman and Tversky referred to this as the "reflection effect". In the financial markets' context, it explains why negative news often triggers stronger reactions than positive news of the same size. It also explains why such responses can generate relatively predictable movements in asset prices.

Empirical research supports this view. De Bondt and Thaler (1985) found that investors often overreact to new information, causing stock prices to move away from their fundamental value before gradually adjusting over time. In other words, psychological factors can temporarily influence and distort prices leading to markets not being always fully efficient.

Hence, investor sentiment has become an important concept to explain why markets sometimes move away from full efficiency. Investor sentiment refers to beliefs or expectations about future asset returns that are not fully justified by fundamental information (Baker & Wurgler, 2006). Price movements may take into account changes in mood, optimism, or pessimism rather than changes in intrinsic value. Theoretical models developed by De Long et al. (1990) talk about the notion of "noise traders," whose decisions are driven by sentiment rather than rational analysis. Since rational investors are not always able or willing to correct the mispricing, these traders can influence asset prices and create additional risk.

Psychology can influence market outcomes through investor attention. Barber and Odean (2008) show that individual investors often buy stocks that grab their attention; sometimes even regardless of the underlying fundamentals. Highly noticeable or emotionally impactful events can amplify trading activity and price movements. Moreover, Tetlock (2007) demonstrated that when financial news carry sentiment, it has a tangible effect on stock returns. This reinforces the importance of the influence of psychological and informational factors on market dynamics.

The previously mentioned findings reveal the following pattern: when assets are hard to value or when investors are emotionally involved, behavioral effects tend to be stronger and more persistent. (Edmans et al., 2007; Shleifer & Vishny, 1997). Sports-related assets fit this profile well, where emotional attachment and collective sentiment may play a central role. This provides a natural bridge to the analysis of football stocks, which are often characterized as highly sentiment-driven assets.

2.3 Football Stocks as Sentiment-Driven Assets

2.3.1 Football Stocks Reactions

A first strand of the literature examines whether sporting performance directly affects the stock returns of listed football clubs. Within an event study framework, match outcomes are considered firm-specific information shocks that can affect investor expectations and, as a result, stock prices.

Early empirical evidence provided by Benkraiem et al. (2009), Palomino et al. (2009) as well as Renneboog and Vanbrabant (2000) show that match results significantly impact stock returns, with victories generally associated with positive abnormal returns and defeats leading to negative reactions. More specifically, losses tend to generate stronger market reactions than wins. This pattern reflects the Prospect Theory (Kahneman & Tversky, 1979), stating that investors are more sensitive to negative outcomes than to positive ones.

Match outcomes alone is not the only variable explaining market reactions. Indeed, a second strand of the literature emphasizes the role of prior expectations. In efficient markets, only the unexpected component of an event should affect asset prices, since anticipated outcomes should be already embedded in valuations.

For football clubs listed on the stock market, betting odds serve as a proxy for forecasts of match results. Palomino et al. (2009) show that stock market reactions to losses are much stronger when the result is unexpected. In other words, unexpected losses lead to larger negative returns than losses that investors had already anticipated. For victories, the opposite effect appears: surprising wins generate smaller abnormal returns than expected wins, suggesting that investors tend to overreact to victories that were already largely priced in.

2.3.2 Investor Sentiment and Emotional Attachment

Football clubs attract a significant proportion of fan-investors whose decisions are driven not only by financial returns but also by emotional attachment to the club.

Empirical work supports this picture. Huth (2020) finds that emotional attachment to a club is a stronger driver of investment decisions than traditional financial objectives, with some investors explicitly seeking an "emotional return" and in certain cases expecting no financial gain whatsoever. This differs strongly from the profit-maximizing assumptions of classical finance.

Weimar and Fox (2021) reinforced this finding, by showing that the stronger the fan involvement, the greater the likelihood of investing, even at the cost of lower or negative financial returns. Their results suggest that in football, investment decisions are often influenced by psychological motivations such as loyalty and identity rather than conventional risk–return reasoning.

These features align with Baker and Wurgler's (2006) broader findings on investor sentiment, which show that sentiment effects are strongest for assets that are hard to value and subject to limits to arbitrage. Football stocks share many of these properties (future performance is inherently uncertain, and retail investors represent a significant portion of the shareholder base) making them plausible candidates for sentiment-driven mispricing.

Lastly, Edmans et al. (2007) show that sports results can influence investor mood and stock returns. In particular, defeats are linked with significant negative market returns that cannot be fully explained by fundamentals.

However, sentiment-driven mispricing does not always correct itself. The concept of limits to arbitrage, developed by Shleifer and Vishny (1997), shows that even when professional investors identify mispricing, trading against it can be too risky, which discourages them from doing so. This is especially true for football stocks, which are characterized by low liquidity, high volatility, and a large retail investor base. As a result, price reactions after match outcomes can be stronger than fundamentals justify, and it may take longer for prices to return to normal compared to traditional markets.

Overall, the literature suggests that football stocks behave like sentiment-driven assets, where emotional investor reactions and limits to arbitrage allow mispricing linked to match outcomes to persist. However, an important limitation of this research is that it often assumes a homogeneous investor base. As institutional investors play an increasingly prominent role in football club ownership, ownership structure may prove crucial in determining how stock prices react to sporting outcomes. This issue is explored in the next Section.

2.4 Ownership Structure and Market Efficiency

A first distinction in the literature concerns the differences between retail and institutional investors. Retail investors are generally seen as having more limited information-processing capacity, shorter investment horizons, and greater sensitivity to attention and sentiment (Barberis & Thaler, 2003). Barber and Odean (2008) show that individual investors often engage in attention-driven trading, buying stocks that catch their attention regardless of their fundamental value. This behavior can lead to temporary mispricing and higher volatility.

As discussed in the previous Section, many investors in football clubs are driven by emotional attachment and loyalty, alongside, or sometimes even more than, pure financial returns (Buchholz & Lopatta, 2017; Huth, 2020). A shareholder base with these characteristics is likely more prone to sentiment-driven trading, which can in turn contribute to excess volatility and temporary mispricing.

On the other side, institutional investors, such as investment funds, pension funds, and hedge funds, are generally seen as more sophisticated. They have greater resources, professional expertise, and better access to information, which allows them to make more informed decisions. As a result, they are less likely to react to short-term sentiment and more likely to trade on fundamentals. (Shleifer & Vichny, 1997)

A substantial body of literature examines the role of institutional investors in promoting market efficiency. Gompers and Metrick (2001) find that institutional investors heavily influence stock return dynamics and tend to favor larger, more liquid firms.

Boehmer and Kelley (2009) provide direct evidence that the higher levels of institutional ownership, the more efficient stock prices. In other words, when institutional ownership is higher, prices tend to adjust faster and more accurately to new information; which points to a stabilizing role for institutional investors in the price discovery process.

Ferreira and Matos (2008) broaden this to global markets, showing that institutional investors contribute to liquidity, corporate governance and market discipline. Where institutional ownership is higher, firms face closer monitoring, which can reduce information asymmetries and support more rational pricing.

That said, institutional ownership doesn't fully solve the problem of mispricing. As discussed in Section 2.3.2, Shleifer and Vishny (1997) show that rational investors may be unwilling or unable to correct pricing inefficiencies when faced with the risks and constraints that limit arbitrage.

Arbitrage strategies can be risky when mispricing lasts longer than expected, potentially causing losses before prices return to their fundamental value. Capital constraints, transaction costs, and short-selling restrictions may further reduce the ability of institutional investors to correct market anomalies.

These constraints tend to be more pronounced in markets characterized by low liquidity, high volatility, and strong sentiment-driven trading: all features commonly associated with football stocks (Nabli et al., 2025; Palomino et al., 2009). So even when sophisticated investors are present, mispricing can persist and price reactions to events like match outcomes may remain exaggerated.

Taken together, the literature suggests that ownership structure shapes price reactions: retail-dominated markets amplify sentiment-driven movements, while institutional investors tend to improve efficiency.

3. Methodology

3.1 Research Objectives

The objective of this thesis is to assess how stock market reactions to sporting outcomes vary depending on the ownership structure of these clubs. More specifically, the study investigates whether the presence of institutional investors moderates the stock price reaction to sporting results.

Building on the behavioral finance and sports finance literature, this research focuses on the distinction between emotionally driven investors - often associated with fans and retail shareholders - and institutional investors, who are assumed to be less prone to sentiment-driven trading (Barber & Odean, 2008). The central hypothesis is the following: the higher the institutional ownership in a club is, the weaker the stock market reactions to match results will be, and therefore the more attractive this investment will be from a diversification standpoint.

To explore this, the study takes a quantitative approach by combining match-level data with stock market and ownership data to measure short-term price movements after games, and whether those movements vary with the level of institutional ownership.

3.2 Hypothesis

Based on the literature review presented above, the following hypotheses are developed for this study.

Hypothesis 1: Sporting outcomes significantly affect the stock prices of listed football clubs. More specifically, wins are expected to generate positive cumulative abnormal returns, while losses are expected to generate negative cumulative abnormal returns.

This hypothesis is based on the findings of Dobson and Goddard (2011), Edmans et al. (2007), Galoppo and Boido (2020) and Renneboog and Vanbrabant (2000).

Hypothesis 2: Listed football clubs with higher institutional ownership exhibit weaker stock market reactions to sporting outcomes than clubs with lower institutional ownership, as higher institutional ownership contributes to more stable and less sentiment-driven pricing of listed football clubs.

This hypothesis is based on the literature suggesting that football club investors are heterogeneous and that fan-investors and retail shareholders may be more sentiment-driven than institutional investors. This argument is supported by Buchholz and Lopatta (2017) and Huth (2020), as well as by the broader behavioral finance literature discussed in this paper.

3.3 Data Collection and Preparation

3.3.1 Data Sources

The empirical analysis relies on four main data sources.

First, daily stock market data for publicly listed European football clubs are collected over the period season 2010/2011 to the season 2023/2024. The sample includes Juventus, Borussia Dortmund, AFC Ajax, and Celtic. Daily stock prices are used to compute stock returns, which in turn are used to calculate abnormal returns. To ensure full currency consistency across all variables, stock prices of football clubs are converted into USD using the daily exchange rate downloaded from Bloomberg. This ensures full currency consistency across all variables, as the Fama–French factor data are also denominated in USD.

Second, expected returns are estimated using the Fama–French three-factor model in order to construct abnormal returns. Factor data are taken from the Kenneth R. French Data Library (Dartmouth College), more precisely the 'Fama/French European 3 Factors [Daily]' file.

Third, the following match-level data are collected for each club: match dates, competition type (domestic league or other), location (home or away), and result (win, loss, or draw). Those variables come from FBref, a public football statistics database, and are converted into binary variables for the empirical analysis.

Finally, ownership data for each club is obtained from the Bloomberg database. Bloomberg provides detailed information on shareholder structure, including shareholder type and historical ownership data. These data are used to construct a time-varying measure of institutional ownership for each football club. More details regarding these data are given in the next Section.

3.3.2 Construction of Institutional Ownership

Institutional ownership is measured using the Bloomberg variable “% of Float Held” indicated under the category *Institutional Holdings – Based on Current Filings*. This variable captures the share of a company's publicly tradeable shares (free float) held by institutional investors.

“% of Float Held” is preferred over total institutional ownership as it only includes shares that are traded. Since price reactions happen through trading in the free float, looking at institutional holdings within it gives a better sense of their actual influence on short-term prices.

Institutional ownership is treated as a slow-moving structural feature of the shareholder base, rather than something that shifts with daily returns. That quarterly figure is applied to all matches the club played during that quarter.

Cases where institutional ownership exceeds 100% are kept unchanged, since they might carry explanation rather than be data errors. Several reasons explain why reported institutional ownership can surpass 100% of shares outstanding. First and most importantly, when both the lender and the ultimate buyer in a short-sale transaction are 13F filers, the analysis of 13F data overstates institutional ownership through double-counting. Indeed, institutional ownership serves as a direct proxy for the supply of lendable shares, meaning that values above 100% are intrinsically linked to short-selling activity. Moreover, misrepresented positions or data transcription errors in the data providers’ 13F files can also contribute to inflated figures. Capping institutional ownership at 100% is not standard practice in the literature. Accordingly, capping these values would artificially remove information about short-selling intensity and institutional demand, thereby introducing a truncation bias into the sample. (Asquith et al., 2004)

When working with the statistical model, to address potential multicollinearity issues and improve the interpretability of interaction effects, the institutional ownership variable was mean-centered. Prior literature suggests that mean-centering reduces the correlation between predictors and their interaction terms, thereby stabilizing coefficient estimates (Iacobucci et al., 2016).

3.3.3 Sample Construction and Final Dataset

The target population for this study consists of European football clubs whose shares are publicly listed on a stock exchange. From this population, the final sample is restricted to four clubs — Juventus, Borussia Dortmund, AFC Ajax, and Celtic — on the basis of three cumulative selection criteria. First, continuous daily price data must be available throughout the study period, running from the 2010/2011 season to the 2023/2024 season, to ensure the integrity of the return series used to estimate abnormal returns and ultimately cumulative abnormal returns. Second, a quarterly measure of institutional ownership must be accessible for each club, as this variable constitutes the central moderating variable in the empirical analysis. Third, official match results must be available across the sample period. Any club failing to meet one of these three criteria was not taken into the sample.

Following Galloppo and Boido (2020), only official competitions (national leagues, national cups, and continental tournaments) are included, as these matches have direct economic implications for clubs (e.g., revenues, qualification, and prestige).

The sample was constructed in several stages. First, the stock market dataset included 3664 trading-day observations for Juventus, 3662 for Borussia Dortmund, 3652 for AFC Ajax, and 3655 for Celtic.

After calculating abnormal returns for each trading day, the match dataset included 711 match observations for Juventus, 661 for Borussia Dortmund, 615 for AFC Ajax, and 526 for Celtic.

In a next step, the match dataset was merged with the stock market dataset using the abnormal return variables AR_{-1}, AR_0, and AR_{+1}. After this merge, the final dataset contained 711 observations for Juventus, 661 for Borussia Dortmund, 615 for AFC Ajax, and 526 for Celtic.

These final observations are used to compute cumulative abnormal returns (CAR) which will be used to estimate the regression models.

3.4 Empirical Model

3.4.1 Computation of Daily Returns

Daily stock returns for each club are computed as follows:

$$R_{it} = \frac{P_{it} - P_{i,t-1}}{P_{i,t-1}}$$

where $P_{i,t}$denotes the closing stock price of club *i* on trading day *t*.

3.4.2 Fama-French Model

Several prior studies have employed the Fama–French three-factor model to compute abnormal returns in the context of sports-related events. For instance, Eisdorfer and Kohl (2017) and Ge and Humphreys (2021) both use this methodology to estimate expected returns and derive abnormal returns around specific events.

Following this established approach, expected returns in this study are estimated using the Fama-French (1993) three-factor model. As originally proposed by Fama and French in 1993, the model extends the traditional market model by incorporating size (SMB) and value (HML) factors to the market risk one. This framework is designed to better capture systematic risk beyond simple market exposure and therefore allows for a cleaner estimation of abnormal returns by removing systematic risk components from observed stock returns.

The return-generating process is specified as:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{MKT,i}(Mkt - RFt) + \beta_{SMB,i}(SMB_t) + \beta_{HML,i}(HML_t) + \varepsilon_{i,t}$$

where:

- $R_{i,t}$denotes the daily return of club *i*,
- $R_{f,t}$denotes the daily return of the risk-free rate
- MKT_trepresents the excess market return,
- SMB_tcaptures the size factor (Small Minus Big),
- HML_tcaptures the value factor (High Minus Low),
- $\alpha_i$is the club-specific intercept, and
- $\varepsilon_{i,t}$is the error term.

The estimated coefficients $\hat{\alpha}_i$, $\hat{\beta}_{MKT,i}$, $\hat{\beta}_{SMB,i}$, and $\hat{\beta}_{HML,i}$are then used to compute the expected excess return on the first trading day after the event.

$$\hat{R}_{i,t} = R_{f,t} + \hat{\alpha}_i + \hat{\beta}_{MKT,i}(R_{m,t} - R_{f,t}) + \hat{\beta}_{SMB,i}SMB_t + \hat{\beta}_{HML,i}HML_t$$

To estimate expected returns, this study follows the standard event-study methodology proposed by MacKinlay (1997). Consistent with this approach, the parameters of the Fama–French three-factor model are estimated over an estimation window of 150 trading days prior to the event. This pre-event estimation window allows for reliable and stable estimation of the factor loadings while avoiding contamination from event-related abnormal returns.

Abnormal returns (AR) are then calculated as:

$$AR_{i,t} = R_{i,t} - \hat{R}_{i,t}$$

Abnormal returns therefore represent the portion of stock performance that cannot be explained by exposure to common risk factors and are interpreted as the market reaction to club-specific sporting information.

3.4.3 Determination of the event window

Because football matches frequently take place outside trading hours (evenings or weekends), the event date (t = 0) is defined as the first trading day after the end of the match, so that abnormal returns capture the market's first opportunity to react to the sporting outcome.

To measure the market's immediate reaction to match outcomes while limiting contamination from unrelated news, cumulative abnormal returns (CARs) will be computed over a short event window of −1 to +1 around the match date. This approach is consistent with prior research on publicly listed football clubs. For example, Galloppo and Boido (2020) rely on $[-1; +1]$ windows around match dates. Likewise, Palomino et al. (2009) as well as Renneboog and Vanbrabant (2000) both rely on short event windows around match dates.

Schertler and van Beurden (2023) show that investors may begin trading before the match, driven by expectations, media coverage, or betting odds. Including day −1 therefore ensures the CAR reflects not just the market's reaction to the result, but also possible trading that was already happening based on that match through forecasts.

Cumulative abnormal returns (CAR) are computed by aggregating abnormal returns over the event window. Following the standard event-study framework in MacKinlay (1997), the CAR for firm (club) i over the interval $[\tau_1, \tau_2]$is defined as the sum of abnormal returns across the days in that window:

$$CAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_{i\tau}$$

Accordingly, for the event window $[-1, +1]$used in this study, cumulative abnormal returns are calculated as:

$$CAR_i[-1, +1] = AR_{i,-1} + AR_{i,0} + AR_{i,+1}$$

3.4.4 Variables to include in the model and construction of the model

Ren (2002) highlights that home-field advantage in soccer has been widely documented in the literature. To control for this potential effect and isolate its impact on stock returns, a dummy variable is created to capture match location. Since a match can be played at home or not at home (either away or at a neutral venue), a dummy variable (*Home*) will be constructed.

Several studies show that stock markets react significantly to match outcomes (Benkraiem et al., 2009; Palomino et al., 2009; Renneboog and Vanbrabant, 2000). To capture this, two dummy variables are used — Win and Loss — with draws serving as the baseline. Finally, Berkowitz and Depken (2018) distinguish between different types of competitions as financial stakes vary substantially across tournament levels. A dummy variable (*Local_League*) is therefore included, equal to 1 for domestic league matches and 0 otherwise.

Following standard recommendations in applied econometrics, this thesis estimates a sequence of nested linear regression models. This strategy makes it possible to identify the partial effect of sporting outcomes on cumulative abnormal returns while progressively holding constant other relevant factors, thereby reducing the risk of omitted variable bias (Angrist & Pischke, 2009; Wooldridge, 2010). It also allows the analysis to examine whether the coefficients of interest remain stable once additional controls are introduced, which is informative about the robustness of the results (Oster, 2019). Hence, this thesis first estimates a baseline model including only match outcomes (Win, $Loss$); then a second model adds match-level controls ($Home$, $Local\_League$), club fixed effects and institutional ownership; and a third, full specification includes the interaction terms $Win \times Inst\_Own$ and

$Loss \times Inst\_Own$, which directly test whether institutional ownership moderates stock market reactions to sporting outcomes.

Model 1: Baseline effect of sporting outcomes

$$CAR_{i,t} = \alpha + \beta_1 Win_{i,t} + \beta_2 Loss_{i,t} + \varepsilon_{i,t}$$

This first model estimates the direct effect of sporting outcomes on cumulative abnormal returns. With draws as the reference category, β_1 and β_2 capture the differential impact of wins and losses respectively, both measured against the draw outcome.

Model 2: Baseline model with controls and club fixed effects

$$CAR_{i,t} = \alpha + \beta_1 Win_{i,t} + \beta_2 Loss_{i,t} + \beta_3 Home_{i,t} + \beta_4 Local\_League_{i,t} + \gamma_i + \varepsilon_{i,t}$$

This second model adds match-level control variables and club fixed effects. The variables $Home$, and $Local\_League$ control for contextual differences across matches, while γ_i captures club-specific time-invariant heterogeneity.

As explained by Wooldridge (2010), fixed effects are useful in panel regressions because they control for unobserved, time-invariant heterogeneity that may be correlated with the explanatory variables. In this setting, some club characteristics are difficult to observe or quantify precisely, but may systematically affect cumulative abnormal returns and may also be correlated with the explanatory variables included in the model. This includes factors such as club reputation, brand strength, fan base intensity, investor culture, long-term governance quality, historical prestige, and baseline media attention. If such factors are omitted, the estimated effect of match outcomes or institutional ownership may suffer from omitted variable bias. Including club fixed effects effectively removes these permanent differences from the equation, so the results reflect how things change within a given club over time rather than what makes one club structurally different from another. This is particularly important in this thesis because Juventus, Borussia Dortmund, AFC Ajax, and Celtic differ structurally in ways that are likely to influence both ownership composition and stock market reactions. More broadly, this approach is consistent with the applied econometrics literature emphasizing the importance of reducing omitted variable bias through appropriate controls (Angrist & Pischke, 2009).

Since the thesis proposes a conditional effect, the impact of a win or loss on abnormal returns may vary with institutional ownership. To capture this, the third model includes interaction terms allowing the market reaction to differ across ownership levels, following standard practice for conditional hypotheses (Brambor et al., 2006).

Model 3: Full interaction model

$$CAR_{i,t} = \alpha + \beta_1 Win_{i,t} + \beta_2 Loss_{i,t} + \beta_3 Inst\_Own\_c_{i,t} + \beta_4 (Win_{i,t} \times Inst\_Own\_c_{i,t}) + \beta_5 (Loss_{i,t} \times Inst\_Own\_c_{i,t}) + \beta_6 Home_{i,t} + \beta_7 Local\_League_{i,t} + \gamma_i + \varepsilon_{i,t}$$

This final specification is the main model of the thesis. It tests whether institutional ownership moderates the stock market reaction to sporting outcomes. More specifically, $\beta_4$indicates whether institutional ownership modifies the reaction to wins, while $\beta_5$indicates whether institutional ownership modifies the reaction to losses.

with:

- $Win_{i,t}$: equals 1 if club *i* wins the match, 0 otherwise
- $Loss_{i,t}$: equals 1 if club *i* loses the match, 0 otherwise
- $Home_{i,t}$: equals 1 if the match is played at home, 0 otherwise
- $Local\_League_{i,t}$: equals 1 if the match is played as part of the Local League, 0 otherwise
- α_i: club fixed effect
- $Inst\_Own\_c_{i,t}$: percentage of floating shares owned by institutional investors, previously mean-centered.

The intercept α captures the baseline CAR for a club that ends in a draw playing in a match that is not held at home and is not part of the local league, with institutional ownership evaluated at its sample mean (since *Inst_Own_c* is mean-centered, a value of zero corresponds to the average level of institutional ownership across the sample).

3.4.5 Computational Implementation

The data processing and empirical analysis were carried out using a combination of Excel, Python, and RStudio. Daily stock returns were first computed in Excel by applying standard return formulas to the closing price series. The estimation of expected returns and abnormal returns was then performed in Python using a Fama–French three-factor model. For each match, the model coefficients were estimated over a rolling estimation window. This approach yields abnormal returns over the event window (AR_{-1}, AR_0, AR_{+1}), which were then aggregated into cumulative abnormal returns (CAR) at the match and club level. Correlation matrices were also computed in Python using Pearson correlation coefficients. Finally, all regression analyses were conducted in RStudio, enabling a structured estimation of the different model specifications presented in this study.

4. Statistical Results

This Chapter presents the empirical results of the analysis. It begins with descriptive statistics to provide an overview of the main variables and highlight initial patterns in the data. It then introduces the different model specifications and discusses the diagnostic tests. The next Section analyzes the regression results to test the hypotheses, before exploring cross-club heterogeneity. Finally, robustness checks are conducted to assess the reliability of the findings.

4.1 Descriptive Evidence

Table 1 presents summary statistics for the main variables used in the regression analysis, computed on the full pooled sample of 2,513 match-day observations spanning the 2010/2011 to 2023/2024 seasons across all four listed clubs.

Table 1 — Descriptive Statistics of the Pooled Sample

Variable	N	Mean	SD	Min	Median	Max
CAR	2,513	0.0001	0.0394	−0.2896	−0.0007	0.4134
Win	1,554	0.6184	0.4859	0	1	1
Loss	463	0.1842	0.3878	0	0	1
Draw	496	0.1974	0.3981	0	0	1
Home	1,251	0.4978	0.5001	0	0	1
Local_League	1,846	0.7346	0.4416	0	1	1
Inst_Own	2,513	37.39%	29.38%	0.52%	27.41%	163.97%
Inst_Own_c	2,513	0.000	0.2938	−0.3687	−0.0998	1.2658

Source: Table prepared by the author based on R calculation results

The mean CAR across all observations is virtually zero (+0.01%), while the median is slightly negative (−0.07%). The relatively wide gap between the minimum of −28.96% and the maximum of +41.34% reveals that individual match events can be associated with substantial stock market reactions.

Wins make up 61.8% of observations, draws 19.7%, and losses 18.4%. Home matches account for 49.8% of the sample, and domestic league matches for 73.5%.

Institutional ownership varies widely across the sample, with a mean of 37.4% and a standard deviation of 29.4 percentage points. The median of 27.4% is below the mean, reflecting a right-skewed distribution which is driven by some observations with very high institutional ownership, as reflected in the maximum value of 163.97%

Table 2 disaggregates the main descriptive statistics by club, revealing substantial heterogeneity that motivates the inclusion of club fixed effects in the regression models.

Table 2 — Sample Summary by Club

Club	N	Win %	Draw %	Loss %	CAR Mean	CAR SD	Inst. Own. (mean)
AFC Ajax	615	61.5%	21.3%	17.2%	+0.082%	2.813%	54.87%
Borussia Dortmund	661	58.1%	19.2%	22.7%	−0.012%	4.385%	16.18%
Celtic	526	64.6%	17.1%	18.3%	+0.108%	2.136%	59.32%
Juventus	711	63.6%	20.8%	15.6%	−0.110%	5.171%	25.76%
Pooled	2,513	61.8%	19.7%	18.4%	+0.008%	3.938%	37.39%

Source: Table prepared by the author based on R calculation results

Several patterns deserve attention. First, the four clubs differ noticeably in their average levels of institutional ownership. AFC Ajax and Celtic display structurally high institutional ownership (54.87% and 59.32% respectively), while Borussia Dortmund and Juventus exhibit considerably lower levels (16.18% and 25.76% respectively). This cross-club heterogeneity is crucial for the identification of the moderation effects examined in the main regression.

Table 3 reports the mean CAR by match outcome and club, providing an initial descriptive test of Hypothesis 1, which predicts that wins generate positive CARs and losses generate negative CARs.

Table 3 — Mean CAR by Sporting Outcome and Club (Event Window [−1, +1])

Club	Win — Mean CAR (SD)	Draw — Mean CAR (SD)	Loss — Mean CAR (SD)
AFC Ajax	+0.426% (2.676%)	−0.123% (2.317%)	−0.895% (3.533%)
Borussia Dortmund	+1.273% (4.326%)	−0.957% (3.993%)	−2.501% (3.513%)
Celtic	+0.234% (2.279%)	+0.011% (2.119%)	−0.244% (1.509%)
Juventus	+0.257% (4.668%)	−0.045% (6.213%)	−1.692% (5.344%)

Source: Table prepared by the author based on R calculation results

The directional patterns are consistent with Hypothesis 1 across all four clubs. Wins are associated with positive mean CARs in every club, while losses are associated with negative mean CARs in every club. Draws occupy an intermediate position, typically closer to zero. These findings are similar to the others from the literature review (Dobson & Goddard, 2011;

Edmans et al., 2007; Galloppo & Boido, 2020; Renneboog & Vanbrabant, 2000). The magnitude of these reactions, however, varies substantially across clubs and will be further explored in Section 4.4.

A second observation concerns the potential asymmetry between wins and losses. Across all clubs, the absolute magnitude of the mean CAR for losses tends to exceed that for wins. This pattern is particularly pronounced for Borussia Dortmund (−2.501% for losses versus +1.273% for wins) and Juventus (−1.692% versus +0.257%), and is consistent with the previous football literature (Edmans et al. 2007; Palomino et al., 2009; Renneboog & Vanbrabant, 2000;). However, whether this asymmetry is statistically significant will be formally tested using the Wald symmetry test reported in Section 4.5.

Before turning to the regression analysis, a preliminary inspection of the correlation structure of the main variables provides useful descriptive insights.

Regarding the cumulative abnormal returns, AR_{-1}, AR_0 and AR_{+1} each exhibit strong correlations with the CAR measure (+0.50, +0.64 and +0.59, respectively), which is expected given that the CAR is defined as their sum. Among the three abnormal return windows, AR_0 shows the strongest individual correlation with the CAR, meaning that the first trading day after the match is the main channel through which sporting results are reflected in stock prices. This is consistent with MacKinlay (1997), who predicts that prices adjust rapidly to new information, with most of the market reaction occurring on the event date. (See Appendix 1.1)

Regarding the relationship between sporting outcomes and abnormal returns, wins and losses are associated with CAR correlations of +0.17 and −0.18 respectively. Even if modest in magnitude, both coefficients carry the expected sign. (See Appendix 1.1)

With respect to institutional ownership, the correlation between Inst_Own and the CAR is virtually zero (−0.01), and the interaction terms Win×Inst_Own and Loss×Inst_Own display only weak correlations with the CAR (+0.07 and −0.11, respectively). (See Appendix 1.2)

Two patterns stand out in the correlation matrix: Home and Away are almost perfectly negatively correlated (−0.99), and Win and Loss show a moderate negative correlation (−0.61). These are expected given the mechanical structure of dummy variables and don't raise any multicollinearity concerns. Among the remaining regressors, correlations stay low which supports the validity of the model specifications. (See Appendix 1.3)

The club-level correlation analysis further reveals substantial heterogeneity in how stock returns respond to sporting outcomes. Juventus, AFC Ajax and Celtic display modest correlations between the CAR and match results — ranging from +0.08 to +0.15 for wins and from −0.08 to −0.16 for losses (See Appendices: 2.2; 3.2; 5.2). In stark contrast, Borussia Dortmund stands as a clear outlier, exhibiting correlations of +0.35 and −0.31 for wins and losses respectively, a magnitude two to four times larger than that observed for the other clubs (See Appendix 4.2). This pattern suggests that Borussia Dortmund's shareholder base is considerably more reactive to sporting outcomes - in line with the fact that Borussia Dortmund has the lower percentage of Institutional Investor's shares. From a methodological standpoint, this cross-club heterogeneity provides additional justification for the inclusion of club fixed effects in the regression models.

4.2 Model Specifications

Before estimating the models, several diagnostic tests are run to verify that the standard OLS assumptions hold. In panel data, valid OLS inference relies on the following assumptions. First, the model must be correctly specified: the relationship between the dependent and explanatory variables must be well captured, with no relevant variable omitted. Second, the regressors must be exogenous, meaning the error term is not systematically correlated with any explanatory variable. Third, there should be no perfect multicollinearity among the regressors, as this would make it impossible to estimate their effects separately. In addition, valid OLS standard errors require the residuals to be homoscedastic and serially uncorrelated. (Wooldridge, 2009)

Regarding the misspecification assumption, fixed effects control for time-constant omitted variables, eliminating the bias they would otherwise introduce (Wooldridge, 2009). As club fixed effects were already included in Models 2 and 3, it reduces concerns related to time-invariant omitted club characteristics.

The exogeneity assumption cannot be formally tested. Indeed, institutional ownership may be influenced by past stock performance, introducing reverse causality. Similarly, unobserved time-varying factors such as club-specific financial events or shifts in media exposure could affect both ownership structure and stock returns simultaneously, creating omitted variable bias. While club fixed effects in Models 2 and 3 control for time-invariant heterogeneity, they do not fully resolve endogeneity concerns. This limitation is acknowledged and discussed further in Chapter 5.

The remaining assumptions are tested using standard diagnostic tests from applied econometrics. Heteroskedasticity is assessed with the Breusch-Pagan test (Breusch & Pagan, 1979), functional form misspecification with the Ramsey RESET test (Ramsey, 1969), and autocorrelation with the Wooldridge test (Drukker, 2003). Multicollinearity is evaluated using the Generalized Variance Inflation Factor (GVIF) (Gujarati & Porter, 2009).

Table 4 presents the diagnostic test results for all three models.

Table 4 — Model Diagnostics

Model	Breusch-Pagan (BP)	RESET Test	Wooldridge	GVIF
Model 1	OK (p=0.541)	OK (p=1.000)	OK (p= 0.5209)	OK (max GVIF=1.58)
Model 2	Heterosk. (p<0.001)	OK (p=0.574)	OK (p=0.1431)	OK (max GVIF=1.27)
Model 3	Heterosk. (p<0.001)	OK (p=0.954)	OK (p= 0.1356)	High (max GVIF=2.32)

Source: Table prepared by the author based on R calculation results

The Breusch-Pagan test finds no heteroskedasticity in Model 1 ($p = 0.541$) but detects it in Models 2 and 3 ($p < 0.001$). This is not surprising given the substantial cross-club heterogeneity in stock return volatility and reaction intensity documented in Section 4.1, which makes constant error variance across observations unlikely in the pooled specifications including club fixed effects. The RESET test does not indicate any major functional form misspecification, suggesting that omitted nonlinearities or neglected interaction structures are not a major concern in this sample. The Wooldridge test does not detect serial correlation across all three models. Finally, GVIF values remain acceptable in Models 1 and 2 (max. 1.27–1.58), but rise to 2.32 in Model 3, due to the mechanical correlation between interaction terms and their main effects. A higher GVIF signals stronger multicollinearity, which inflates coefficient variance, increases standard errors, and makes individual estimates harder to interpret (Fox & Monette, 1992). Hence, to assess whether the interaction terms are significant, they are jointly evaluated via the Wald test in Section 4.5.

Since heteroskedasticity is detected, conventional OLS standard errors are unreliable, as they may be inconsistent and lead to invalid inference (Wooldridge, 2009). To address this, HC3 robust standard errors are used. HC3 robust standard errors correct for heteroskedasticity and perform well in finite samples, which is our case (Long & Ervin, 2000; MacKinnon & White, 1985).

Table 5 presents the regression results for all three model specifications. As a reminder, models are estimated sequentially with controls added progressively to assess whether the coefficients of interest remain stable across specifications.

Table 5 — Main Regression Results: Comparison of Model Specifications

	Model 1	Model 2	Model 3
Intercept	0.00289 (0.0019) *	-0.00018 (0.00229)	0.00058 (0.00234)
Win	0.00833 *(0.00213)* ***	0.00870 *(0.00218)* ***	0.00876 *(0.00214)* ***
Loss	−0.01182 *(0.00261)* ***	−0.01237 *(0.00259)* ***	−0.01210 *(0.00256)* ***
Home	—	−0.00211 *(0.00160)*	−0.00207 *(0.00159)*
Local_League	—	−0.00154 *(0.00164)*	−0.00124 *(0.00162)*
Fixed Effect Borussia Dortmund	—	−0.00005 *(0.00199)*	−0.00200 *(0.00213)*
Fixed Effect Celtic	—	0.00004 *(0.00149)*	0.00005 *(0.00153)*
Fixed Effect Juventus	—	−0.00231 *(0.00224)*	−0.00408 *(0.00226)* *
Inst_Own_c	—	—	−0.00310 *(0.00590)*
Win × Inst_Own_c	—	—	−0.00727 *(0.00648)*
Loss × Inst_Own_c	—	—	0.01499 *(0.00824)* *
R^2	0.0386	0.0403	0.0449
Adj. R^2	0.0378	0.0376	0.0410
N	2,513	2,513	2,513

Note: HC3 heteroskedasticity-robust standard errors are reported in parentheses below the coefficients.
***** p < 0.01, ** p < 0.05, * p < 0.10.**

Source: Table prepared by the author based on R calculation results

Win and Loss coefficients remain stable across all three models with Win ranging from +0.0083 to +0.0088, and Loss from −0.0124 to −0.0118. This consistency suggests the relationship between match outcomes and stock returns is robust and not driven by omitted variables such as match location, competition type, or club fixed effects.

R^2 increases from 3.86% in Model 1 to 4.49% in Model 3. While this may seem quite low, it is consistent with prior studies reporting low R^2 as well (Palomino et al., 2009; Renneboog & Vanbrabant, 2000). The adjusted R^2 follows the same pattern, rising from 3.78% to 4.10%, confirming that the additional variables in Model 3 add explanatory power rather than just inflating the R^2 mechanically.

Model 3 is retained as the preferred specification for this thesis. This choice is motivated not primarily by its marginally higher R^2 but by the fact that it directly tests the central hypothesis of the study, which is whether institutional ownership moderates the stock market reaction to sporting outcomes. Models 1 and 2 are reported as benchmarks to document coefficient stability and to provide context for interpreting the interaction effects introduced in Model 3.

4.3 Regression Results

Hypothesis 1 predicts that wins generate positive CARs and losses generate negative CARs. This hypothesis finds strong and consistent empirical support across all model specifications.

In Model 1 (baseline specification with no controls), the coefficient on Win is +0.00833 ($p < 0.01$), implying that winning a football match is associated with a CAR approximately 0.83 percentage points higher than that observed following a draw. The coefficient on Loss is −0.01182 ($p < 0.01$), implying that losing a match is associated with a CAR approximately 1.18 percentage points lower than a draw. These estimates remain remarkably stable in Model 2 (Win: +0.00870***, Loss: −0.01237***) and Model 3 (Win: +0.00876*** Loss: −0.01210***), confirming that the baseline sporting outcome effect is not wrongly attributed to match-level controls or club heterogeneity.

These results are consistent with the findings of Benkraiem et al. (2009), Galloppo and Bodoi (2020) and Renneboog and Vanbrabant (2000) who document significant positive (negative) abnormal returns following wins (losses) for listed European football clubs. These results suggest that match outcomes carry economically meaningful information for equity investors beyond what is already captured by risk factor exposures. This supports the view that football stocks are significantly driven by sporting sentiment.

A second pattern worth noting is the asymmetry between wins and losses. In all regressions, the Loss coefficient (around −0.012) is larger in absolute terms than the Win coefficient (around +0.009). In Model 1, for instance, the coefficient on Loss is approximately 1.42 times larger in absolute value than the coefficient on Win. This directional asymmetry — whereby negative sporting news triggers a stronger reaction than positive sporting news — is consistent with Kahneman and Tversky (1979) findings that show that individuals exhibit loss aversion, placing greater weight on negative outcomes than on positive ones of equal magnitude. This interpretation is also consistent with the allegiance bias, whereby investors who are also supporters perceive victories as the reference outcome and therefore react more strongly to negative sporting results than to positive ones (Benkraiem et al., 2009). However, as reported in Section 4.5, the formal Wald test for symmetry (H_0: Win + Loss = 0) fails to reject the null hypothesis at conventional significance levels across all models, meaning that the asymmetry is not statistically distinguishable from zero in this sample.

The central test of this thesis concerns whether institutional ownership moderates the stock market reaction to sporting outcomes. Hypothesis 2 predicts that higher institutional ownership attenuates the reaction to both wins and losses, and more broadly contributes to more stable and less sentiment-driven pricing of listed football clubs.

Model 3 includes two interaction terms: Win×Inst_Own_c and Loss×Inst_Own_c.

The coefficient on Win×Inst_Own_c is estimated at −0.00727. Although, the negative sign is directionally consistent with Hypothesis 2 - suggesting that higher institutional ownership is associated with a somewhat weaker positive reaction to wins, this coefficient is not statistically significant. Institutional investors do not appear to systematically dampen the market's positive response to good sporting news.

The coefficient on Loss×Inst_Own_c, by contrast, is estimated at +0.01499 and is marginally significant. The positive sign makes economic sense and aligns with Hypothesis 2 stating that the higher the institutional ownership, the weaker the negative market reaction to a loss. In other words, institutional investors seem to dampen the effect of a defeat on stock prices.

To illustrate, take a club at the sample mean (Inst_Own_c = 0). Following a loss, the implied CAR is approximately −1.21 percentage points relative to a draw. Now consider a club with institutional ownership ten percentage points above the mean (Inst_Own_c = +0.10). Its implied CAR following a loss becomes −0.01210 + 0.01499 × 0.10 ≈ −1.06 percentage points. A ten-percentage point increase in institutional ownership is thus associated with a reduction in the loss effect of around 0.15 percentage points; roughly 12% relative to the baseline. While this effect is economically non-trivial, its interpretation must be tempered by the sensitivity of its statistical significance to the choice of standard errors.

These results provide partial support for Hypothesis 2, which predicts that clubs with higher institutional ownership exhibit weaker stock market reactions to sporting outcomes, is supported specifically with respect to losses, but not with respect to wins.

4.4 Cross-Club Heterogeneity

The descriptive evidence presented above (in Section 4.1) already hints at substantial cross-club heterogeneity in the sensitivity of stock returns to sporting outcomes. This Section explores this heterogeneity more formally through club-specific regression models.

Even at the descriptive level, the contrast between clubs is striking, as shown in Table 3 under Section 4.1. Borussia Dortmund's mean CAR following a win (+1.27%) and a loss (−2.50%) are both substantially larger in magnitude than those of the other three clubs. AFC Ajax displays moderate sensitivity, with a mean win CAR of +0.43% and a mean loss CAR of −0.90%. The same goes for Juventus, that has a win CAR of 0.26% and a loss CAR of -1.7%. Celtic exhibits a more muted unconditional pattern, showing a remarkably narrow win-to-loss spread of only 0.47 percentage points (with a win CAR of 0.23% and a loss CAR of -0.24%).

These heterogeneous patterns are likely driven by several club-specific factors. Borussia Dortmund's high retail investor base — reflected in its structurally low institutional ownership of only 16.18% — may amplify sentiment-driven trading around match events. The same goes for Juventus, that has relatively low institutional ownership (25.76%) and exhibits high return volatility. Celtic and AFC Ajax, in contrast, display much higher average institutional ownership (59.32% and 54.87% respectively), which may contribute to more tempered market reactions at the club level.

Table 6 reports the results of Model 3 estimated separately for each club. These club-specific regressions allow the coefficients on sporting outcomes, institutional ownership, and their interactions to vary freely across clubs.

Table 6 — Club-Specific Regression Results

	AFC Ajax	Borussia Dortmund	Celtic	Juventus
Intercept	0.00698 (0.00698) **	-0.004933 (0.012363)	0.001048 (0.005081)	-0.009435 (0.006752)
Win	0.00677 (0.00275) **	0.01982 (0.01499)	−0.00089 (0.00542)	0.00581 (.00553)
Loss	−0.01030 (0.00372) ***	−0.01781 (0.01613)	−0.00012 (0.00547)	−0.01443 (0.00790) *
Inst_Own_c	−0.00609 (0.00524)	0.00379 (0.05033)	−0.00888 (0.01433)	−0.02787 (0.03341)
Win × Inst_Own_c	0.00283 (0.00617)	−0.01366 (0.06421)	0.01328 (0.01581)	0.02010 (0.03696)
Loss × Inst_Own_c	0.00749 (0.01096)	−0.00892 (0.06860)	−0.00823 (0.01637)	−0.00298 (0.04177)
Home	-0.00508 (0.00231) **	-0.00344 (0.003333)	-0.000361 (0.001934)	0.000905 (0.004139)
Local_league	-0.00717 (0.00282) **	-0.003179 (0.003092)	0.001743 (0.002037)	0.006166 (0.004116)
R^2	0.0512	0.1348	0.0153	0.0247
Adj. R^2	0.0403	0.1256	0.0020	0.0150
N	615	661	526	711

Note: HC3 heteroskedasticity-robust standard errors are reported in parentheses below the coefficients.
**** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.*

Source: Table prepared by the author based on R calculation results

Results vary considerably across clubs. AFC Ajax shows the most statistically significant results: Win is +0.00677 (**), Loss is −0.01030 (***).

For Juventus, only the Loss coefficient is marginally significant, while the Win coefficient is statistically indistinguishable from zero.

Despite Borussia Dortmund having the highest R^2 of the four clubs (0.1348), neither the Win nor the Loss coefficient is individually significant. This is explained by the high volatility of Borussia Dortmund's stock returns (SD = 4.39%), which inflates standard errors. The coefficients are bigger than the ones of the other clubs (Win: +1.98%, Loss: −1.78%). This is consistent with the idea that Dortmund's more retail-oriented investor base amplifies sentiment-driven reactions. Indeed, Borussia Dortmund has the lowest average institutional ownership and the highest CAR magnitude of the four.

Celtic is the one club for which the model finds no statistically significant results whatsoever: neither Win nor Loss is significant and the R^2 is only 1.53%. This result suggests that Celtic's stock price is essentially not systematically responsive to match outcomes in the empirical sample considered. Several factors may contribute to this finding: Celtic's very low return volatility (SD = 2.14%) and its concentrated shareholder structure (mean institutional ownership of 59.32%) may all reduce the scope for significant abnormal return patterns around match events.

Regarding the interaction terms in the club-specific regressions, none of the Win×Inst_Own_c or Loss×Inst_Own_c coefficients are individually statistically significant at conventional levels for any club. The club-specific interaction results should therefore be interpreted with considerable caution.

4.5 Robustness Checks

Table 7 presents the results of three families of Wald tests conducted under HC3 standard errors: a symmetry test (H_0: Win + Loss = 0), a joint club fixed effects test (H_0: all club FE = 0), and a joint interaction test in Model 4 (H_0: Win×Inst_Own_c = Loss×Inst_Own_c = 0).

Table 7 — Wald Tests

Model	Hypothesis Tested	F-stat	p-value
Model 1	Symmetry: Win + Loss = 0	0.657	0.418
Model 2	Symmetry: Win + Loss = 0	0.726	0.394
Model 2	Joint Club FE = 0	0.434	0.729
Model 3	Symmetry: Win + Loss = 0	0.620	0.431
Model 3	Joint Club FE = 0	1.336	0.261
Model 3	Joint interactions = 0 (Win×IO & Loss×IO)	5.485	0.004***

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10. IO denotes Inst_Own_c. FE denotes Fixed Effects*
Source: Table prepared by the author based on R calculation results

The symmetry test (Win + Loss = 0) examines whether the stock market reaction to wins and losses is symmetric in absolute magnitude. As reported above (in Section 4.3), models show constantly a larger negative reaction to losses than a positive reaction to wins. However, the Wald test fails to reject the null of symmetry across all models (F-statistics range from 0.620 to 0.726, p-values from 0.394 to 0.431). This result is consistent with the existing literature, which often documents asymmetric stock market reactions to wins and losses, with stronger responses to negative outcomes (Benkraiem et al., 2009; Renneboog & Vanbrabant, 2000).

However, empirical evidence on this asymmetry remains mixed (Palomino et al., 2009). In this context, this result should be interpreted as an absence of strong statistical evidence for asymmetry, rather than as evidence that reactions are symmetric.

The joint club fixed effects test fails to reject the null hypothesis that all club-specific intercepts are jointly zero across Models 2 and 3 (F-statistics of 0.434 and 1.336, p-values of 0.729 and 0.261 respectively). This finding suggests that the average level of CAR does not differ significantly across clubs once match-level controls are introduced, consistent with the individual insignificance of the club fixed effects reported in Table 6. Nevertheless, the club fixed effects are retained in the preferred specification as a precautionary control against potential omitted variable bias related to time-invariant club characteristics.

The most informative Wald test in the context of this thesis is the joint significance test for the two interaction terms in Model 3 (Win×Inst_Own_c and Loss×Inst_Own_c). Despite the individual interaction coefficients being only marginally or marginally-to-moderately significant depending on the standard error used, the joint Wald test strongly rejects the null that both interactions are jointly zero: $F = 5.485$, $p = 0.004$ (***). This result is important: even though the Win interaction alone is not statistically significant, the interaction terms as a whole carry meaningful information about the moderation of sporting outcome effects by institutional ownership. This finding provides the strongest statistical support for Hypothesis 2, and underscores the relevance of the ownership structure channel in the pricing of listed football clubs.

4.6 Summary of results

This Chapter aimed to empirically test the two hypotheses formulated in the theoretical framework.

Several conclusions can be drawn from the results.

First, Hypothesis 1 is robustly confirmed: sporting outcomes significantly affect the cumulative abnormal returns of listed football clubs. Wins are associated with CARs approximately 0.87 percentage points above those observed following a draw, while losses are associated with CARs approximately 1.21 percentage points below. These effects remain stable across all model specifications and standard error types, attesting to their robustness and confirming the conclusions of prior literature (Benkraiem et al., 2009; Galloppo & Boido, 2020; Renneboog & Vanbrabant, 2000).

Second, a directional asymmetry between wins and losses is consistently observed throughout the analysis — losses triggering stronger market reactions than wins — which is directionally consistent with Kahneman and Tversky's (1979) loss aversion framework. The Wald test does not reject symmetry, meaning the difference between win and loss effects cannot be statistically distinguished from zero. The direction is as expected, but the evidence is not strong enough to make a firm claim about asymmetry in this sample.

Third, the results offer partial support for Hypothesis 2. Indeed, institutional ownership does not significantly moderate the market reaction to wins, but it does dampen the negative reaction to losses (Loss × Inst_Own_c ≈ +0.015, and statistically significant). The joint Wald test strongly rejects the null that both interaction terms are zero ($F = 5.485$, $p = 0.004$), confirming that ownership structure plays a meaningful role in how football stocks are priced. This suggests that institutional investors exert a stabilizing effect primarily on negative over-reactions following defeats, rather than on positive reactions to wins.

Finally, the cross-club heterogeneity analysis reinforces these conclusions. Borussia Dortmund, whose shareholder base is the most retail-oriented, exhibits by far the largest market reactions to match outcomes, while Celtic, which carry the highest average institutional ownership shows virtually no statistically significant responsiveness to sporting results. These contrasts further reinforce that shareholder composition plays a structurally important role in shaping the stock price dynamics of listed European football clubs.

5. Discussion

To make sense of these results, it is helpful to consider the reasons that could explain them.

Hypothesis 1 is confirmed: sporting outcomes significantly shape the stock market reactions of listed football clubs. Wins are associated with positive CARs and losses with negative ones. This pattern is consistent with prior literature and reinforces the view that football stocks remain strongly influenced by investor sentiment.

A notable feature of the results is the consistent, though not statistically significant, asymmetry between wins and losses, with negative outcomes triggering larger reactions. This aligns with the loss aversion framework of Kahneman and Tversky (1979), suggesting that investors react more strongly to negative news. This aligns with previous studies as well – whether it is about stocks in general (Barberis et al.,1998; Conrad et al., 2002) or football stocks more specifically (Edmans et al. 2007; Palomino et al., 2009; Renneboog & Vanbrabant, 2000).

Hypothesis 2 finds only partial support. Indeed, institutional ownership does not appear to shape how markets react to wins, but it does dampen the negative reaction to losses, which indicates that institutions have a bigger effect in the presence of negative shocks. This pattern likely comes down to differences in investor behavior. Institutional investors tend to be better informed, while retail investors are more sentiment-driven (Li et al., 2017). As a result, institutional ownership tends to smooth price adjustments and reduce sensitivity to sentiment-driven shocks. It is also worth noting that reactions to wins are generally more contained, leaving less room for institutional ownership to further reduce market responses, which may explain the asymmetry observed in the results.

Consequently, it is important to consider the limitations and weaknesses of the study that has been carried out.

Firstly, several results in this thesis do not reach conventional levels of statistical significance. Several factors may help explain this. One is the small number of clubs in the sample limits statistical power. With only four listed football clubs, the analysis relies primarily on within-club variation over time, which makes it harder to estimate interaction effects with precision. Another factor is that the inclusion of club fixed effects absorbs much of the variation across clubs, leaving relatively little remaining variation to identify the moderating role of institutional ownership. (Wooldridge, 2010). A third factor is that football stock returns are inherently noisy, as they are influenced not only by sporting outcomes but also by investor sentiment and other non-fundamental factors (Edmans et al., 2007), making it difficult to fully isolate causal effects in an event-study framework. Finally, the use of quarterly ownership data introduces measurement imprecision, as intra-quarter variations in institutional holdings are not captured. If ownership changes are correlated with performance, this timing mismatch may attenuate the estimated effects.

Secondly, we shall have a look at the methodological and data-related limitations of this thesis. The main limitation concerns the potential endogeneity of institutional ownership. Although treated as an exogenous moderator, institutional investors may choose clubs based on characteristics correlated with stock market behavior, such as lower volatility, better governance, or stronger financial performance (Abdioğlu, 2013). In that case, the estimated moderation effect would reflect selection rather than causation. Addressing this issue would require instrumental variables (IV), but it is not feasible given the small sample of clubs, as IV methods lose their reliability and become prone to bias when the number of independent units is too small. (Abadie et al., 2017; Aleksin & Becker, 2024).

A third limitation is the risk of event window contamination. Even within a short [-1, +1] window, club-specific news — such as transfers, managerial changes, sanctions, or sponsorship deals — can fall close to match dates and introduce noise into the CARs that has nothing to do with sporting outcomes. As the dataset does not screen for such events, the estimated coefficients may partly capture this noise, although the use of abnormal returns mitigates it by removing expected factor-driven performance. A clear example is Juventus: on 20 January 2023, a 15-point Serie A deduction was announced (Reuters, 2023), coinciding with the t+1 of the 19 January Coppa Italia match and the t−1 of the 22 January Serie A match, thereby contaminating both event windows with a non-sporting shock.

Fourth, overlapping event windows represent a non-trivial concern. During congested periods, clubs play multiple matches per week, causing event windows to overlap. As a result, CARs may reflect anticipation ahead of upcoming matches or linger from previous ones. The short [-1, 0, +1] window helps contain this, but cannot eliminate it entirely. For instance, Juventus played an Europa League match on 26 August 2010 and a Serie A match on 29 August, only three days apart. In this case, the Friday trading day serves both as t+1 for the first event and t−1 for the second, creating a direct overlap. Consequently, CARs may reflect both anticipation and residual effects across matches.

These limitations can provide potential room for future research and analysis on the topic.

Hence, future research could expand the sample of listed football clubs, particularly in Southern and Eastern Europe where ownership structures may differ, allowing for a more granular analysis of how varying levels of institutional ownership affect stock price behavior and identifying potential threshold effects. Once more comprehensive and consistently reported ownership data becomes available across European football markets, such studies could be conducted with greater statistical power and precision. A second extension could be to tackle endogeneity through instrumental variables (such as regulatory changes affecting institutional ownership or shifts in index composition) though finding valid instruments in this context remains a real challenge. Finally, higher-frequency ownership data, drawn for example from real-time regulatory filings, could better capture how ownership evolves around match dates and could also sharpen the analysis of how ownership and sporting outcomes interact to drive stock market reactions.

6. Conclusion

The purpose of this thesis was to look at how ownership structure affects stock prices of publicly listed European football clubs after match results. More specifically, the study examined whether having more institutional investors leads to smaller unusual stock price changes after match results. By doing so, it looked at whether football stocks are slowly becoming more rationally priced, rather than being driven purely by fan sentiment and emotion.

The study uses a quantitative method analyzing ownership data, stock returns, and match results. The data comes from four football clubs: AFC Ajax, Borussia Dortmund, Celtic FC, and Juventus FC through fourteen seasons (from 2010/2011 to 2023/2024). The base of the study is cumulative abnormal returns that were computed using the Fama-French three-factor model. In order to analyze the data, the three following regressions were done: a basic model looking at match results, an expanded model adding background factors and club-specific controls, and a final model testing whether institutional ownership influences how stock prices react to wins and losses.

The results confirm that match results have a significant impact on football club stock prices. Across all three models, wins were associated with positive and statistically significant abnormal returns. And for what concerns losses, these generate stronger negative and statistically significant reactions. This asymmetric response remains strong even after adding extra controls and fixed effects. It is also consistent with prior literature and behavioral finance theory, which says that investors tend to react more strongly to bad news than to good news. These findings fully support Hypothesis 1 and confirm that match outcomes significantly influence football club stock prices, with negative results causing stronger reactions than positive ones.

More importantly, the findings show that ownership structure matters. In the full interaction models, the higher institutional ownership, the smaller the magnitude of abnormal stock price reactions following match results. More specifically, this effect is statistically significant for losses, suggesting that institutional investors help reduce the stronger negative stock price reactions typically seen after defeats. For wins, the results also suggest a dampening effect, but it is smaller and not statistically significant. Additionally, the Wald test confirms that ownership structure has a meaningful overall impact on how markets react to match results. In general, these findings partially support the second hypothesis and confirm that higher institutional ownership leads to more stable and less emotionally driven stock pricing in listed football clubs.

However, the moderating effect of institutional ownership is not the same across all clubs and situations. The club-specific regressions show important differences in both the size and the statistical significance of the estimated coefficients. In particular, AFC Ajax shows the clearest and most consistent relationship between match results and stock market reactions, with significant positive reactions to wins and negative reactions to losses. Even if Borussia Dortmund shows the largest CAR, these effects become statistically insignificant once the club's higher overall stock volatility is considered. For Juventus, only losses remain marginally significant, suggesting that losses matter more to investors than wins. Celtic shows almost no relation between match results and stock returns. This is likely due to a more stable shareholder base and higher average institutional ownership

Furthermore, in none of the individual club regressions institutional ownership is statistically significant. This suggests that at the individual club level, the ownership structure has a weaker effect, likely due to smaller sample sizes and limited changes in ownership within each club. Therefore, the influence of institutional investors is more visible when data from all clubs is combined, rather than when each club is analyzed separately. Overall, these findings show that institutional ownership helps stabilize the market, but its impact depends on the context and interacts with each club’s specific investor base, liquidity conditions, and market environment.

This thesis contributes to existing research in two main ways. First, it builds on previous studies of football stock behavior by going beyond just match outcomes and incorporating ownership structure into the analysis. Second, it expands behavioral finance literature by showing how the type of investors can influence sentiment-based mispricing. From a practical standpoint, these findings may help investors better understand the risk and volatility of football stocks through the stabilizing role of institutional ownership. It may also help understand how the composition of shareholders can influence how efficiently and credibly a club's stock is priced.

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Appendices

Appendix 1.1 – Pooled Club – Main Matrix

MAIN MATRIX — Stock market reaction & sports results

Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative

	AR(-1)	AR(0)	AR(+1)	CAR	Win	Loss	Inst_Own
AR(-1)	—	0.0425	-0.0446	0.4999	0.0227	-0.0521	-0.0412
AR(0)	0.0425	—	0.0165	0.6426	0.1314	-0.1402	-0.0070
AR(+1)	-0.0446	0.0165	—	0.5912	0.1351	-0.1107	0.0239
CAR	0.4999	0.6426	0.5912	—	0.1732	-0.1786	-0.0105
Win	0.0227	0.1314	0.1351	0.1732	—	-0.6050	0.0346
Loss	-0.0521	-0.1402	-0.1107	-0.1786	-0.6050	—	-0.0210
Inst_Own	-0.0412	-0.0070	0.0239	-0.0105	0.0346	-0.0210	—

Source: *Table prepared by the author based on Python calculation results*

Appendix 1.2 – Pooled Club – Ownership Matrix

OWNERSHIP MATRIX — Institutional moderation (Hypothese 2)

Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative

	CAR	Win	Loss	Inst_Own	Win×Inst	Loss×Inst
CAR	—	0.1732	-0.1786	-0.0105	0.0735	-0.1069
Win	0.1732	—	-0.6050	0.0346	0.6238	-0.4607
Loss	-0.1786	-0.6050	—	-0.0210	-0.3774	0.7616
Inst_Own	-0.0105	0.0346	-0.0210	—	0.6401	0.2467
Win×Inst	0.0735	0.6238	-0.3774	0.6401	—	-0.2874
Loss×Inst	-0.1069	-0.4607	0.7616	0.2467	-0.2874	—

Source: *Table prepared by the author based on Python calculation results*

Appendix 1.3 – Pooled Club – Multicollinearity Matrix

MULTICOLLINEARITY MATRIX — Verification of regressors

Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative

	Win	Loss	Home	Away	Local_League	Inst_Own
Win	—	-0.6050	0.1661	-0.1622	0.1660	0.0346
Loss	-0.6050	—	-0.1426	0.1349	-0.1862	-0.0210
Home	0.1661	-0.1426	—	-0.9905	0.0091	0.0012
Away	-0.1622	0.1349	-0.9905	—	0.0068	0.0000
Local_League	0.1660	-0.1862	0.0091	0.0068	—	-0.0411
Inst_Own	0.0346	-0.0210	0.0012	0.0000	-0.0411	—

Source: *Table prepared by the author based on Python calculation results*

Appendix 2.1 – Juventus – Main Matrix

MAIN MATRIX — Juventus							
Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative							
	AR(-1)	AR(0)	AR(+1)	CAR	Win	Loss	Inst_Own
AR(-1)	—	0.2337	-0.1073	0.5741	-0.0092	-0.0284	-0.0814
AR(0)	0.2337	—	0.0649	0.7356	0.0797	-0.1381	-0.0373
AR(+1)	-0.1073	0.0649	—	0.5267	0.0955	-0.0679	-0.0042
CAR	0.5741	0.7356	0.5267	—	0.0938	-0.1316	-0.0644
Win	-0.0092	0.0797	0.0955	0.0938	—	-0.5682	0.0141
Loss	-0.0284	-0.1381	-0.0679	-0.1316	-0.5682	—	0.0815
Inst_Own	-0.0814	-0.0373	-0.0042	-0.0644	0.0141	0.0815	—

<u>Source:</u> Table prepared by the author based on Python calculation results

Appendix 2.2 – Juventus – Ownership Matrix

OWNERSHIP MATRIX — Juventus						
Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative						
	CAR	Win	Loss	Inst_Own	Win×Inst	Loss×Inst
CAR	—	0.0938	-0.1316	-0.0644	0.0506	-0.1344
Win	0.0938	—	-0.5682	0.0141	0.7061	-0.4769
Loss	-0.1316	-0.5682	—	0.0815	-0.4012	0.8393
Inst_Own	-0.0644	0.0141	0.0815	—	0.5497	0.2931
Win×Inst	0.0506	0.7061	-0.4012	0.5497	—	-0.3367
Loss×Inst	-0.1344	-0.4769	0.8393	0.2931	-0.3367	—

<u>Source:</u> Table prepared by the author based on Python calculation results

Appendix 3.1 – Ajax – Main Matrix

MAIN MATRIX — Ajax							
Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative							
	AR(-1)	AR(0)	AR(+1)	CAR	Win	Loss	Inst_Own
AR(-1)	—	-0.2608	-0.0917	0.4314	-0.0098	-0.0305	-0.0748
AR(0)	-0.2608	—	-0.1706	0.4112	0.0865	-0.0766	0.0450
AR(+1)	-0.0917	-0.1706	—	0.5540	0.1348	-0.1119	-0.0049
CAR	0.4314	0.4112	0.5540	—	0.1548	-0.1585	-0.0227
Win	-0.0098	0.0865	0.1348	0.1548	—	-0.5763	0.0545
Loss	-0.0305	-0.0766	-0.1119	-0.1585	-0.5763	—	-0.0649
Inst_Own	-0.0748	0.0450	-0.0049	-0.0227	0.0545	-0.0649	—

Source: Table prepared by the author based on Python calculation results

Appendix 3.2 – Ajax – Ownership Matrix

OWNERSHIP MATRIX — Ajax						
Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative						
	CAR	Win	Loss	Inst_Own	Win×Inst	Loss×Inst
CAR	—	0.1548	-0.1585	-0.0227	0.0780	-0.1152
Win	0.1548	—	-0.5763	0.0545	0.6735	-0.4445
Loss	-0.1585	-0.5763	—	-0.0649	-0.3882	0.7713
Inst_Own	-0.0227	0.0545	-0.0649	—	0.6159	0.2041
Win×Inst	0.0780	0.6735	-0.3882	0.6159	—	-0.2994
Loss×Inst	-0.1152	-0.4445	0.7713	0.2041	-0.2994	—

Source: Table prepared by the author based on Python calculation results

Appendix 4.1 – Borussia – Main Matrix

MAIN MATRIX — Borussia

Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative

	AR(-1)	AR(0)	AR(+1)	CAR	Win	Loss	Inst_Own
AR(-1)	—	-0.0513	0.0823	0.4373	0.0761	-0.1122	-0.0288
AR(0)	-0.0513	—	0.0444	0.6280	0.2700	-0.2382	0.0205
AR(+1)	0.0823	0.0444	—	0.6850	0.2335	-0.1809	-0.0368
CAR	0.4373	0.6280	0.6850	—	0.3452	-0.3077	-0.0223
Win	0.0761	0.2700	0.2335	0.3452	—	-0.6379	-0.0261
Loss	-0.1122	-0.2382	-0.1809	-0.3077	-0.6379	—	0.0484
Inst_Own	-0.0288	0.0205	-0.0368	-0.0223	-0.0261	0.0484	—

Source: Table prepared by the author based on Python calculation results

Appendix 4.2 – Borussia –Ownership Matrix

OWNERSHIP MATRIX — Borussia

Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative

	CAR	Win	Loss	Inst_Own	Win×Inst	Loss×Inst
CAR	—	0.3452	-0.3077	-0.0223	0.2725	-0.2816
Win	0.3452	—	-0.6379	-0.0261	0.8080	-0.5821
Loss	-0.3077	-0.6379	—	0.0484	-0.5154	0.9124
Inst_Own	-0.0223	-0.0261	0.0484	—	0.4401	0.2200
Win×Inst	0.2725	0.8080	-0.5154	0.4401	—	-0.4703
Loss×Inst	-0.2816	-0.5821	0.9124	0.2200	-0.4703	—

Source: Table prepared by the author based on Python calculation results

Appendix 5.1 – Celtic – Main Matrix

MAIN MATRIX — Celtic

Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative

	AR(-1)	AR(0)	AR(+1)	CAR	Win	Loss	Inst_Own
AR(-1)	—	0.0106	0.0129	0.5079	0.0767	-0.0267	0.0103
AR(0)	0.0106	—	0.1267	0.6083	0.0409	-0.0209	0.0036
AR(+1)	0.0129	0.1267	—	0.6931	0.0322	-0.0868	-0.0393
CAR	0.5079	0.6083	0.6931	—	0.0794	-0.0780	-0.0174
Win	0.0767	0.0409	0.0322	0.0794	—	-0.6388	-0.0141
Loss	-0.0267	-0.0209	-0.0868	-0.0780	-0.6388	—	0.0130
Inst_Own	0.0103	0.0036	-0.0393	-0.0174	-0.0141	0.0130	—

Source: Table prepared by the author based on Python calculation results

Appendix 5.2 – Celtic –Ownership Matrix

OWNERSHIP Matrix — Celtic

Pearson Correlation | ■ Strong positive >0.5 | ■ Moderate 0.2–0.5 | ■ Weak | ■ ■ Negative

	CAR	Win	Loss	Inst_Own	Win×Inst	Loss×Inst
CAR	—	0.0794	-0.0780	-0.0174	0.0838	-0.0967
Win	0.0794	—	-0.6388	-0.0141	0.8733	-0.6007
Loss	-0.0780	-0.6388	—	0.0130	-0.5579	0.9403
Inst_Own	-0.0174	-0.0141	0.0130	—	0.3886	0.1608
Win×Inst	0.0838	0.8733	-0.5579	0.3886	—	-0.5246
Loss×Inst	-0.0967	-0.6007	0.9403	0.1608	-0.5246	—

Source: Table prepared by the author based on Python calculation results

Abstract

The purpose of this research is to examine how ownership structure influences stock market reactions to sporting outcomes in publicly listed European football clubs. While previous studies have mainly focused on the direct relationship between match results and stock price movements, this thesis addresses a gap in the literature by examining whether the presence of institutional investors moderates these reactions and leads to more rational pricing. More specifically, the study analyzes whether clubs with higher institutional ownership show weaker abnormal stock market reactions to wins and losses compared to clubs mostly held by retail investors.

To explore these questions, a quantitative methodology is used combining ownership data, stock market data, and match results. The sample covers fourteen seasons, from 2010/2011 to 2023/2024, and includes four publicly listed European football clubs: AFC Ajax, Borussia Dortmund, Celtic FC, and Juventus FC. Stock market reactions are measured through an event-study framework, with three-day cumulative abnormal returns estimated through the Fama-French three-factor model. Regression models are then built using a nested specification approach, progressively adding explanatory variables. The empirical analysis includes club fixed effects to control for unobserved differences between clubs, as well as dummy variables to account for sporting factors that may influence stock market reactions.

The findings confirm that match results significantly affect football stock prices. Wins are generally associated with positive abnormal returns, while losses generate stronger negative reactions. More importantly, the results suggest that the higher institutional ownership the smaller the magnitude of sentiment-driven price movements. Clubs with more institutional investors appear less sensitive to match results, indicating a more stable and efficient pricing process. However, this moderating effect is not uniform across all clubs and contexts. Overall, the results highlight that ownership structure is a relevant determinant of price efficiency in football stocks. These findings contribute to both sports finance and behavioral finance literature by showing how investor composition can shape market reactions in emotionally driven asset classes.

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