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ORIGINAL PAPER

How relative competitive strength moderates stock price responses after European soccer tournaments

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Abstract
Stock price responses of soccer clubs to national and international tournaments have been interpreted in light of fan investors who are prone to emotions. We employ Champions League and Europa League fixtures between 2004 and 2020 to investigate whether postmatch stock price responses are driven by emotions. We argue that a soccer club's relative competitive strength can be a proxy for investors' emotions, such as rage and disappointment, after losing against a strong opponent, which then leads to abnormal decreases in stock prices. While we find several factors, such as the percentage of shares held by institutional investors less subject to emotions, whose effects on postmatch abnormal returns are in line with rational information processing, our evidence also suggests that the effect of a club's relative competitive strength on stock performance is driven by investor emotion. We outline the general applicability of stock price responses arising from relative competitive strength in corporate finance settings.

Keywords Postmatch abnormal returns · Relative competitive strength · Investor emotion · Event study · Institutional investors

JEL Classification G41 · G12 · G14

1 Introduction

Stock prices are affected by new information on future cash flows that investors incorporate into their expectation formation to come up with a new stock price estimate as well as by their emotions and sentiment. Whether emotions play a role

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in stock price formation is a debatable question; previous literature has identified stock price responses that are not aligned or not fully explainable by new information under the efficient market paradigm. For sports events, fan investors are held responsible for several observed facts not in line with investors rationally updating and processing the information on firms' future cash flows. For instance, for individual soccer clubs, the absolute average return after losses is very often higher than the respective return after wins, and this is difficult to explain through the lens of market efficiency (Geyer-Klingeberg et al. 2018). Moreover, fan investors are held responsible for significant prematch stock price increases. Bernile and Lyandres (2011) argue that investors have biased ex ante beliefs that cause them to incorrectly estimate the probabilities of different outcomes and systematically overestimate the probability of winning. Such overly optimistic fan investors drive stock prices abnormally up before the match, and they may end up disappointed after the match, especially if their team loses. While Bernile and Lyandres (2011) investigate investor overoptimism before the match, we focus on how investors' emotions affect soccer clubs' postmatch performance after Champions League and Europa League fixtures.

In our analysis, we emphasize the role of a firm's relative competitive strength by measuring the response of stock prices to the goal difference, which captures the current strength of a team, and the previous season's relative UEFA coefficient, which captures the track record of a team. While the difference in the number of goals scored and those conceded in a match has been employed before (e.g., Berkowitz and Depken II 2018; Demir and Rigoni 2017), the relative strength of a club in the previous season is new to the literature. Two noncompetitive value channels exist for a relationship between the goal difference and a soccer club's stock price response. First, a relatively higher number of goals scored stirs investors' emotions, such as euphoria, happiness or pride in the case of a win, and a relatively higher number of goals conceded may initiate rage, disappointment and frustration in the case of a loss. Second, because of the new outcome information, investors rationally update their beliefs regarding the strengths of the club and consequently expect higher or lower future cash flows in the form of prize money and revenues from merchandising sales. Whether the effect of the goal difference on stock prices is driven by emotions or rational updating of a club's strength can usually not be determined.

We propose a test to investigate whether emotions drive the positive effect of the goal difference. The starting point is that fan investors are especially subject to emotional responses (Demir and Rigoni 2017), and a similar reasoning may hold true for private investors. Institutional investors, on the contrary, are expected to react more rationally (e.g., Palomino et al. 2009); they fulfil important government tasks in publicly listed firms, such as disciplining management teams by exiting their shares or by influencing firm policies via voice (e.g., Duan and Jiao 2016; Helwege et al. 2012). Therefore, we investigate whether institutional holdings moderate the relationship between postmatch performance and those factors that are grounded on both an emotional and rational explanation, such as the goal difference. While our line of argument follows Palomino et al. (2009), our empirical approach differs. We consider the aggregate of institutional holdings, while they investigate whether the postmatch stock price response depends on whether a major institutional shareholder

owns the club. We further expect that the prematch price increase due to investors' overoptimism decreases with an increasing percentage of shares held by institutional investors and that the postmatch response in stock prices is less pronounced when the percentage of institutional holdings is higher. Thus, we test whether institutional investors fulfil another important function in stock markets, namely, to reduce the emotional responses of stock prices to firm news. This is our first contribution to the literature.

The goal difference only captures the strength of a club in the last match and therefore likely deviates from the previous season's strength of the club. A relationship between the previous season's relative competitive strength (i.e., the competitive strength of the return club relative to that of the opposing club) and postmatch stock price performance can be motivated by the abovementioned value channels. From a rational perspective, a mismatch of the previous season's relative competitive strength and the current match outcome signals to investors the need to rationally update their information on the strength of a club. The outcome of a weak club that wins against a strong opponent club signals to investors that the former is much stronger than previously expected, leading to additional future prize money and additional revenue from merchandising sales, which drive the stock price up. In contrast, investors have little evidence based on which to revaluate their price estimate for a strong club that wins against a strong opponent. When a strong club loses against a weak opponent, the strong club's strength must have deteriorated substantially; therefore, investors must consider the expected lower stream of future prize money and merchandising product sales in their stock valuation. When a relatively weak club loses, investors have no need to update their information, as the outcome is in line with what they already knew and expected.

Emotions[1] will be stirred more strongly for relatively weak clubs than for relatively strong clubs regardless of whether the outcome is a win or a loss. For relatively strong clubs, emotions will play a minor role because they will participate in the competitions again next year (or have a higher likelihood of doing so); thus, they will have another chance to win. For relatively weak clubs, the fan investors dream about what they will do after their club wins a competition; before the match outcome is determined, everything seems possible. When their weak club wins against a strong opponent, fans of such a club are expected to be more euphoric, prouder and happier, and these emotions lead to higher postmatch stock prices. When their weak club loses against a strong opponent, these fans are expected to experience rage, disappointment and frustration because their dream comes to an end, which causes emotional pain. Fans of a relatively strong club do not have dream-like hopes and their corresponding emotions. With emotions at work, we expect that the previous season's relative strength correlates negatively

[1] The stock price response could be grounded in the different behaviors of locally and internationally operating investors, such as institutional investors, whereby the former but not necessarily the latter execute emotionally motivated selling and buying decisions, while both types react positively to a win and negatively to a loss. However, many of the clubs we examine have international fan bases, and therefore the distinction between local and international investors seems inappropriate.

with postmatch abnormal returns when the outcome is a win and correlates positively with postmatch abnormal returns when the outcome is a loss. When a match outcome is a loss, the emotional and rational value channels deliver opposing predictions with respect to the sign of how relative competitive strength affects the stock price response. If investors' rational update of club strength is the main value channel, we expect to find a negative correlation between the previous season's relative competitive strength and stock price responses for the loss outcomes. If investors' emotions are the main value channel, we should see that relative competitive strength correlates positively with stock price responses. The loss events, therefore, provide an indication of whether the stock price response is mainly determined by investors' rational updating of the club's strength or by their emotions. Introducing relative competitive strength as a new factor determining stock price responses is the second contribution of our study to the literature investigating investor mood and emotions in sports events. We detail the sports literature in Sect. 2 below.

Our empirical findings show that postmatch stock prices of soccer clubs are significantly affected by the results of the Champions League and Europa League fixtures when the outcome is a loss. The cumulative average abnormal return (CAAR) from the two days after the match is − 1.44% in the case of a loss, while when the outcome is a win, the average stock price response is close to zero. We apply regression analyses to investigate how the goal difference and previous season's relative competitive strength calculated with UEFA success indexes of the return and opponent clubs moderates stock price responses. We find that postmatch abnormal returns systematically increase in the goal difference regardless of whether the outcome is a loss or win. The effect of the goal difference is more moderate when a substantial part of the shares is held by institutional investors. Abnormal returns also vary with the previous season's relative strength and not with the strength of the return club alone. In the case of a loss, the effect on abnormal returns is strongest for a weak club that loses against a strong opponent. This finding can be explained by investors' emotions but only with difficulty by investors' rational updating of the club's strength. Therefore, we conclude that these price responses are partly driven by investors' emotions, such as euphoria, pride and happiness in the case of a win and rage, disappointment and frustration in the case of a loss.

Our analysis also shows that several factors help explain abnormal returns that are in line with the rational progression of new information related to the future cash flows of a club. A higher percentage of institutional holdings leads to lower prematch abnormal returns and to higher postmatch abnormal returns when the match outcome is a loss. A lost final or semifinal match comes with significantly negative abnormal returns. Moreover, the club's position in the competition matters and is in line with rational considerations. Progressing the knockout stage leads to significantly higher abnormal returns when the match outcome is a loss. Employing betting quotations to identify unexpected outcomes shows that unexpected outcomes lead to significant stock price responses, underlining the role of new information to investors. While several of these factors have been used in previous literature, we are the first to apply a progressing dummy variable to capture the stance of a club during the competition.

The implications of our relative strength arguments transcend the scope of soccer clubs. However, measuring how relative competitive strength matters for an economic outcome may be easiest in the soccer setting. Nevertheless, in various corporate finance situations, such as competing for a target,[2] auctions and public sales, relative competitive strength may matter. While the competitive strength of soccer clubs can be measured by using UEFA club coefficients, an appropriate proxy for other corporate finance settings might be more difficult to find. Company market share is one valid proxy, which is, however, not available for all industries. An alternative is to use company size, as our line of argument can be similarly applied to this firm characteristic; i.e., investor emotions are stirred more strongly when a relatively small company succeeds in competition against a large company. Company size proxies have a long tradition in the literature (e.g., Moeller et al. 2004; Dang et al. 2018), and the relative company size of the two competing parties seems to be the best proxy available to model relative competitive strength for most corporate finance settings. While we cannot apply club size, as size information on nonlisted clubs is hardly available, we can and do use clubs' stadium capacity as a proxy and find that relative capacity positively correlates with postmatch abnormal returns after a tournament ends in a loss. This effect is in line with the argument that investors' emotions are stirred more strongly when a club is relatively small.

The remainder of the paper is structured as follows. Section 2 reviews the literature on emotions and soccer outcomes. Section 3 describes our sample and discusses the event-study methodology. Section 4 presents the results. Section 5 concludes the paper.

2 Literature review

The outcomes of sports events have been demonstrated to stir people's emotions (e.g., Trovato 1998; Hirt et al. 1992; Wann et al. 1994; Edmans et al. 2007). For instance, fans who identify with a sport club report an increase in positive emotions following a win and an increase in negative emotions following a loss (Wann et al. 1994). Fans estimate their own competencies and their teams' future performance more positively after a win than after a loss (Hirt et al. 1992). Sports outcomes may foster extreme fan behavior. For instance, in Quebec, suicide rates are higher when the main team, the Montreal Canadians hockey club, is eliminated early from the Stanley Cup, which is a North American ice hockey tournament (Trovato 1998). Emotions stirred by sport outcomes also have financial implications, as tips paid to New York taxi drivers are higher when there are unexpected close wins in sporting events (Ge 2018).

The literature on national soccer teams is also interesting for our study because tournament outcomes have been used as proxies for investors' mood. Several studies demonstrate a relationship between these tournaments and national stock market

[2] For example, when two potential acquirers bid for the same target, we expect the stock price response of the winning bidder to be moderated by its competitive strength relative to that of the losing bidder.

performance. Edmans et al. (2007), Ashton et al. (2011) and Kolaric et al. (2015) document that losses in international soccer tournaments are accompanied by significant negative stock market responses in the country of the losing team. Ehrmann and Jansen (2016) investigate how the stock prices of a company cross-listed in Milan and Paris changed during the 2010 FIFA World Cup. The investor mood of the two nations was expected to lead to different stock price responses on the national exchanges. Their results present causal evidence that sports outcomes create investor mood. However, Klein et al. (2009a, b) do not find that win and loss outcomes of national soccer teams affect national stock performance. This conclusion is also supported by a meta-regression analysis: Geyer-Klingeberg et al. (2018) conclude that sports sentiment in the case of national teams does not systematically create a nationwide stock price response. Our paper differs from the aforementioned studies not only by investigating individual soccer club returns but also by postulating that investors' emotions are stirred by relative competitive strength.

The stock performance of individual soccer clubs around tournament outcomes has received much attention in recent years. The first studies investigated how stock performance depends on the match outcome. Renneboog and Vanbrabant (2000) find that a win increases while a loss reduces the stock performance of British soccer clubs. Similar stock price patterns are documented for international match outcomes (Scholtens and Peenstra 2009).[3] These stock price responses are in line with the match outcome's financial implications. According to the annual Deloitte Football Money League reports, the main income sources for soccer clubs are derived from commercials, broadcast rights, and matchday profits, such as ticket sales, stadium consumption, and prize money. The sizes of these income sources depend on the sporting results of the club (Audas et al. 2002). Positive match results translate into financial rewards since success attracts media attention and sponsorship agreements. Poor match outcomes lead to lower game attendance, merchandising product sales, and income from catering and sponsorship (Renneboog and Vanbrabant 2000).

Investors' expectancies have been shown to moderate these stock price responses because investors are expected to react more strongly to a match outcome when they expect a different outcome. Palomino et al. (2009), Stadtmann (2006), Demir and Danis (2011), Scholtens and Peenstra (2009), Jørgensen et al. (2012), Castellani et al. (2015), and Berkowitz and Depken II (2018), for instance, use betting quotations to distinguish between expected and unexpected match outcomes and find that unexpected outcomes initiate a stronger stock price response than expected outcomes.

Investors rationally updating their expectations do not interpret all lost or won matches in an international competition in the same way because the information content of a match outcome depends on the type of competition and on the stage of the competition. Distinguishing between fixtures of the Champion League and the Europa League seems of priority since the prize money, prestige, and number of broadcast viewers of the Champions League are larger than those of

[3] With meta-regression analysis, Geyer-Klingeberg et al. (2018) confirm that lost matches lead to negative stock price responses, but winning a match does not generate significant returns.

the Europa League. The stage information of international competitions is also relevant, as successful teams have to survive all these stages. The first matches in a season occur in the so-called qualification stage, which is subsequently followed by the group and knockout stage. Previous literature on international tournaments has not modeled the stage structure of international competitions for postmatch abnormal returns (e.g., Scholtens and Peenstra 2009; Bernile and Lyandres 2011), while literature on national tournaments distinguished between matches before and after March because the fixtures after March are more relevant in determining a club's final position in the competition (e.g., Palomino et al. 2009; Demir and Rigoni 2017). We extend previous studies on international tournaments by modeling the outcome of the qualification, group and knockout stages in an explicit way.

The difference in the number of goals scored and the number of goals conceded of the respective match has been documented to affect stock price responses (e.g., Berkowitz and Depken II 2018; Demir and Rigoni 2017). The goal difference has a positive effect on abnormal returns after lost and won matches (Demir and Rigoni 2017; Palomino et al. 2005, 2009). Thus, a large goal difference in the case of a win results in large positive abnormal returns, and a large goal difference in the case of a loss corresponds with large negative abnormal returns. We extend the previous studies by investigating whether the goal difference has a less pronounced effect if the percentage of shares held by institutional investors is higher.

Bernile and Lyandres (2011) argue that fan investors have biased ex ante beliefs because they systematically overestimate the probability of their team winning. In anticipation of a win, stock prices already increase before the match outcome is determined. The positive effect of a win might be fully incorporated into the stock price before the actual tournament outcome is determined; therefore, prices may no longer adjust after the match. In the case of a loss, the stock price response after the match will be more negative if investor overoptimism substantially increased the stock price before the match. Then, the positive prematch price increase must be more than compensated after the negative outcome is determined. Thus, their line of argument implies that biased ex ante expectancies influence ex post market reactions, while we focus on the emotional response after the match outcome is determined. We onboard the argument by Bernile and Lyandres (2011) by controlling for investors' revealed prematch beliefs, which moderate postmatch stock price responses.

3 Sample and methodology

We first introduce our sample of soccer clubs and discuss how we distinguish between expected and unexpected match outcomes. Then, we describe the event-study methodology that we apply to determine stock price responses.

3.1 Sample

We start with a list of all clubs that played in the Champions League or Europa League between February 2004 and March 2020. From this list, we consider all publicly listed soccer clubs as return clubs whose dividends and stock split-adjusted stock prices (in US dollars) are available from Refinitiv Datastream and whose matches have a betting quotation from Pinnacle, an online gambling website located on the Island of Curaçao of the Kingdom of the Netherlands. When clubs delisted their stocks on one and list them on another exchange, we combine the price series to obtain a longer return series. In our sample, Manchester Utd. and Rangers switched exchanges.[4]

As shown in Table 1, our sample contains 20 return clubs located in eight European countries that played 2245 matches; 957 ended in a win and 716 ended in a loss. The 20 return clubs played against 275 listed and unlisted opponent clubs, which were located in as many as 50 countries.

To distinguish between expected and unexpected match outcomes, we employ betting quotations. In the days that precede a match, these quotations are constantly updated by the bookie, who determines them based on new information and on the bets placed by individuals. Betting quotations in our dataset are reported in the so-called European or decimal notation for each of the three possible outcomes (the home or away team can win, or the match can end in a draw), where the match outcome possibility with the smallest betting odds has the highest probability of occurring. We classify match outcomes as expected when the match outcome is also the outcome with the smallest last betting quotation, which is posted a few minutes before the match begins; otherwise, match outcomes are classified as unexpected. As shown in Table 1, the numbers of unexpected wins and losses, 137 and 164, respectively, are substantially smaller than the numbers of total wins and losses, 975 and 716.

3.2 Methodology

We use a traditional event-study methodology (e.g., MacKinlay 1997; Brown and Warner 1985) to measure how Champions League or Europa League fixture outcomes affect stock prices. Of importance for measuring the stock price response with an event study is that the time at which the new information arrives at the stock market can be determined and that the value implication of the new information for the stock is clear. In our case, the time at which the information of the match outcome becomes publicly available is well defined, and the result of a soccer match is a clear and distinctive event.

An event study focuses on the difference between the actual return and the return that would have been expected without the new information from the match. For the latter return, we use a market model, as in the literature (e.g., Scholtens and Peenstra

[4] Landis and Skouras (2021) point out that "many stocks appear with constant return indexes toward the end of their series even when the series have been truncated at their delisting dates" (Landis and Skouras 2021, p 12). Therefore, we eliminated constant stock prices before the clubs' delisting dates.

Table 1 The sample

Return clubs	Country	# matches	# WIN	# unexpectedWin	# LOSS	# unexpectedLoss
Aalborg	Denmark	41	15	4	15	1
Ajax	Netherlands	163	66	12	52	12
Arsenal	UK	149	81	8	36	7
AS Roma	Italy	128	53	6	45	12
Benfica	Portugal	144	63	11	51	12
Besiktas	Turkey	126	54	10	46	9
Brondby	Denmark	72	29	2	26	2
Celtic	UK	168	63	5	68	10
Dortmund	Germany	99	48	0	32	11
FC Porto	Portugal	158	74	12	47	11
Fenerbahce	Turkey	121	51	10	36	7
Galatasaray	Turkey	100	30	8	41	6
Juventus	Italy	138	69	8	29	11
Lazio	Italy	92	40	2	28	12
Lyon	France	121	54	12	35	9
Manchester Utd	UK	82	42	3	23	10
Newcastle	UK	31	22	2	3	0
Rangers	UK	102	36	6	27	4
Sporting	Portugal	149	64	11	54	12
Trabzonspor	Turkey	61	21	5	22	6
Total		2245	975	137	716	164

This table displays the names and countries of the return clubs that played in the Champions or Europa Leagues between February 2004 and March 2020 for which we can determine a stock price response after the fixtures. We report the number of matches (# matches), wins (# *WIN*), unexpected wins (# *unexpectedWin*), losses (# *LOSS*) and unexpected losses (# *unexpectedLoss*). To determine whether a match outcome was expected or unexpected, we relied on betting odds

2009; Benkraiem et al. 2009). According to Bernile and Lyandres (2011), many soccer club stocks are thinly traded; for thinly traded stocks, market movements may not be incorporated into the price on the same day but are perhaps incorporated with a delay. Therefore, our market model for predicting the return on the event day appears as follows:

$$R_{ijt} = \alpha_{ij} + \beta_{ij}^{0} R_{mt} + \beta_{ij}^{1} R_{mt-1} + \beta_{ij}^{2} R_{mt-2} + \varepsilon_{ijt}, \tag{1}$$

where R_{ijt} is the stock return of club i on day t before match j, R_{mt} is the return of the market index of the club's home country on day t, ε_{ijt} is the zero-mean error term, and α_{ij} and β_{ij} are the unknown parameters for the market model for club i and match j. These parameters are estimated using an estimation window of 252 days before the event window that starts five days before match j.

We calculate the abnormal returns as the difference between the actual and predicted returns from the market model:

$$AR[\tau]_{ijo} = R_{ij\tau} - \widehat{\alpha}_{ij} - \widehat{\beta}^{0}_{ij} R_{m\tau} - \widehat{\beta}^{1}_{ij} R_{m\tau-1} - \widehat{\beta}^{2}_{ij} R_{m\tau-2}, \tag{2}$$

where $AR[\tau]_{ijo}$ is the abnormal return of club i after match j against opponent o on day τ, and $\widehat{\alpha}_{ij}$ and $\widehat{\beta}_{ij}$ are the estimated parameters of the market model for club i and match j. τ measures the event time; it is equal to 0 on the event day and + 1/− 1 on the day after/before the match takes place.

Because investors may incorporate new information into stock prices in a sluggish way, we study cumulative abnormal returns (CARs), which sum up the abnormal returns for several days starting on day τ_1 and ending on day τ_2:

$$CAR[\tau_1, \tau_2]_{ijo} = \sum_{\tau_1}^{\tau_2} AR[\tau]_{ijo}. \tag{3}$$

Since we are interested in postmatch emotional responses in stock prices, we employ CAR[1,2] and in robustness tests CAR[1,3]. We do not include the event day in these returns because Champions League and Europa League matches are played after the stock markets of the return clubs are closed[5] such that the stock price response on the first trading day after the match is played will reflect investor valuations of this new information.

4 Empirical analysis

We first discuss the results of the event-study tests for matches that ended in a win or a loss. Second, we employ measures of the relative competitive strength between the return club and the opponent club in a regression analysis. Third, we present robustness tests.

4.1 Event-study tests

To see how the stock prices fluctuate in the event window, we aggregate CARs cross-sectionally starting five days before up to five days after the match:

$$CAAR\left[-5, \tau_2\right] = \frac{1}{N} \sum CAR\left[-5, \tau_2\right]_{ijo}, \tag{4}$$

where N represents the number of events that are included in the CAR summation.

Figure 1 plots CAARs for all matches as well as for win and loss events separately. For all events, the CAARs continuously increase before the match and continuously decrease after the match. For win events, the CAARs continuously increase from five days before to the day after the match. Then, the prices decline somewhat before they are more or less constant. For loss events, it seems that investors

[5] However, because Manchester Utd. is listed at the New York Stock Exchange, investors' valuations for the match outcomes of this club are likely included on the event day.

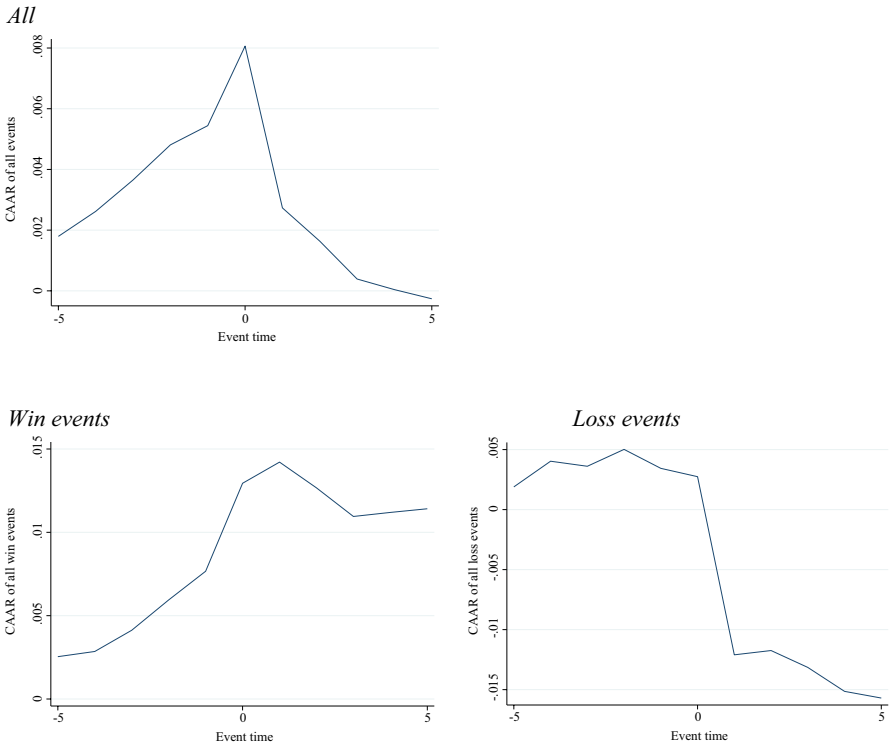

Fig. 1 These graphs show the CAARs of 20 soccer clubs from five days before to 5 days after a fixture in the Champions League or Europa League between February 2004 and March 2020. The match outcomes are further subdivided into wins and losses

hope for a favorable outcome, and this hope ends when the match outcome is realized, at which point CAARs sharply decline. Overall, in line with Bernile and Lyandres (2011), we find that stock prices also respond before the match outcome is determined.

We apply two event-study tests to determine whether the CAARs significantly differ from zero. In our sample, a substantial number of matches are played on the same days, which introduces event-date clustering such that the abnormal returns related to various events are not necessarily independent. Kolari and Pynnönen (2010) document that event-date clustering increases the chance of a type 1 error even for low levels of abnormal return cross-correlation. In this case, the null hypothesis of zero-average abnormal returns will be rejected even if it is true. Therefore, we explicitly address event-date clustering by applying the modified t test proposed by Kolari and Pynnönen (2010).

Campbell et al. (2010) examine the strength of selected event-study tests in a multicountry context such as ours. They show that in event studies, generalized sign (Cowan 1992) and rank (Corrado 1989) tests, which do not rely on the assumption of normality, are more powerful than the commonly applied parametric tests.

For this reason, we additionally apply the generalized sign test. This test examines whether the number of negative CARs in the event window exceeds the number of negative CARs expected in the absence of the event.

Table 2 presents the results. In the case of a win, the CAAR[1,2] accounts for − 0.03%, which is insignificant. In the case of a loss, the CAAR[1,2] accounts for economically important − 1.44%, which is significant at the 1% level according to both tests. Geyer-Klingeberg et al. (2018) report in their meta-analysis based on 37 original studies on national and international soccer tournaments an average abnormal return of 0.38% for wins and − 0.76% for losses. Thus, our results on loss events are more pronounced than are their average number, while our results for win events are less pronounced.

Furthermore, we run tests on subsamples to determine whether unexpected as well as expected outcomes create significant postmatch responses. The CAAR[1,2] is 1.67% for unexpected wins and − 0.30% for expected wins. The former number is highly significant. When a loss is unexpected, that is, when the team is expected to win or draw, we find a CAAR[1,2] of − 2.33%, and when a loss is expected, the CAAR is − 1.18%. Thus, an unexpected outcome has a stronger effect on stock prices than an expected outcome. However, expected loss outcomes also show significant postmatch responses.

Champions League matches may have stronger stock price implications than Europa League matches, as prize money is higher for the former than for the latter. Therefore, we split the sample and find that the postmatch stock price responses to match outcomes are stronger for Champions League matches when the outcome is unexpected but less so when the match outcome is expected. In the case of an expected win, the CAAR[1,2] is − 0.44% for Champions League matches and − 0.17% for Europa League matches; the difference between the two is insignificant according to an unreported test. However, in the case of an unexpected win, the CAAR[1,2] is 1.84% for Champions League matches and 1.46% for Europa League matches, where both numbers are significant. In the case of an unexpected loss, the CAAR[1,2] is − 2.73% for Champions League matches and − 1.90% for Europa League matches. Thus, the unexpected match outcomes indicate that the postmatch stock price response is stronger for the Champions League than for the Europa League.

4.2 Regression analysis

4.2.1 Model setup

We conduct regression analyses to investigate whether the abnormal returns vary systematically with relative competitive strength. Our dependent variable is the CAR[1,2], which is, as described above, the CAR from the first and second day after the match is played. The model has the following form:

$$CAR[1,2]_{ijo} = \alpha_1 \Delta Goal_{ijo} + \alpha_2 \Delta Coefficient_{ios-1} + \alpha_3 CAR[-3,-1]_{ijo} + \beta' Controls + \mu_s + \varepsilon_{ijo}, \quad (5)$$

Table 2 Event study tests

	Win				Loss			
	N	CAAR[1,2]	Kolari test	Cowan test	*N*	CAAR[1,2]	Kolari test	Cowan test
Both leagues								
All	975	− 0.03%	0.629	0.368	716	− 1.44%	0.000	0.000
Expected outcome	838	− 0.30%	0.368	0.601	552	− 1.18%	0.000	0.000
Unexpected outcome	137	1.67%	0.000	0.000	164	− 2.33%	0.000	0.000
Champions league								
All	486	− 0.09%	0.760	0.497	415	− 1.66%	0.000	0.000
Expected outcome	410	− 0.44%	0.439	0.728	330	− 1.38%	0.000	0.000
Unexpected outcome	76	1.84%	0.006	0.011	85	− 2.73%	0.000	0.001
Europa league								
All	489	0.03%	0.705	0.552	301	− 1.15%	0.000	0.000
Expected outcome	428	− 0.17%	0.645	0.696	222	− 0.88%	0.003	0.001
Unexpected outcome	61	1.46%	0.029	0.007	79	− 1.90%	0.004	0.038

This table shows the *CAAR[1,2]* of 20 soccer clubs after a fixture in the Champions League or Europa League between February 2004 and March 2020. The match outcomes are subdivided into expected and unexpected wins and losses on the basis of betting odds. *N* refers to the number of CARs we consider in the calculation of the CAAR. We determine normal returns by using a market model. The parameters used to calculate the normal returns are estimated from the 252 trading days before the event window that starts five days before the fixture. The column labeled "Kolari test" reports p values based on the parametric test statistic proposed by Kolari and Pynnönen (2010), while that labeled "Cowan test" reports the p values that come from the nonparametric generalized sign test of Cowan (1992). We show results when all events are considered, as well as when events of the Champions League or the Europa League are included in the estimations

where $CAR[1,2]_{ijo}$ is the CAR of return club i in match j against opponent club o, μ_s is a seasonally fixed effect and ε_{ijo} is the error term. Because we observe return clubs several times per season and in different seasons, we cluster standard errors on the club as well as season level. We apply Eq. (5) to win and loss events separately because the previous season's relative competitive strength may have opposite effects on positive and negative tournament outcomes. In Panel a of Table 3, we present descriptive statistics and the correlations among variables for the win sample; definitions and sources of our variables are stated in Panel b.

In our model, we consider the relative strength of the return club in the current match as well as in the previous season. We measure relative strength in the current match by including the difference between goals scored, $\Delta Goal$, as in, e.g., Palomino et al. (2005, 2009). The relative strength in the previous season is built on UEFA club coefficients, which are updated seasonally and classify all clubs participating in the Champions League or Europa League from the strongest to the weakest

based on the points that clubs receive for their performance in previous seasons of the leagues. The higher that the coefficient is, the stronger the club. Our relative competitive coefficient ($\Delta Coefficient_{ios-1}$) is calculated as the UEFA coefficient of the return club minus that of the opponent club. Unfortunately, for several opponents, no UEFA coefficient in the previous season is available. For these clubs, we employ the average coefficient of the clubs located in their home country. We discuss alternative indicators in our robustness section.

Our first control variable is related to investors' biased ex ante probability estimates and irrational ex post reactions (Bernile and Lyandres 2011). Before the match, investors are overly optimistic, and their hopes for a win drive the stock price upward, leading to a positive CAR before the outcome is fixed. When the eventual result is a loss, this run-up in the stock price has to be compensated for, leading to a negative correlation between the postmatch abnormal return and the CAR before the match. Therefore, we use revealed prematch beliefs as a control variable. More specifically, we calculate the CAR from three days to one day before the match, $CAR[-3,-1]$, and employ it as an additional regressor. We expect that prematch return increases correlate negatively with postmatch performance. This correlation should be more pronounced for losses than for wins because for losses, the prematch increase in stock prices must be compensated with a postmatch decrease.

Further controls are as follows. First, we control for whether the fixture belongs to the Champions League (*ChampionsLeague*). Second, we consider the respective stage of the match. In international tournaments, three stages can be distinguished: the qualification stage, which is played by clubs that are not directly allowed to the group stage; the group stage, where the two best teams in a group progress; and the knockout stage. The qualification and knockout stages follow the same set up where two matches are played and the winner over two matches progresses. If both outcomes are the same, then away goals are counted heavier than are home goals. If the outcome cannot be distinguished, extra time is used, and penalties might be employed. We create dummy variables to subdivide matches into qualifying stage (*QualiStage*), group stage (*GroupStage*), and knockout stage (*KnockOutStage*). This stage information might, however, be less relevant compared to the information on whether a club progresses a stage. Therefore, a distinction is made regarding whether the return club progresses to the knockout stage (*KnockOutProgress*). Moreover, because finals differ in importance from other matches in the knockout stage, we include a dummy variable to measure their effects. Unfortunately, the number of finals in our sample of listed return clubs is too low to model this match type; therefore, we merge these matches with the semifinals (*FinalMatch*). Finally, for unexpected match outcomes, the information content is higher than for expected outcomes. Therefore, we employ dummy variables for unexpected wins (*unexpectedWin*) and unexpected losses (*unexpectedLoss*).

Recent literature argues that fan investors of soccer clubs often respond in an emotional way (e.g., Demir and Rigoni 2017). Such an emotional response is not expected to hold for sophistical investors, such as institutional investors. We add to this line of argument by considering the percentage of shareholdings of institutional investors (*InstHoldings*), such as mutual funds, hedge funds and funds from

Table 3 Descriptive statistics

Panel a

	Variable	Mean	Std. Dev	Correlations												
				(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	ΔGoal	1.95	1.16	1												
(2)	ΔCoefficient	6.50	18.90	0.07	1											
(3)	Coefficient RC	54.30	28.49	0.00	0.07	1										
(4)	Coefficient NoRC	31.99	30.22	− 0.14	− 0.27	0.27	1									
(5)	ΔCapacity	2.91	3.91	0.17	0.26	− 0.14	− 0.32	1								
(6)	CAR[− 3,− 1]	0.49	4.77	− 0.06	0.00	0.02	− 0.02	− 0.01	1							
(7)	ChampionsLeague	0.50	0.50	− 0.02	− 0.08	0.39	0.37	− 0.10	− 0.02	1						
(8)	FinalMatch	0.02	0.15	− 0.05	− 0.04	0.02	0.08	− 0.05	− 0.02	− 0.04	1					
(9)	KnockOutStage	0.23	0.42	− 0.07	− 0.11	0.09	0.30	− 0.17	0.06	− 0.21	0.24	1				
(10)	GroupStage	0.51	0.50	− 0.07	− 0.02	0.20	0.08	− 0.13	− 0.07	0.23	− 0.16	− 0.58	1			
(11)	QualiStage	0.26	0.44	0.16	0.14	− 0.32	− 0.40	0.32	0.02	− 0.06	− 0.09	− 0.31	− 0.59	1		
(12)	KnockOutProgress	0.07	0.26	0.00	− 0.05	0.06	0.16	− 0.09	0.06	− 0.11	− 0.04	0.52	− 0.3	− 0.16	1	
(13)	unexpectedWin	0.14	0.35	− 0.14	− 0.09	− 0.04	0.29	− 0.16	− 0.01	0.04	0.00	0.14	− 0.01	− 0.13	0.10	1
(14)	InstHoldings	0.04	0.02	0.26	0.08	0.00	− 0.03	0.09	0.06	0.03	0.05	− 0.10	0.06	− 0.05	− 0.05	− 0.05

Panel b

$CAR[\tau_1,\tau_2]_{ijo}$	Abnormal returns of return club *i* in match *j* against opponent club *o* cumulated over τ1 to τ2, where τ = 0 is the event day. We estimate the parameters to calculate normal returns from the 252 trading days before the event window that starts five days before match j
	Source: Authors' own calculations based on dividend and stock-split adjusted stock prices from Datastream and match information from Indatabet, a former platform that published sports results
$CAAR[\tau_1,\tau_2]$	Cumulative abnormal returns averaged over all matches calculated as follows: $CAAR[\tau_1, \tau_2] = \frac{1}{N} \sum CAR[\tau_1, \tau_2]_{ijo}$, where *N* denotes the number of CARs considered in the summation

Table 3 (continued)

Panel b	
Measures of interest	
ΔGoal	Difference in the number of goals scored by the return and opponent clubs after extra time. In the case of a penalty shootout, we appoint a goal to the winner of the penalty shootout. *Source*: Indatabet
ΔCoefficient	Difference in UEFA coefficients in the previous season between the return club and the opponent club. When the UEFA coefficient for a club in the previous season is not available, we use the UEFA country coefficient *Source*: https://www.uefa.com/memberassociations/uefarankings/club, and https://www.uefa.com/nationalassociations/uefarankings/country
Unadj. ΔCoefficient	Difference in UEFA coefficients in the previous season between the return club and the opponent club. When we employ this unadjusted measure, we do not approximate missing UEFA coefficients and, therefore, do not consider return or opponent clubs with missing UEFA coefficients in our estimation *Source*: https://www.uefa.com/memberassociations/uefarankings/club
Coefficient RC[NoRC]	UEFA coefficient in the previous season of the return club [opponent club]. When the UEFA coefficient for a club in the previous season is not available, we use the UEFA country coefficient *Source*: https://www.uefa.com/memberassociations/uefarankings/club, and https://www.uefa.com/nationalassociations/uefarankings/country
ΔCapacity	Difference in stadium capacity between the return club and the opponent club. *Source*: http://stadiumdb.com/stadiums; for missing values, we performed a Google search
Controls	
ChampionsLeague	Dummy variable that takes a value of 1 if the match played is a Champions League fixture and is zero when the fixture is a Europa League competition. *Source*: Indatabet
FinalMatch	A dummy variable equals 1 if the match is a final or semifinal match and 0 otherwise. *Source*: Manually collected from various sources

Table 3 (continued)

Panel b	
KnockOutStage	A dummy variable that takes a value of 1 if the match occurs in a knockout stage and if it is not a final or semifinal match and 0 otherwise.
	Source: Manually collected from various sources
GroupStage	A dummy variable that takes a value of 1 if the match occurs in the group stage and 0 otherwise.
	Source: Manually collected from various sources
QualiStage	A dummy variable that takes a value of 1 if the match occurs in the qualification stage and 0 otherwise.
	Source: Manually collected from various sources
KnockOutProgress	A dummy variable that takes a value of 1 if the club progresses the knockout stage and if the match is not a final or semifinal match and 0 otherwise.
	Source: Manually collected from various sources
WIN	A dummy variable that equals 1 if the return club wins the match and 0 otherwise.
	Source: Indatabet
expectedWin	Dummy variable that equals 1 if the return club is expected to win the match and 0 otherwise. We consider the outcome with the lowest odds as the most expected outcome.
	Source: Indatabet
unexpectedWin	A dummy variable equals 1 if the return club wins the focal match when it was expected to draw or lose.
	Source: Indatabet
LOSS	A dummy variable that equals 1 if the return club loses the match and 0 otherwise.
	Source:Indatabet
expectedLoss	Dummy variable that equals 1 if the return club is expected to lose the match and 0 otherwise. We consider the outcome with the lowest odds as the most expected outcome.
	Source: Indatabet

Table 3 (continued)

Panel b	
unexpectedLoss	A dummy variable equals 1 if the return club loses the focal match when it was expected to draw or win. *Source*: Indatabet
DRAW	A dummy variable that equals 1 if the match ends in a draw and 0 otherwise. *Source*: Indatabet
log(MC)	The logarithm of a return club's market capitalization. *Source*: Refinitiv's Eikon
Leverage	The long-term leverage ratio of the return club. *Source*: Refinitiv's Eikon
InstHoldings	The percentage of shares owned by institutional investors relative to all outstanding shares. *Source*: Refinitiv's Eikon
HIGH	Dummy variable equals 1 if the percentage of club shares held by institutional investors is above the median institutional holdings in our sample and zero otherwise

Panel a presents descriptive statistics on and correlations between the independent variables when the outcome is a win. Panel b defines all variables used in the main analysis and robustness tests and states their sources

insurance companies. Because these holdings are not available for all return clubs, we apply them in an extension of our model.

To check for multicollinearity, we use correlation coefficients and variance inflation factors. The former can be found in Table 3 for the win sample. In our analysis, we consider only the progression information of the knockout stage because the stage dummy variables are highly correlated (the correlation for loss events exceeds 0.7).[6] For all results presented in the following, we find that multicollinearity is not an issue, as all variance inflation factors are less than ten.

5 Results

In Table 4, we present the results. Irrespective of whether the outcome is a win (column (1)) or loss (column (2)), the difference in goals scored leads to higher abnormal returns. This effect can be explained by both rational updating and emotional responses. For wins (column (1)), we find that the relative coefficient of the return clubs is insignificant. For losses (column (2)), the relative coefficient loads significantly positively. This positive coefficient indicates that the relatively stronger the return club is, the less negative abnormal returns will be following a loss. The findings on loss events are in line with the argument that the previous season's relative competitive strength is a proxy for investors' exposure to emotions, which we expect to be more strongly affected when a weak return club loses against a strong opponent than when the same club loses against a weak opponent.

We expect that the absolute UEFA coefficients of the return and opponent clubs are not relevant for the stock price response. In columns (3) and (4), we therefore include return clubs' and the opponent clubs' coefficients instead of our relative indicator. When the outcome is a win (column (3)), the coefficient of the return club does not determine the outcome. When the outcome is a loss (column (4)), we also find no significant effects. Thus, for the stock price response, relative competitive strength matters, not the return clubs' strength.

The CAR before the match loads negatively and significantly for win and loss events, as expected. The negative sign indicates that potentially inflated CARs before the match due to investor overoptimism reduce the positive CARs after the outcome when the match is a win. The effect of the CAR before is less pronounced for win events than for loss events, in line with the argument that the price run-up has to be compensated for in the case of loss events.

The match type is also relevant for abnormal returns. Abnormal returns when losing a (semi)final match are more negative (columns (2) and (4)), in line with the argument of lower future cash flows generated from prize money and merchandise sales. Progressing the knockout stage comes with significantly higher abnormal returns when the outcome is a loss. Confirming our event-study tests, we further

[6] In unreported regressions, we consider the stage dummy variables instead of the progressing dummy variable and find that all three stage dummy variables lack significance when the outcome is a win as well as when it is a loss. The magnitude and significance of the coefficients of our variables of interest as well as controls are not affected.

Table 4 Abnormal returns after matches

	(1) Win	(2) Loss	(3) Win	(4) Loss
ΔGoal	0.298** (0.130)	0.377** (0.177)	0.307** (0.125)	0.408** (0.184)
ΔCoefficient	− 0.002 (0.007)	0.027** (0.009)		
Coefficient RC			− 0.011 (0.007)	− 0.007 (0.009)
Coefficient NoRC			0.005 (0.004)	0.002 (0.005)
CAR[-3,-1]	− 0.088* (0.043)	− 0.191** (0.073)	− 0.086* (0.044)	− 0.193** (0.072)
ChampionsLeague	− 0.026 (0.279)	− 0.624 (0.403)	0.125 (0.288)	− 0.610 (0.459)
FinalMatch	− 1.253 (1.149)	− 4.553*** (0.949)	− 1.264 (1.125)	− 4.568*** (0.950)
KnockOutProgress	0.377 (0.696)	3.015** (1.259)	0.398 (0.654)	2.975** (1.257)
unexpectedWin	1.606** (0.639)		1.453* (0.704)	
unexpectedLoss		− 0.905* (0.473)		− 0.715 (0.475)
Season FE	Yes	Yes	Yes	Yes
# of obs	975	716	975	716
adj R2	0.018	0.088	0.020	0.085
# clubs	20	20	20	20
# seasons	17	17	17	17

The dependent variable in the OLS regressions is the CAR[1,2] for the 20 stock exchange-listed soccer clubs that played in the Champions League or Europa League between February 2004 and March 2020. In columns (1) and (3), the outcome is a win, while in columns (2) and (4), it is a loss. Variables are defined in Panel b of Table 3. Standard errors clustered at the return-club and the season level are presented in parentheses, where ***p < 0.01, **p < 0.05, *p < 0.1

see that an unexpected win (loss) results in greater positive (negative) CARs than an expected win (loss).

Table 5 is dedicated to the role of institutional investors in stock price responses. In columns (1) and (2), we find that a higher percentage of shares held by institutional investors leads to lower abnormal returns after winning and to higher abnormal returns after losing a match, although the effect in the case of winning lacks statistical significance. These effects are in line with the argument that the presence of institutional investors reduces the emotional response that the match outcome creates. With institutional investors as shareholders, winning may less stimulate positive emotions, and losing a match may less stimulate negative emotions; therefore, the stock price response is less pronounced.

Institutional investors may also moderate how relative competitive strength affects stock prices. In columns (3) and (4), we therefore add an interaction term of ΔGoal and a dummy variable that equals one when the percentage of institutional holdings is above the median value of institutional holdings in our sample (HIGH*ΔGoal). We find that this interaction term is significantly negative when the outcome is a win, indicating that the emotions stirred by the outcome of the match are less pronounced when a higher percentage of shares is held by institutional investors. When

Table 5 Abnormal returns and institutional investors

	(1) Win	(2) Loss	(3) Win	(4) Loss	(5) Win	(6) Loss
ΔGoal	0.459*** (0.152)	0.447** (0.192)	0.633*** (0.211)	0.395** (0.183)	0.450** (0.156)	0.440** (0.189)
ΔCoefficient	0.001 (0.006)	0.031*** (0.007)	0.001 (0.005)	0.031*** (0.007)	0.034 (0.022)	0.054** (0.023)
HIGH*ΔGoal			− 0.338* (0.163)	0.106 (0.248)		
HIGH*ΔCoefficient					− 0.039* (0.021)	− 0.043 (0.043)
CAR[− 3,− 1]	− 0.052** (0.020)	− 0.198** (0.088)	− 0.054** (0.022)	− 0.198** (0.088)	− 0.052 (0.036)	− 0.198** (0.088)
ChampionsLeague	− 0.151 (0.276)	− 1.012** (0.426)	− 0.030 (0.276)	− 0.993** (0.426)	− 0.107 (0.289)	− 0.975** (0.440)
FinalMatch	− 0.698 (1.041)	− 5.550*** (0.760)	− 0.745 (1.084)	− 5.519*** (0.853)	− 0.662 (1.050)	− 5.546*** (0.828)
KnockOutProgress	0.870 (0.712)	2.245* (1.103)	0.883 (0.716)	2.251* (1.086)	0.926 (0.705)	2.277* (1.134)
InstHoldings	− 1.108 (0.752)	3.452** (1.278)	0.165 (0.596)	3.871*** (0.803)	− 0.669 (0.846)	3.792*** (1.136)
unexpectedWin	2.269*** (0.696)		2.248*** (0.708)		2.291*** (0.717)	
unexpectedLoss		− 1.024 (0.651)		− 1.028 (0.647)		− 1.055 (0.644)
Season FE	Yes	Yes	Yes	Yes	Yes	Yes
# obs	749	560	749	560	749	560
adj R2	0.024	0.105	0.027	0.103	0.027	0.105
# clubs	16	16	16	16	16	16
# seasons	17	17	17	17	17	17

The dependent variable in the OLS regressions is the CAR[1,2] for stock exchange-listed soccer clubs that played in the Champions League or Europa League between February 2004 and March 2020. In columns (1), (3) and (5), the outcome is a win, while in columns (2), (4) and (6), it is a loss. Variables are defined in Panel b of Table 3. Standard errors clustered at the return-club and the season level are presented in parentheses, where ***p < 0.01, **p < 0.05, *p < 0.1

the outcome is a loss, this interaction term does not matter. In columns (5) and (6), we similarly add an interaction term of the relative UEFA coefficient and this dummy variable (HIGH*ΔCoefficient). We find that this interaction term loads significantly negatively, which is in line with a rational updating of a club's strength, but it could also be explained by an emotional response.

Our main argument is that the previous season's relative strength proxies for investors' postmatch exposure to emotions. Therefore, it should be less relevant for investor overoptimism before the match. Hence, we test whether prematch abnormal returns, *CAR[− 3,− 1]*, are affected by our relative strength indicator (Table 6, columns (1) to (3)). We find that neither the relative coefficient nor the absolute values of the UEFA coefficients for the return and opponent clubs influence the CAR in the days preceding the match. In column (3), we see that a higher percentage of shares held by institutional investors leads to lower prematch abnormal returns, indicating that overoptimism is less pronounced when institutional investors are present.

Next, we test whether the UEFA coefficients correlate in economically meaningful ways with match outcomes. Return clubs with a (relatively) strong track record in the previous season should have a higher probability of winning a match. We run probit models in which the dependent variable equals 1 when the return club wins the match and zero otherwise. The results are presented in columns (4) to (6) of Table 6. The probability of winning significantly increases with the relative coefficient (column (4)), as expected. Moreover, strong return clubs have higher chances of winning, while strong opponent clubs have lower chances of losing against the return club (column (5)). The return clubs in our sample have a lower probability of winning in the knockout stage relative to the group and qualification stage, which are the reference category in this specification. A higher percentage of shares held by institutional investors is observed for clubs with higher probabilities of winning (column (6)). This indicates that institutional investors pick only soccer shares when they are more successful in international tournaments.

5.1 Robustness tests

We carry out several tests to show that our findings hold under modified circumstances. Our first two robustness tests deal with alternative measures of the relative strength that we expect to trigger emotional stock price responses. First, a UEFA coefficient is not available for every opponent club in our sample. For these clubs, we employed the average country coefficient of the previous season. In columns (1) and (2) of Table 7, we use the unadjusted relative coefficient and do not consider opponents with missing UEFA coefficients in our estimation. The coefficient of the unadjusted relative coefficient is significantly positive for loss events. Our second test focuses on size differences between the return and opponent clubs. While several size measures are available in corporate finance research (Dang et al. 2018), we lack adequate size measures for most opponent clubs. Therefore, we use the stadium capacity as an alternative to firm size and compare the capacity of the return club's

Table 6 Returns before the match and the probability of winning

	(1) CAR[− 3,− 1]	(2) CAR[− 3,− 1]	(3) CAR[− 3,− 1]	(4) Prob(WIN)	(5) Prob(WIN)	(6) Prob(WIN)
ΔCoefficient	0.003 (0.004)		0.002 (0.003)	0.009*** (0.002)		0.009*** (0.003)
Coefficient RC		− 0.007 (0.006)			0.006*** (0.002)	
Coefficient NoRC		− 0.006 (0.004)			− 0.009*** (0.001)	
CAR[− 3,− 1]				0.005 (0.005)	0.003 (0.002)	0.006 (0.004)
ChampionsLeague	0.126 (0.271)	0.499 (0.395)	0.100 (0.295)	− 0.179*** (0.068)	− 0.031 (0.079)	− 0.169*** (0.057)
FinalMatch	− 0.759 (0.987)	− 0.675 (0.979)	− 0.281 (1.325)	− 0.001 (0.150)	0.028 (0.153)	0.130 (0.146)
KnockOutStage	0.491 (0.460)	0.715 (0.445)	0.569 (0.540)	− 0.224*** (0.074)	− 0.102 (0.087)	− 0.221** (0.091)
InstHoldings			− 1.851** (0.828)			0.614*** (0.174)
expectedWin	0.401 (0.263)	0.407 (0.267)	0.396* (0.207)			
expectedLoss	− 0.472* (0.240)	− 0.413* (0.203)	− 0.546* (0.309)			
Season FE	Yes	Yes	Yes	Yes	Yes	Yes
# obs	2245	2245	1755	2245	2245	1755
adj R2	0.008	0.011	0.011			
# clubs	20	20	16	20	20	16
# seasons	17	17	17	17	17	17

In columns (1) to (3), the dependent variable is the CAR[− 3,− 1]. The coefficients are from OLS estimations. In columns (4) to (6), the dependent variable equals 1 when the return club wins the match and zero otherwise. The coefficients in those columns are from probit estimations. We consider 20 stock exchange-listed soccer clubs that played in the Champions League or Europa Leagues between February 2004 and March 2020. Variables are defined in Panel b of Table 3. Standard errors clustered at the return-club and the season level are presented in parentheses, where ***p < 0.01, **p < 0.05, *p < 0.1

Table 7 Robustness tests

	(1) Win	(2) Loss	(3) Win	(4) Loss	(5) Win	(6) Loss	(7) Win	(8) Loss	(9) Win	(10) Loss
ΔGoal	0.352** (0.160)	0.374** (0.142)	0.305** (0.125)	0.384** (0.133)	0.489*** (0.146)	0.457** (0.199)	0.221 (0.153)	0.467** (0.216)	0.268* (0.131)	0.494** (0.211)
Unadj. ΔCoefficient	− 0.003 (0.006)	0.026* (0.014)								
ΔCapacity			− 0.042 (0.029)	0.173* (0.094)						
ΔCoefficient					0.001 (0.007)	0.032*** (0.006)	0.002 (0.008)	0.027* (0.013)	− 0.004 (0.005)	0.022** (0.010)
CAR[− 3,− 1]	− 0.112** (0.045)	− 0.155** (0.061)	− 0.103** (0.047)	− 0.149** (0.059)	− 0.047* (0.026)	− 0.185* (0.095)	− 0.014 (0.041)	− 0.240** (0.088)	− 0.083 (0.049)	− 0.178* (0.084)
Champions-League	− 0.152 (0.317)	− 0.494 (0.401)	− 0.189 (0.287)	− 0.374 (0.370)	− 0.162 (0.302)	− 1.095* (0.514)	0.022 (0.250)	− 0.658 (0.460)	0.005 (0.381)	− 0.518 (0.462)
FinalMatch	− 1.523 (1.157)	− 4.012*** (0.890)	− 1.598 (1.038)	− 4.080*** (0.869)	− 0.565 (1.180)	− 5.693*** (0.929)	− 0.687 (1.307)	− 4.653*** (0.961)	− 0.818 (1.041)	− 4.771*** (1.011)
KnockOutProgress	0.338 (0.669)	1.174 (1.070)	0.325 (0.700)	1.040 (1.072)	0.897 (0.652)	2.072 (1.363)	0.411 (0.579)	2.183** (0.973)	0.309 (0.765)	2.875** (1.196)
unexpectedWin	1.687** (0.660)		1.612** (0.660)		2.556*** (0.713)		1.950** (0.750)		1.658** (0.699)	
unexpected-Loss		− 1.072*** (0.334)		− 1.061** (0.392)		− 1.136* (0.626)		− 0.572 (0.547)		− 1.015 (0.584)
log (MC)					− 0.569** (0.261)	0.281 (0.313)				
Leverage					− 0.035*** (0.008)	0.010 (0.019)				
Season FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# obs	863	689	939	706	668	499	971	715	876	615
adj R2	0.026	0.087	0.023	0.087	0.047	0.089	0.011	0.086	0.017	0.089
# clubs	20	20	20	20	14	14	20	20	20	20
# seasons	16	16	17	17	17	17	17	17	17	17

The dependent variable in the OLS regressions is the postmatch cumulative abnormal return following a win in columns (1), (3), (5), (7) and (9) or following a loss in columns (2), (4), (6), (8), and (10) for the 20 listed soccer clubs that played in the Champions or Europa Leagues between February 2004 and March 2020. In columns (1) and (2), we employ the unadjusted relative coefficient; in columns (3) and (4), we employ the relative capacity measured by the clubs' stadium capacity; in columns (5) and (6), we add market capitalization and leverage as independent variables; in columns (7) and (8), we employ CAR[1,3] instead of CAR[1,2], which is used in all other columns; and in columns (9) and (10), we exclude from each club the first match in each season. In all specifications, season fixed effects are included but not reported. Please consult Panel b of Table 3 for a thorough description of the variables. Standard errors clustered at the return-club and the season level are presented in parentheses, where ***p < 0.01, **p < 0.05, *p < 0.1

stadium with that of its opponent.[7] In columns (3) and (4), we find that the relative capacity loads significantly positively when the match outcome is a loss, and it lacks significance when the outcome is a win. Thus, this alternative measure confirms our previous findings.

Additional control variables are added in our third robustness test, namely, the return club's market capitalization and its long-term leverage ratio. While market capitalization captures the size of the club, the leverage ratio is used as a risk measure; a lost match might have more severe implications when the club has a high leverage ratio and therefore little leeway to increase its financial capacity. We use only these two controls in a robustness test because their inclusion substantially reduces the number of observations.[8] These controls do not change the sign of the relative coefficient when the outcome is a loss (column (6)).

Our fourth robustness test applies an alternative event window. In columns (7) and (8), we consider CAR[1,3] and see that the relative coefficient has a significantly positive effect when the outcome is a loss.

Recent research shows that lottery-type assets are mispriced (Franke 2020) and that the sports betting market is inefficient (Bernardo et al. 2019). Deutscher et al. (2018) find evidence that betting market inefficiencies are especially pronounced at the start of the season because insufficient information might be available to determine a club's absolute and relative strength. Following their line of argument, we exclude the first match in each season for each return club as well as the opponent club. For the matches considered in the estimation, at least the outcome of the first match is available to bookrunners, and therefore, the betting market should be less inefficient. The results in columns (9) and (10) of Table 7 confirm our previous findings.

Thus far, we have focused only on the two subsamples of win and loss outcomes. Our next test, therefore, uses an alternative modeling approach in which we consider all observations simultaneously and include interaction terms of the relative coefficient and the match outcome, i.e., WIN, LOSS, and DRAW. The results are presented in column (1) of Table 8. We confirm that a higher relative coefficient leads to higher abnormal returns in the case of a loss. When the match results in a draw, the relative coefficient does not matter for the stock price response.

Because our sample contains abnormal returns from 20 soccer clubs, we also check whether we can confirm our findings when we include a fixed effect for each return club that controls for all observable and unobservable club characteristics that are constant over time. The results of this test are presented in column (2) of Table 8. They indicate that the relative coefficient affects abnormal returns if the outcome is a loss. Overall, we can conclude that the relative coefficient matters when the match outcome is a loss.

[7] Please note that there are two reasons that this proxy is not perfect. First, countries often have a national stadium where the club of that city plays and where national matches are played. In these cases, stadium size might not fairly represent the success of the club playing in this stadium. Second, over time, the stadium size and success of a club may substantially deviate because the construction of a new stadium takes time.

[8] We also check performance measures, such as the return on assets and the return on equity. These variables would, however, reduce our sample by approximately 50% and are therefore not employed.

Table 8 Alternative modeling approach

	(1)	(2)
ΔGoal	0.310** (0.114)	0.303** (0.118)
ΔCoefficient*LOSS	0.030** (0.011)	0.029** (0.011)
ΔCoefficient*DRAW	0.009 (0.014)	0.011 (0.014)
ΔCoefficient*WIN	− 0.002 (0.007)	− 0.002 (0.006)
CAR[− 3,− 1]	− 0.173*** (0.048)	− 0.173*** (0.049)
ChampionsLeague	− 0.213 (0.177)	− 0.182 (0.170)
FinalMatch	− 2.869*** (0.702)	− 2.845*** (0.721)
KnockOutProgress	0.679 (0.465)	0.704 (0.475)
WIN	0.259 (0.340)	0.271 (0.354)
unexpectedWin	1.526** (0.671)	1.523** (0.686)
LOSS	− 0.098 (0.401)	− 0.165 (0.406)
unexpectedLoss	− 0.929* (0.465)	− 0.839* (0.475)
Season FE	Yes	Yes
Club FE	No	Yes
# obs	2245	2245
adj R2	0.079	0.080
# clubs	20	20
# seasons	17	17

The dependent variable is the CAR[1,2] of 20 stock exchange-listed soccer clubs that played in the Champions or Europa Leagues between February 2004 and March 2020. To tackle that the effects of factors might have opposite effects depending on whether the outcome was a loss, draw or win, we include the following three interaction terms: *ΔCoefficient*LOSS*, *ΔCoefficient*DRAW* and *ΔCoefficient*WIN*. Please consult Panel b of Table 3 for a thorough description of the variables. Season fixed effects are included in all columns but not reported. In column (2), return-club fixed effects are included, which are not included in column (1). Standard errors clustered at the return-club and the season level are presented in parentheses, where ***p < 0.01, **p < 0.05, *p < 0.1

Finally, to verify that our results are not driven by one specific club, each club is removed from the specification reported in column (1) of Table 8. The interaction-term coefficients of interest between the relative coefficient and WIN and LOSS are presented in Fig. 2. For ΔCoefficient*WIN, the effect is always insignificant. For ΔCoefficient*LOSS, we see a significant effect with little variation. Overall, we can conclude that the results for the relative coefficient are not driven by any individual club.

6 Summary

Stock price responses to announcements of company news can be grounded on rational arguments as well as investors' emotions. We study the case of a soccer club's postmatch stock price responses to Champions League and Europa

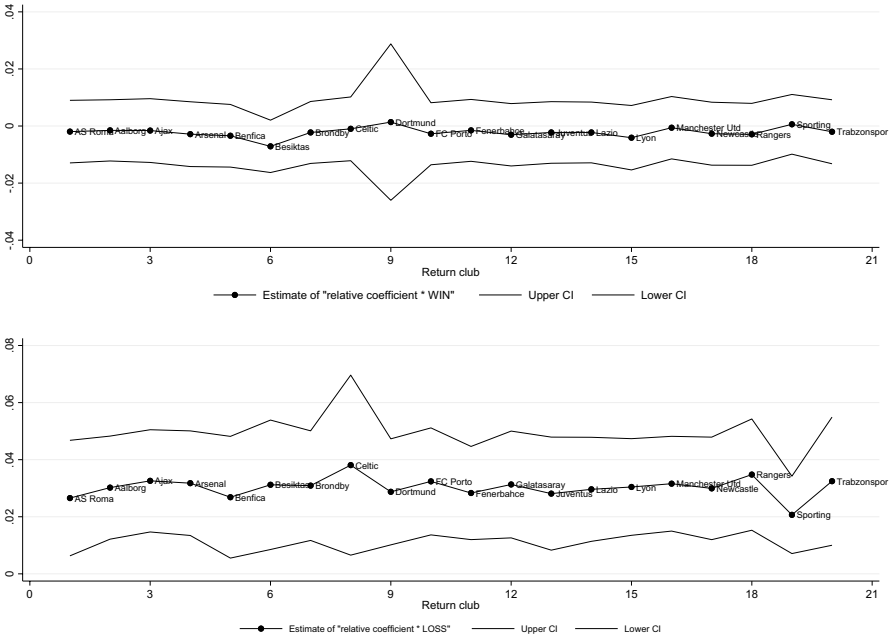

Fig. 2 These graphs plot coefficient estimates and their 90% confidence intervals (CIs) for the interaction terms between the relative coefficient and the match outcome WIN or LOSS. To obtain these estimates and their confidence intervals, we estimate the specification in column (1) of Table 8 and exclude each return club once. Return club numbers are assigned in alphabetical order. The confidence intervals are based on standard errors clustered at the return-club and the season level

League fixtures between 2004 and 2020 and consider rational and emotional explanations. In addition to rational factors, such as Champions League matches, which are characterized by higher prize money than Europa League fixtures, and progressing the knockout stage, we focus on the effects of a club's relative competitive strength because it may stir the emotional reactions of fan investors. We find that a club's current strength as manifested in the goal difference of a match increases abnormal returns after a win and a loss. Moreover, a higher relative UEFA coefficient of the previous season increases abnormal returns in the case of a loss. These results hold in several robustness tests. The effect of the relative UEFA coefficient is in line with investors' emotions and not with rational updating of the club's strength information. To check whether the relative UEFA coefficient is a valid proxy, we show that it significantly increases the probability of winning a match. We also study abnormal returns before the match because before the match, fan investors are too optimistic that their club will win, and this overoptimism leads to positive abnormal returns before the match, which impact abnormal returns when fan investors finally incorporate the match outcome into their stock valuation. In line with our interpretation that the relative UEFA coefficient triggers emotions after the match, we find no evidence that it affects CARs before a match.

Not all investors are expected to respond to match outcomes in an emotional way. While fan investors are prone to emotional responses, institutional investors, such as mutual funds and hedge funds, are not. We therefore test how the percentage of shares held by institutional investors affects the postmatch stock price response. A higher percentage of institutional holdings leads to higher postmatch abnormal returns after a loss, but it does not affect abnormal returns after a win. This finding may suggest that the postmatch price response is less emotional when a higher percentage of shares is held by institutional investors. We also test whether the stock price response to the difference in goals is moderated by institutional holdings and find that in the case of a win, this effect is significantly lower when institutional investors held a part of the club's shares. This finding lends further support to the argument that postmatch stock price responses are partly driven by emotions. Notably, a higher percentage of institutional holdings comes with lower CARs before a match, indicating that the overoptimism of investors before the match is less pronounced if more institutional holdings are among the shareholders. We have also evidence that indicates stock picking by institutional investors: the higher the percentage of institutional investors is, the higher the probability that the respective soccer club will win a match.

The validity of our results is tested in robustness checks, such as employing interaction terms on all soccer events or considering club fixed effects as a control for unobservable effects. However, our research has two imperfections. First, the stocks of soccer clubs are often thinly traded. We address this problem when we set up our model for predicting normal returns. Nevertheless, we cannot rule out that a sluggish adjustment in stock prices because of insufficient liquidity might be incompletely accounted for in our return prediction model. Second, we use betting quotations to model expectations for match outcomes. These betting quotations may imperfectly reflect outcome expectations because bookmakers have incentives to exploit prices in their favor. In a robustness test, we focus on matches where inefficiencies in betting quotations are less pronounced and find our results confirmed. Nevertheless, betting quotations may lead to misclassifying expected and unexpected outcomes in our study.

Our line of argument regarding the role of relative competitive strength and the moderating effect of institutional investors in emotional stock price responses transcend the scope of soccer clubs. Therefore, future research may investigate how relative competitive strength affects stock price responses in alternative settings. A setting in which it may play a significant role is in takeover battles, where several companies compete to acquire a target and differ in terms of their competitive strength. While, in the soccer setting, we can easily approximate relative competitive strength, it might be more difficult to approximate in other settings. However, relative company size will be—in many applications—a very valid starting point.

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Data availability The dataset generated during the current study is available in commercial databases that the authors acquired through a license. Information on how to obtain it and reproduce the analysis is available from the corresponding author on request.

Declarations

Conflict of interest The authors have no relevant financial or nonfinancial interests to disclose.

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