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THE PITCH RATHER THAN THE PIT

INVESTOR INATTENTION DURING FIFA WORLD CUP MATCHES

by Michael Ehrmann and David-Jan Jansen

In 2012 all ECB publications feature a motif taken from the €50 banknote.

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Abstract

At the 2010 FIFA World Cup in South Africa, many soccer matches were played during stock market trading hours, providing us with a natural experiment to analyze fluctuations in investor attention. Using minute-by-minute trading data for fifteen international stock exchanges, we present three key findings. First, when the national team was playing, the number of trades dropped by 45%, while volumes were 55% lower. Second, market activity was influenced by match events. For instance, a goal caused an additional drop in trading activity by 5%. The magnitude of this reduction resembles what is observed during lunchtime, and as such might not be indicative for shifts in attention. However, our third finding is that the comovement between national and global stock market returns decreased by over 20% during World Cup matches, whereas no comparable decoupling can be found during lunchtime. We conclude that stock markets were following developments on the soccer pitch rather than in the trading pit, leading to a changed price formation process.

JEL-codes: G12, G14, G15

Keywords: investor inattention, stock markets, trading volume, high-frequency data, soccer

Non-technical summary

Every four years, 32 national soccer teams compete in the World Cup. This tournament, which is organised by the world soccer association FIFA, attracts attention from millions of fans across the globe. During the 2010 edition in South Africa, many matches were played during stock market trading hours. This presents us with a natural experiment to analyze possible fluctuations in investor attention.

The paper presents three key findings. First, we find strong evidence of decreased activity in stock markets during soccer matches at the 2010 World Cup. Trading activity dropped markedly, especially if the national team was one of the competitors. Compared to normal market circumstances, the median number of trades dropped by 45% if the national team was playing, while the volume dropped by around 55%. Second, we show how goals scored by either team led to an even stronger decline in the number of trades and offered quotes. Also, we find that market activity was already significantly below the benchmark right before the match started, and continued to be lower during the 45 minutes after the match had ended. Third, we show that also price formation was affected during the soccer matches, as the evolution of returns on national markets decoupled from those on global markets.

Overall, there is a strong sense that stock markets were following developments on the soccer pitch rather than in the trading pit. These results provide evidence for limited attention in financial markets, which in itself affects the price formation process. Further tests show that inattention was particularly strong for relatively less salient information – there was a particularly strong decoupling of national from global markets as long as the price movements on the global market were relatively small. Furthermore, the cross-sectional dispersion of returns across the individual constituents of a country's stock market index was substantially reduced, suggesting that the distraction coming from the soccer matches led to a reduced focus on firm-specific as opposed to market and sector-wide information.

1. Introduction

Every four years, 32 national soccer teams compete in the World Cup. This tournament, which is organised by the world soccer association FIFA, attracts attention from millions of fans across the globe. During the 2010 edition in South Africa, many matches were played during stock market trading hours. This presents us with a natural experiment to analyze fluctuations in investor attention. We show that during matches at the 2010 World Cup, trading activity on fifteen international stock exchanges declined sharply, especially if the national team was one of the contenders. Furthermore, price formation on national markets decoupled from global markets. Overall, there is a strong sense that stock markets were following developments on the soccer pitch rather than in the trading pit.

This paper fits in the literature on limited attention in financial markets, which takes its cue from the idea that attention is a scarce resource (Kahnemann 1973).[1] In recent years, supportive empirical evidence has accumulated steadily. For instance, Cohen and Frazzini (2008) present evidence that news about a given firm is immediately reflected in that firm's stock price, but only affects stock prices of economically related firms with some delay, suggesting that there is inattention to relatively *complex information*. Peng and Xiong (2006) show that investors process more market and sector-wide information than firm-specific information, implying they are inattentive to relatively *detailed information*. Furthermore, DellaVigna and Pollet (2007) suggest that stock market valuations of age-sensitive sector stocks (such as toys, beer, or nursing homes) neglect (publicly available) demographic information, as investors are inattentive to *information about the distant future*.

Furthermore, Mondria et al. (2010) show how attention allocation *across countries* can help to explain home bias, while Hou, Peng and Xion (2009) focus on differential attention *across firms*. They show that less attention given to a stock leads to a muted price reaction to that company's earnings announcements. Barber and Odean (2008) find that individual investors tend to be net buyers of 'attention-grabbing' stocks, either meaning those that are discussed in the news, that experience high abnormal trading volume, or extreme one-day returns. This finding also suggests that salient information receives more attention.

Finally, a set of papers analyses variation in allocation of attention *across time*: DellaVigna and Pollet (2009) have argued that the upcoming weekend distracts investors and mutes the response to news released on a Friday. Indeed, they find that earnings announcements released on a Friday have a fifteen percent lower immediate response and a 70

[1] A related literature deals with inattention in macroeconomics, see, e.g., Mackowiak and Wiederholt (2009), Mankiw and Reis (2002) or Sims (2003).

percent higher delayed response. Also, trading volume is significantly lower around Friday announcements. Louis and Sun (2010) have shown how market reactions have also been less strong when merger announcements were made public on a Friday. Finally, Hirshleifer, Lim and Teoh (2009) have found that price and volume reactions to earnings surprises are weaker on days when a greater number of other firms release similar information.[2]

A major challenge in this literature is how to identify variation in investor attention. Corwin and Coughenour (2008) propose a direct test by studying market makers on the New York Stock Exchange, who often have to divide attention across a range of securities. They measure the degree of attention a specialist can give an individual stock by the inverse of trading volume and absolute returns of all stocks in her portfolio. Our paper proposes an alternative measure for shifts in investor attention across time: major sporting events. The 2010 FIFA World Cup is particularly suited for investigating such an exogenous shift, as a substantial amount of soccer matches were played during trading hours in Europe, the United States, Latin America and South Africa. Another distinguishing feature of our paper is the use of minute-by-minute data on stock market activity. Using data on the number of trades and trading volumes, we can accurately pinpoint shifts in attention. In particular, we are able to relate attention to match events, such as the scoring of goals or the half-time break.

We are not the first to study the effects of sporting events on financial markets. Edmans, García and Norli (2007) have shown that losing an international soccer match can lead to lower next-day returns on the national stock market of up to 49 basis points. For international cricket, rugby and basketball games, the loss effect is smaller, but still significant. Kaplanski and Levy (2010) argued that the loss effect found by Edmans et al. can even affect the U.S. stock market, as a large share of investors in most countries invest internationally.[3]

Major sporting events seem a likely candidate to study shifts in attention, as so many people follow these tournaments. During the 2010 World Cup more than three million spectators attended the 64 soccer matches.[4] However, most fans followed matches on television, either at home or in public places. The final match between Spain and the Netherlands was

[2] Other contributions include Gabaix, Laibson, Moloche and Weinberg (2006) and Hirshleifer and Teoh (2003).
[3] Another debate focuses on net economic benefits of hosting major sporting events. As it turns out, it is difficult to establish clear positive fall-out. Baade and Matheson (2004) estimate that U.S. host cities of the 1994 World Cup experienced cumulative losses of $5.5 to 9.3 billion. Taking a long-run perspective, Hagn and Maennig (2008) find that that the 1974 World Cup in West-Germany was unable to generate medium to long-run positive effects on employment. Rose and Spiegel (2011) provide a more positive assessment, by showing how exports of countries hosting the Olympic Games have been positively affected.
[4] http://www.fifa.com/worldcup/archive/southafrica2010/statistics/news/newsid=1273493/index.html

watched by 700 million viewers, according to early estimates by FIFA.[5] When the World Cup was held in Germany in 2006, 376 channels broadcasted the matches, and the total cumulative television audience for all matches during the 2006 World Cup was an amazing 26.3 billion. Furthermore, interest in the soccer matches is not restricted to one particular region. In 2006, Asia was the biggest contributor to the number of viewers, with more than eight billion in-home viewers during all matches, while audiences were also large in traditional soccer regions like Latin America and Europe. In the United States, audiences increased by around 40 % compared to the 2002 edition.[6] According to Nielsen, 112 million people in the US watched part of the games of the 2010 World Cup.[7]

When major sporting events take place during business hours, are people tempted to watch? Lozano (2011) estimates that the average worker in the United States reduced his working hours during the World Cups from 1994 to 2006 by between 9 and 28 minutes per week. Instead of taking time off, workers can also call in sick. Despite this being a major concern for employers, in a 2010 survey only 3% of workers in the United Kingdom said they would consider taking time off sick to watch games.[8] On the other hand, Skogman Thoursie (2004) has estimated that the number of Swedish men who reported sick increased in parallel to major, televised sporting events, such as the Olympic Games.

Is it possible that financial markets could also be distracted by sporting events? Would this not contrast the notion of continuously operating markets, where information is tirelessly processed 24 hours per day? Perhaps, but the literature on limited attention cited above strongly suggests that this view of financial markets may be optimistic. In response to upcoming soccer matches, investors may place orders well in advance of the matches, or, alternatively, postpone them to the next day. Alternatively, investors may still be present at their desk during matches, but may be distracted as the action unfolds. In the end, this question can only be settled empirically. Therefore, we assembled minute-by-minute data for stock markets of fifteen countries that participated in the 2010 World Cup. We gathered data on the number of ticks, trading volumes and offered quotes for all stocks included in a country's main stock index. We also collected information on the price history for the national stock index, as well as individual stock prices.

Using our high-frequency dataset, we present three key findings. First, we find strong evidence of decreased activity in stock markets during soccer matches at the 2010 World Cup.

[5] http://www.reuters.com/article/2010/07/13/us-football-idUSTRE66C0ZV20100713
[6] http://www.fifa.com/aboutfifa/marketing/factsfigures/tvdata.html
[7] http://blog.nielsen.com/nielsenwire/consumer/increased-viewership-online-visits-and-ad-engagement-among-world-cup-highlights/.
[8] http://www.kronos.co.uk/PR/Absence-Survey-2010.aspx

Trading activity drops markedly, especially if the national team is one of the competitors. Compared to normal market circumstances, the median number of trades drops by 45% if the national team is playing, while the volume drops by around 55%. Even though there is a clear heterogeneity in the magnitude of this effect across countries, we can identify a reduction in every single one of them. The decline in trading activity is also accompanied by a lower level of activity by market makers. During national team matches, the number of offered quotes is roughly 30% lower than otherwise.

Second, exploiting the minute-by-minute frequency of our data, we show how goals scored by either team led to an even stronger decline in the number of trades and offered quotes. Also, we find that market activity is already significantly below the benchmark right before the match starts, and continues to be lower during the 45 minutes after the match has ended. During the half-time break, trading activity recovers somewhat compared to the actual playing time, but remains substantially lower than on benchmark days.

Third, we show that also price formation is affected during the soccer matches. Assuming that the price formation on global stock markets on average should be changing only marginally, whereas national stock markets are more likely to be affected, we test whether and how the comovement between national and global stock market returns change during matches of the national team. On average, this comovement is found to be reduced by somewhat more than 20%, and it is smaller by more than 40% if returns in the global market are relatively small (and therefore less salient). Importantly, during lunchtime, when trading activity declines by a similar order of magnitude, there is only limited evidence of decoupling from global stock markets. This comparison suggests that soccer generated relatively high levels of inattention, which coincided with less frequent updating of stock prices. In line with this, we also find a significant decline of around 20% in the dispersion of individual stock returns, which should be expected if markets price only relatively salient information (such as global news), and neglect more idiosyncratic information (such as for instance stock-specific news).

This paper proceeds as follows: section 2 describes the data. Section 3 and 4 shows how World Cup soccer matches led to drops in trading activity. Section 5 presents evidence how, simultaneously, price formation on national stock markets decoupled from global markets. Section 6 presents additional results and robustness checks, while section 7 concludes.

2. Data and methodology

The dataset contains information on trading in major stocks on stock exchanges in nine European countries, four countries from Latin America and one country each from North America and Africa, on a minute-by-minute basis. We use two requirements when choosing the countries. First, high-frequency stock market data have to be available, and, second, the national team had to play at least one soccer match during trading hours of the national stock market. Per country, we use the major stock market index to define which individual stocks we would include. The stock market data was obtained through Bloomberg.

Table 1 presents an overview of the stock market indices covered for each country, and the number of stocks contained in each index. The number of stocks differs vastly across countries, ranging from 17 in Argentina's MERVAL Index to 100 in the UK's FTSE100 Index. In the light of this, and due to different market depths across countries, it will be important to normalise our trading activity indicators by country, as we would obviously expect more trades and higher volumes in a given minute if we aggregate over relatively more stocks, and for deeper markets. The final two columns list the trading hours of the national stock exchange, both in local time and in South African time.

Table 1

For each stock contained in the most relevant stock market index, we collected information on the number of trades, trading volumes (measured as the number of traded stocks), the number of bid-ask quotes and the quoted volumes on a minute-by-minute basis. We aggregate this information to the national level, such that we cover the entire trading activity for the most relevant stocks in a given country. Furthermore, we also obtained the level of the national stock market index on a minute-by-minute basis. We are only looking at the largest stocks in each country, as data availability poses less of an issue. This choice might introduce a bias against finding drops in trading activity. Any reduction in trading activity might be disproportionately larger for localised stocks which trade in thinner markets.

During the 2010 FIFA World Cup, the national team of one of the countries in our database was playing during regular national trading hours on 29 occassions. Table 2 has information on the relevant matches. Capital letters indicate we are able to evaluate effects for a particular match. We cover 21 matches, as in eight cases, data for both teams are available. Table 2 shows how most matches in our sample are from the group stage. Also, we include two second-round matches and one quarter-final.

Table 2

In addition to analysing 'own matches' - matches where the national team of a given country is playing - we test whether trading activity is affected when any of the other 31 nations are playing. In this case, the number of events increases to 317.[9] At the same time, given that the national team is not participating, we would expect smaller, if any, effects on trading activity.

To estimate the effect of World Cup matches on trading activity (measured by either the number of trades or the volume of traded stocks), we first define expected trading activity, $\overline{TA}$, in country *c* at the time of day *t* and the weekday *dow* as:

$$\overline{TA}_{c,t,dow} = \frac{\sum_{t} TA_{c,t,dow}}{n_{c,t,dow}}, t \notin WorldCup, \quad (1)$$

where TA denotes actual trading activity and *n* is the number of observations. Our measure therefore computes the average trading activity observed in a given country for a given time of day, and separately for each day of the week outside the World Cup ($t \notin World\ Cup$). As such, this benchmark controls for country effects, day-of-the-week effects and time-of-the-day effects. To compute this benchmark, we use six weeks prior to the World Cup and three weeks afterwards. The 2010 World Cup started on June 11 and ended on July 11. Our full dataset covers, therefore, the period from May 1st to July 31st, 2010.

Then, we compute abnormal trading activity (*ATA*) as the percentage difference from expected activity:

$$ATA_{c,t,dow} = 100 \frac{ATA_{c,t,dow} - \overline{TA}_{c,t,dow}}{\overline{TA}_{c,t,dow}}, \quad (2)$$

So, for each minute during a World Cup match, we can compare, say, the number of trades to the average number of trades on that particular country's stock exchange, during the same time-of-day, during the same weekday, but during a period outside the World Cup. In the empirical analysis, we use these measures of abnormal activity (either trades or volumes) as our dependent variables. In the robustness analysis, we show that using an alternative measure of abnormal trading activity leads to qualitatively similar conclusions.

[9] Note that here, we are able to use matches by all countries participating in the World Cup, and not just the fifteen for which we were able to obtain high-frequency data. The only requirement is that these matches take place during trading hours in the countries for which we have data.

3. Less trading activity during soccer matches

We first show graphical evidence. Figures 1 and 2 present histograms of the relative number of trades and trading volumes as defined in equation (2). These variables are shown for the national matches (black bars) and for the benchmark period before and after the World Cup (grey bars). The latter only includes those times of the day and days of the week where we actually observe matches, meaning we use directly comparable data.[10] Figure 1 presents the results for the pooled dataset, whereas Figure 2 shows country results.

Figures 1 and 2 suggest the following three points. First, when the national team is playing, there is a shift in the distribution of abnormal trading activity. Both for the number of trades and trading volumes, the figures indicate lower levels of market activity. Second, our variables of interest are non-normal, which we need to take into account in our estimations. Our main strategy is to use median regressions rather than least-squares regressions, to counter the effect of outliers. In one of the robustness exercises, we use tobit regressions, which take into account that the dependent variables are truncated from below at -100%. We furthermore show how the findings are robust to a number of other estimation methods. Third, the reduction portrayed in Figure 1 is mirrored in the national breakdown, with evident reductions in nearly all countries. At the same time, there is important heterogeneity across countries.

Figures 1 and 2

Table 3 provides a statistical assessment of the shifts in trading activity. We show results for numbers of trades and trading volume, first for the pooled data, second broken down by country, and finally aggregated by continent.[11] Column 1 of Table 3 provides the median number of trades and the median trading volume during our control sample, so before June 11 and after July 11, 2010, during time windows that match the time windows of the soccer matches. The second column shows the reduction in trading activity during other nations' matches (so, excluding matches in which the national team participated), and the third column contains the corresponding numbers for own matches. Column 4 indicates whether the reduction in trading activity during own matches is significantly larger than during other nations' matches.

Tables 3 and 4

Starting with the pooled results, the impression from figures 1 and 2 is clearly confirmed. Market activity drops significantly during 2010 World Cup soccer matches. The median number

[10] For these plots, but not for the later analysis, we exclude values larger than 500%. Such observations are rare and make the reading of the chart difficult.
[11] Note, though, that for North America and Africa, these results are based on just one country.

of trades is lower by 24% during other nations' matches, and by 45% during own matches. Not surprisingly, this effect is substantially larger if a country's national soccer team is playing compared to matches by other nations. Whereas a reduced number of transactions could be compensated by an increase in the volume traded per transaction, this is clearly not the case: also the median volume is reduced, and even by a somewhat larger magnitude (namely by 55%).

Again, there are substantial differences across countries. Still, in nearly all countries, trading activity is strongly reduced. The drop in trading activities for individual countries can be substantial, with a maximum of 40% reduction in the median number of trades for other nations' matches (in case of Argentina), and a maximum of 83% for the own matches (in case of Chile). The Latin American countries show particularly large declines – for the case of the reduction in number of trades during own matches, the four Latin American countries are among the six largest reductions observed. In line with this, Table 4 tests for differences across continents, and finds that, indeed, Latin America shows the biggest drop in trading activity during own matches.

A final comment relates to the results for the United States. Contrary to our prior, we also find strong indications of declining activity in U.S. stock markets. Often, the United States is not perceived as being enthusiastic about soccer. At the same time, investors in the U. S. markets often have an international background, which might explain the rather strong effects. This role of international investors is also crucial in Kaplanski and Levy's (2010) argument that the loss effect after World Cup matches has had negative effects on U.S. markets. Also, it must be said that interest in soccer in the U.S. has been increasing over the years. As estimated by Nielsen, well over 100 million people watched at least part of the games of the 2010 edition.[12] In addition, the results by Lozano (2011) are relevant, who showed that even in the United States, workers take time off to follow matches.

4. Match events influenced trading activity

The median regressions indicate shifts in trading activity across the entire time of the matches. For a more detailed analysis, we are interested how trading activity evolved during, before and after the soccer matches. In particular, can we show that it reacted to match-related events, such as goals, cautions or half-time? To code when the match occurred, we use match reports

[12] http://blog.nielsen.com/nielsenwire/consumer/increased-viewership-online-visits-and-ad-engagement-among-world-cup-highlights/.

available on the FIFA-website.[13] These reports identify the exact length of each half, by providing the amount of injury time, and show the timing of special events such as goals or red and yellow cards.[14] As we cannot be fully certain that the match started on time, and as half-time may have taken longer than the standard fifteen minutes, we use dummies for goals and cautions that equal one during the minute when the event is recorded, but also during the two minutes before and after. The dataset comprises 63 goals and 142 red and yellow cards. If, for a given match, both teams are in our dataset, we count these events for both countries. As explanatory variables for the evolution of trading activity, we also include dummies for the 15 minute period prior to the kick-off. During this period, game previews are televised, and the national anthems are being played, which may already distract investors. We also include dummies for half-time, to see if traders make up for lost activity during the first half. Finally, we test whether and how market activity recovers, by adding dummy variables for the first, the second and third quarter of an hour after each match. These regressions do therefore contain observations for the match time as well as the preceding fifteen and the subsequent 45 minutes. The regression is (for the example of trades per minute) specified as:[15]

$$\begin{aligned} trades_{c,t} = {} & \alpha_1 + \alpha_2 goal_{c,t} + \alpha_3 card_{c,t} + \alpha_4 anthems_{c,t} + \alpha_5 halftime_{c,t} + \\ & \alpha_6 aftermath\_1_{c,t} + \alpha_7 aftermath\_2_{c,t} + \alpha_8 aftermath\_3_{c,t} + u_{c,t} \end{aligned} \tag{3}$$

Table 5 reports results. Columns 1 and 2 report benchmark results from median regressions, whereas all subsequent ones report sensitivity tests, which we will discuss in Section 6. The constant term in the benchmark results indicates that, on average, median trading activity is lower by 47% for the number of trades, and by 57% for the trading volume. These magnitudes are in line with table 3. However, during the five minutes surrounding a goal, there is an additional reduction of around 5% (significantly estimated for the number of trades). In contrast, cautions do not lead to additional drops in activity. Interestingly, the reduced market activity starts already in the run-up to the match. Again, the effects are sizeable, in the magnitude of 40% for number of trades, and 50% for trading volume. These figures are obtained as the sum of the constant and the coefficient on the anthems variable. After the match, trading recovers, albeit slowly. Only after 30-45 minutes, trading activity is roughly back to normal levels. During the half-time break, trading activity is still around 35% lower than on benchmark days. However, market activity is higher than during actual playing-time, suggesting investors do compensate for the lower activity during the first half, and the expected loss of activity during the second half.

[13] Source: http://www.fifa.com/worldcup/archive/southafrica2010/matches/index.html. See also: http://www.fifa.com/mm/document/affederation/technicaldevp/01/29/30/95/reportwm2010_web.pdf
[14] As there is only one penalty in our sample, we cannot check for any effects.
[15] The dependent variable is as defined in equation (2), so we already control for country fixed effects.

Table 5

5. Decoupling: less comovement with global stock markets

Having established that there is reduced trading activity during soccer matches, we will now investigate whether this also had effects on price formation consistent with a reduced attention due to the distraction presented by the matches.[16] The main results are based on an aggregate approach, by studying stock indices rather than prices of individual stocks. However, section 6 will report additional findings on the dispersions of returns of individual stocks. We are specifically interested in the effects of matches played by the national team on the country's stock exchange. If investors are less attentive during matches, relevant news would not be incorporated as quickly in prices as under normal circumstances (in line with previous results by DellaVigna and Pollet (2009), Hirshleifer, Lim and Teoh (2009) or Louis and Sun (2010)). Unfortunately, there is no systematic news arrival during our sample (such as earnings announcements or the release of macroeconomic data) that would allow for a direct test of this hypothesis.

Accordingly, we will take an indirect approache and study the comovement between the national stock market and the global stock market. Under the assumption that the global stock market should be affected only marginally by a Wrold Cup soccer match, we would expect that the global stock market continues to price news in a regular fashion. If attention really had sizeable effects on the national stock markets, we would expect that this cand affect the national pricing patterns, leading to a neglect of news that get priced into the global market. Accordingly, the comovement between national and global markets would be less strong.[17] To test this hypothesis, we estimate the following model using minute-by-minute data:

$$r_{c,t} = \alpha_1 + \alpha_2 r_{c,t-1} + \alpha_3 r_{c,t-2} + \alpha_4 r_{c,t-3} + \beta r_{w,t} + \delta r_{w,t} match_{c,t} + \gamma_1 match_{c,t} + \gamma_2 dow_{c,t} + \gamma_3 tod_{c,t} + u_{c,t} \quad (4)$$

[16] We also assessed whether the loss effect documented by Edmans et al. (2007) could be confirmed using our high-frequency data. To this end, we computed abnormal returns and regressed those on dummies measuring wins and losses. For horizons up to 24 hours after the match, we found no significant effects of match outcomes on returns. However, it should be noted that the number of matches is small compared to Edmans et al.. Also, most of the matches included in our sample were played during the group stage, where the impact of losing a match is smaller than during the elimination stage.

[17] Many authors have analyzed the comovement of stock markets across countries. One issue in the debate is whether the comovement of returns across national markets has increased, and if so, why. Another point of discussion is whether country or industry factors are the most relevant driver of comovement (Bekaert, Hodrick and Zhang 2009; Brooks and Del Negro 2004; Heston and Rouwenhorst 1994).

where $r_{c,t}$ denotes index returns in country c, $r_{w,t}$ is the return of the global stock market index (measured by the MSCI World Index), $match_{c,t}$ is a dummy variable equal to one during the time of a national team's match, $dow_{c,t}$ are dummy variables for weekdays (Monday through Thursday), and $tod_{c,t}$ are dummy variables for each five-minute period of a day.[18] In the extreme case, if only local investors trade on the stock exchange, and assuming full inattention, there would be no price movements in local markets. In that case, our estimations would indicate that $\delta = -\beta$. In practice, a portion of the trades is initiated by international investors. Also, presumably, only a fraction of investors will be distracted by soccer matches. Therefore, we expect $0 < \delta < -\beta$.

We estimate the regressions using panel-corrected standard errors (PCSE) proposed by Beck and Katz (1995). In contrast to related work (Edmans et al. 2007, Hirshleifer and Shumway 2003), we assume that the only deviations from Gaussian errors in $u_{c,t}$ are due to panel heteroskedasticity. This means that we allow the variance of $u_{c,t}$ to be country-specific, but do not allow for contemporaneous cross-country correlation. The reason is that the matches in our sample are usually not played at the same time.[19]

For brevity, Table 6 shows only selected coefficients. The parameters of interest are the comovement of stock returns when the national team is not playing a match (coefficient β, labelled as *beta* in the table) and the changing strength of this comovement during matches (coefficient δ, labelled as *decoupling* in the table). For the pooled regression reported in the first row, *beta* is estimated to be 0.87, indicating a high degree of international stock market integration.[20] Interestingly, however, this comovement became substantially weaker during national team matches: On average, the comovement is reduced by 21%. On the one hand, this suggests that national stock markets still follow global developments during matches. However, there is a strong sense of decoupling, as markets are following developments on the soccer pitch, rather than in the trading pit.

The country-by-country regressions in the remaining part of Table 7 confirm this overall picture. Even if the decoupling parameter is significantly estimated only for seven six countries,

[18] Allowing for lags of the global stock market index or estimating a static model leads to similar conclusions. Results available on request from the corresponding author.

[19] An alternative estimation method would be the FGLS approach (Parks 1967, Kmenta 1986). Beck and Katz (1995) argued that FGLS may produce anti-conservative standard errors in cases where the number of time observations (T) is small relative to the number of panels (N). For each of the fifteen countries in our sample, however, at least 85 minutes of playing time during market opening hours are available. Still, Beck and Katz (1996) have also argued that the efficiency gains of FGLS will be minor unless high heteroskedasticity and parameter homogeneity are present.

[20] By construction, the MSCI World Index is to a large extent driven by developments in U.S. and U.K. markets. Therefore, we re-ran the pooled regression without these two countries, which gave very similar results.

the point estimates are negative for most countries. Germany is the notable exception, where we find, counterintuitively, an increase in the strength of the comovement.

Table 6

6. Robustness and extensions

This section reports on a large number of robustness tests and various extensions. We will proceed along the three key findings. First, we discuss the results of reduced trading activity during soccer matches, then proceed to the reactions to match events, and finally discuss the results for price formation.

6.1 Reduced trading activity during soccer matches: robustness

Using market makers to measure activity, and using different estimators

Table 7 reports on a number of robustness checks for the results of Table 3. Whereas we had previously tested for effects on the number of trades and the traded volumes, the row 'Quotes' repeats the estimations for the number of quotes given per minute, as well as the quoted volumes. The focus here is on market maker activity, rather than on actual trades. Again, we find strong indications of reduced activity during national team matches.

Second, given the non-normality of the variables of interest, we had used median regressions in table 3. The row 'OLS regression' in table 7 shows how the qualitative conclusions are similar when using least-squares regressions (using panel-corrected standard errors). Third, as our dependent variable is truncated from below at -100%, we also ran tobit regressions. Again, the conclusion is that there is a significant reduction in the number of trades and traded volumes.

Table 7

Evidence using German government bond futures

A further robustness test checks whether the results obtained are specific to the 2010 FIFA World Cup, or could also be observed more systematically. Unfortunately, we do not have access to the equivalent intraday stock market data that would allow expanding our analysis to previous World Cups. Instead we reverted to an intra-day dataset for trading in long-term German government bond futures, covering a highly liquid basket of both non-benchmark and benchmark German governments bonds with a remaining time-to-maturity between 8.5 and

10.5 years. We have obtained these data from TickData.[21] Regarding the number of trades, our data covers the World Cups organized by France (1998), Japan and South Korea (2002), Germany (2006) and South Africa (2010). We evaluate shifts in investor attention for a total of eight matches during these tournaments, in which Germany participated, and which were played during German trading hours. Regarding trading volumes (measured as the number of contracts – over €1 million each) our data sample is shorter, such that we are able to analyze effects for three German matches during the World Cups in 2006 and 2010. This robustness test implies that we cover a very different financial market, as well as soccer matches played during different World Cups. Table 7 show that the effects are again sizeable, with a reduction in trading activity of 29% for the number of trades, and 48% for the trading volume.[22]

Placebo time schedule

In order to assess whether the results are truly driven by the soccer matches, or possibly by other factors, we ran the empirical analysis, while shifting the times of the soccer matches by 120 minutes backward. So, a match that started at 16:00 would be coded to start at 14:00. Of course, we would expect to see no effect of these artificial matches on trading activity. Indeed, as the final row of table 7 shows, the effect is small and statistically insignificant for the number of trades, and virtually zero for the volume traded. We also applied the placebo time schedule to our analysis of decoupling. Doing so, we find as expected that the decoupling parameter is insignificant.[23]

Alternative definition of abnormal trading activity

In our benchmark analysis, we compare trading activity during matches to average activity during corresponding days of the week and times of the day outside the World Cup. In this section, we study abnormal trading activity using a filtering procedure as in Edmans et al. (2007), who follow Gallant, Rossi and Tauchen (1992). The idea is to construct, for each country, a mean-zero, unit variance series for abnormal trading activity $\acute{\omega}_{ct}$. First, for each country in the

[21] The data generally refer to the contract with the nearest maturity. The switch to the next maturity is done by a procedure that compares daily tick volumes for two adjacent contracts. It switches usually around 3-5 days before expiration of the contract with the nearest maturity, when daily tick volumes exceed those of the old contract. This procedure ensures maximum liquidity of the considered contracts. For more information, see http://www.tickdata.com.

[22] If we exclude the one German match from the 2010 World Cup, the number of trades still shows a significant decline of 22.4%. On the other hand, there is no significant decline in the traded volumes, possibly due to the fact that the sample covers only two matches in this case.

[23] Results not shown; available upon request from corresponding author.

dataset, we run the regression $V_{ct} = \upsilon_{0c}\, x_{ct} + u_{ct}$, where V_{ct} denotes the natural logarithm of trading activity (either the number of trades or trading volume) in country c in minute t, and x_{ct} contains a constant, time-of-day dummies for each five-minute period during trading hours, day-of-the-week dummies, weekly and monthly dummies, a time trend, the time trend squared, and 15 lags of the dependent variables.[24] Next, we use the residuals to model the variance as $\log(\acute{u}^2_{ct}) = \upsilon_{1c}\, y_{ct} + \varepsilon_{ct}$ where y_{ct} has the same components as $x_{ct,}$ with the exception of the lagged dependent terms. In the end, abnormal trading activity is defined as $\acute{\omega}_{ct} = a_c + b_c\, \acute{u}_{ct}/\exp(\acute{\upsilon}_{1c} y_{ct}/2)$ where we choose a_c and b_c such that $\acute{\omega}_{ct}$ has zero mean and unit variance.

As these alternative measures of abnormal trading activity show few outliers, we use least-squares regressions, again using panel-corrected standard errors. The bottom row of table 7 has results, which broadly confirm our earlier findings. During matches by the national team, there is a reduction in both measures of trading activity (column 3). For number of trades, the abnormal reduction is 0.14 standard deviations, while for trading volumes, the reduction is 0.16. In addition, we also find a significant, though small, reduction in trades during matches in which the national team did not participate.

6.2 Robustness analysis for match events

As mentioned in section 4, we performed various robustness results for the analysis of match events. In addition to the benchmark findings, the remaining columns of table 5 list results replacing trades by quotes (panel "Quotes"), conducting least-squares regressions (panel "OLS regression"), tobit regressions (panel "Tobit regression"), artificially shifting backward the timing of all matches by 120 minutes (panel "Shifted time schedule"), and using the alternative measure of abnormal trading activity (panel "Alternative definition of abnormal trading"). In the first three cases, the constant terms continue to point to a marked drop in trading activity during matches. Also, the additional effect of goals scored by either team on the number of trades is replicated by the other estimations. When using the placebo time schedule, we find no clear significant findings. In the last column, using the alternative measure of abnormal trades, we find that goals are accompanied by significant declines in the number of trades (of 0.19 standard deviations), but do not significantly affect trading volumes.[25]

[24] We also used, with similar results, specifications with more and fewer lags.

[25] Note that in this case, trading activity is already above match levels in the first 15 minutes after the match ended. This is due to the construction of the abnormal trade levels, which use fifteen lags of the variables. By treating the depressed levels of activity during the match as normal market circumstances, even a slight uptick in trading after the match ends will be seen as an abnormal increase.

6.3 Further results for price formation

Decoupling: salience of information

The literature has identified that the salience of information may matter in the presence of inattentive investors, with more salient information receiving relatively more attention (e.g. Barber and Odean 2008). Our setup allows for testing this by conditioning on the size of price changes. Thus, we study whether the reduction in comovement is more pronounced for large than for regular-sized price movements in global markets. Large price changes in global markets (or the underlying news that triggered these price changes) are more likely to get noticed, even by relatively inattentive investors. In contrast, regular swings in global prices might be more easily overlooked, especially when soccer matches are also drawing attention. Accordingly, we expect that the decoupling results presented above are particularly pronounced in a situation when price changes in global stock markets were relatively muted.

To test this hypothesis, we extend the regression model of equation 4 by differentiating both the *beta* and *decoupling* terms depending on the magnitude of the movement in global stock markets. Table 8 presents the corresponding results. In the first column, we classify returns in the global stock market as large, if they are above the 90^{th} and below the 10^{th} percentile of the sample distribution. In the second column, the definition is based on movements beyond the 85^{th} and the 15^{th} percentile.

Table 8

Two findings emerge. When there are no soccer matches in progress, the comovement between national and global stock markets differs somewhat across large and regular-sized market movements. In particular, the comovement is smaller when we condition on large movements in global stock markets. Second, in line with our hypothesis, the decoupling is particularly strong during regular price changes on global markets. In the presence of salient price swings in global stock markets, we still find evidence for a lower comovement between global and local markets. However, the degree of decoupling is less pronounced. The coefficient is only reduced by some 15% to 18%. When swings in global stock prices are relatively smaller (and thus less salient), the degree of decoupling is estimated to be well over 40%. This low degree of comovement suggests that national stock markets pretty much "dance to their own tune" during soccer matches, at least as long as there are no large movements in global stock markets. The different decoupling results are in line with the idea that salient information has a greater impact on price formation, thus confirming the hypothesis that there is investor inattention during soccer matches.

Decoupling during lunch hours

Does the drop in trading activity really constitute a shift in attention? To provide further guidance on our results, we study what happens during lunch hours, as this is another occasion on which trading activity is often systematically lower. At the same time, we would expect that market participants arrange their lunch time in a way that ensures attention to the ongoing developments, such that we would not expect a decoupling to occur. Therefore, examining trade and return patterns during lunch hours serves as a benchmark to see if soccer has really acted as a distraction, by lowering attention.

We define lunchtime as the two hours with the largest drop in trading activity relative to the rest of the trading day. For instance, for most of the European countries in our sample, this definition takes the two hours between 12:00 and 13:59 as the lunch break. Using the same approach as for the soccer matches, we find that the median trading activity is reduced by 38% (43%) for the number of trades (volume traded). This decline in trading activity is comparable to what we established for soccer matches, and supports using lunch hours as a benchmark.

How are stock returns affected during lunch breaks? To examine this, we extend the regression model of equation (4) to

$$r_{c,t} = \alpha_1 + \alpha_2 r_{c,t-1} + \alpha_3 r_{c,t-2} + \alpha_4 r_{c,t-3} + \beta r_{w,t} + \delta_1 r_{w,t} match_{c,t} + \delta_1 r_{w,t} lunch_{c,t} + \gamma_1 match_{c,t} + \gamma_2 dow_{c,t} + \gamma_3 tod_{c,t} + \gamma_4 lunch_{c,t} + u_{c,t} \quad (5)$$

where all variables are defined as in equation (4), with the addition of a dummy variable that is equal to one during lunchtime, and its interaction with the global stock market index. Estimation results are given in Table 9. First, including the dummy for lunch hours does not change the estimates for the other variables. Second, we find a small effect of lunch hours on the comovement between local and global stock returns. However, compared to the decoupling during soccer matches, the decoupling parameter of 0.018 during lunch hours is negligible. In comparison, the large decoupling during soccer matches indicates that inattention had substantive price effects.

Table 9

A reduced pricing of firm-specific information

A final test exploits the cross-sectional variation in our dataset. Peng and Xiong (2006) have shown that limited investor attention leads investors to process more market and sector-wide

information than firm-specific information. Applying this finding to our case, it should be that individual stock prices move in a less idiosyncratic fashion during soccer matches, i.e. that there is stronger comovement across the stocks in a given country. To test this hypothesis, we computed the standard deviation of minute-by-minute stock returns across all constituents of the national stock index. Table 10 shows that percentage difference of this dispersion measure during soccer matches compared to the benchmark period outside the World Cup (defined analogously to equations 1 and 2). We find a significant reduction in dispersion during other nations' matches of 19.5%, and even a slightler stronger drop during national team matches. This result is in line with the hypothesis that during times of inattention, firm-specific news are priced in to a smaller extent than market and sector-wide information.

Table 10

7. Conclusions

This paper uses a major sporting event to study the occurrence and effects of shifts in investor attention. Using high-frequency data on fifteen international stock markets, we present three pieces of evidence on reduced attention during soccer matches at the 2010 FIFA World Cup. Using various measures, primarly the number of transactions and the volumes of traded stocks, we find evidence of strongly reduced activity in stock markets, especially during matches in which the national team competed. Using minute-by-minute data also allows us to relate stock market activity to events during matches. In particular, we find how the number of offered quotes and the number of actual trades were significantly lower at the time when goals were scored.

In line with previous work (DellaVigna and Pollet 2009; Hirshleifer, Lim and Teoh 2009; Louis and Sun 2010), we show how limited attention in stock markets has had implications for price formation. National stock markets comoved less with global stock markets, suggesting that news which got priced into the global market affected the national market in a different fashion than otherwise. This decoupling was especially large when there were no outstanding price movements in global stock markets, which indicates that in particular less salient information received less attention during soccer matches. Interestingly, no such decoupling is found during lunchtime, despite a reduction in trading activity of a similar magnitude. In the light of this, we conclude that markets were following developments on the soccer pitch rather than in the trading pit, leading to a changed price formation process.

References

Baade, R. A. and V. A. Matheson (2004) 'The Quest for the Cup: Assessing the Economic Impact of the World Cup' *Regional Studies* 38(4), 343-354.

Barber, B. M. and T. Odean (2008) 'All That Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors' *Review of Financial Studies* 21(2), 785-818.

Beck, N. and J. N. Katz (1995) 'What to do (and not to do) with time-series cross-section data' *American Political Science Review* 89(3), 634-647.

Beck, N. and J. N. Katz (1996) 'Nuisance vs. Substance: Specifying and Estimating Time-Series-Cross-Section Models' *Political Analysis* 6(1), 1-36.

Bekaert, G., R. J. Hodrick and X. Zhang (2009) 'International Stock Return Comovement' *Journal of Finance* LXIV(6), 2591-2626.

Brooks, R. and M. Del Negro (2004) 'The rise in comovement across national stock markets: Market integration or IT bubble?' *Journal of Empirical Finance* 11, 649–680.

Cohen, L. and A. Frazzini (2008) 'Economic Links and Predictable Returns' *Journal of Finance* LXIII(4), 1977-2011.

Corwin, S. A. and J. F. Coughenour (2008) 'Limited Attention and the Allocation of Effort in Securities Trading' *Journal of Finance* LXIII(6), 3031-3067.

DellaVigna, S. and J. M. Pollet (2007) 'Demographics and Industry Returns' *American Economic Review* 97(5), 1667-1702.

DellaVigna, S. and J. M. Pollet (2009) 'Investor Inattention and Friday Earnings Announcements' *Journal of Finance* LXIV, 709-749.

Edmans, A., D. García and Ø. Norli (2007) 'Sports Sentiment and Stock Returns' *Journal of Finance* LXII(4), 1967-1997.

Gabaix, X., D. Laibson, G. Moloche and S. Weinberg (2006) 'Costly Information Acquisition: Experimental Analysis of a Boundedly Rational Model' *American Economic Review* 96(4), 1043-1068.

Gallant, R., P. E. Rossi and G. Tauchen (1992) 'Stock prices and volume' *Review of Financial Studies* 5, 199-242.

Hagn, F. and W. Maennig (2008) 'Employment effects of the Football World Cup 1974 in Germany' *Labour Economics* 15, 1062-1075.

Heston, S. L. and G. K. Rouwenhorst (1994) 'Does industrial structure explain the benefits of international diversification?' *Journal of Financial Economics* 36, 3-27.

Hirshleifer, D., and T. Shumway (2003) 'Good Day Sunshine: Stock Returns and the Weather' *Journal of Finance* LVIII(5), 1009-1032.

Hirshleifer, D. and S. H. Teoh (2003) 'Limited attention, information disclosure, and financial reporting' *Journal of Accounting & Economics* 36, 337-386.

Hirshleifer, D., S. S. Lim and S. H. Teoh (2009) 'Driven to Distraction: Extraneous Events and Underreaction to Earnings News' *Journal of Finance* LXIV(5), 2289-2325.

Hou, K. L. Peng and W. Xiong (2009) 'A tale of two anomalies: The implications of investor attention for price and earnings momentum' Working Paper. Available at http://ssrn.com/abstract=976394.

Kahnemann, D. (1973) *Attention and Effort,* Englewood Cliffs, NJ: Prentice-Hall.

Kaplanski, G. and H. Levy (2010) 'Exploitable Predictable Irrationality: The FIFA World Cup Effect on the U.S. Stock Market' *Journal of Financial and Quantitative Analysis* 45(2), 535-553.

Kmenta, J. (1986) *Elements of Econometrics* 2nd edition. New York: MacMillan.

Louis, H. and A. Sun (2010) 'Investor Inattention and the Market Reaction to Merger Announcements' *Management Science* 56(10), 1781-1793.

Lozano, F. A. (2011) 'The flexibility of the workweek in the United States: Evidence from the FIFA World Cup' *Economic Inquiry* 49(2), 512-529.

Mackowiak, B. and M. Wiederholt (2009) Optimal Sticky Prices under Rational Inattention' *American Economic Review* 99, 769-803.

Mankiw, G. and R. Reis (2002) 'Sticky Information Versus Sticky Prices: a Proposal to Replace the New Keynesian Phillips Curve' *Quarterly Journal of Economics* 117, 1295-1328.

Mondria, J., T. Wu and Y. Zhang (2010) 'The determinants of international investment and attention allocation: Using internet search query data' *Journal of International Economics* 82, 85-95.

Parks, R. (1967) 'Efficient estimation of a system of regression equations when disturbances are both serially and contemporaneously correlated' *Journal of the American Statistical Association* 62(318), 500-509.

Peng, L. and W. Xiong (2006) 'Investor attention, overconfidence, and category learning' *Journal of Financial Economics* 80(3), 563-602.

Rose, A. K. and M. M. Spiegel (2011) 'The Olympic effect' *Economic Journal,* 121(553), 652-677.

Sims, Christopher A. 'Implications of Rational Inattention' *Journal of Monetary Economics*, 50(3), 665–90.

Skogman Thoursie, P. S. (2004) 'Reporting sick: are sporting events contagious' *Journal of Applied Econometrics* 19, 809-823.

White, H. (1980) 'A Heteroskedasticity-Consistent Covariance Matrix and a Direct Test for Heteroskedasticity' *Econometrica* 48, 817-838

Figure 1a: Abnormal number of trades, for control sample and during own matches at the 2010 World Cup

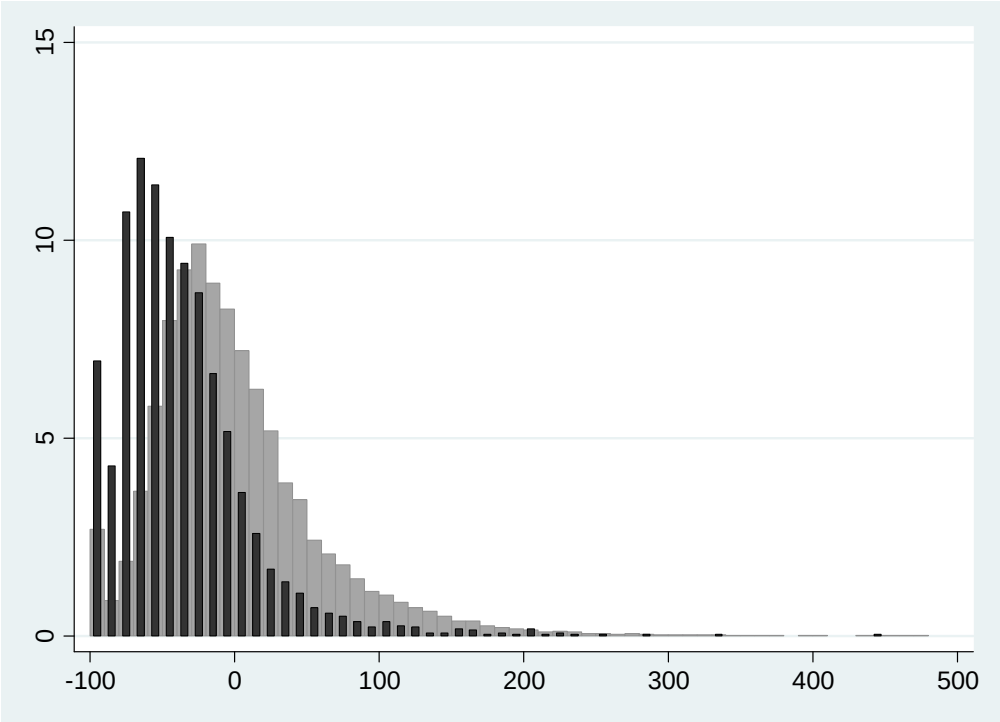
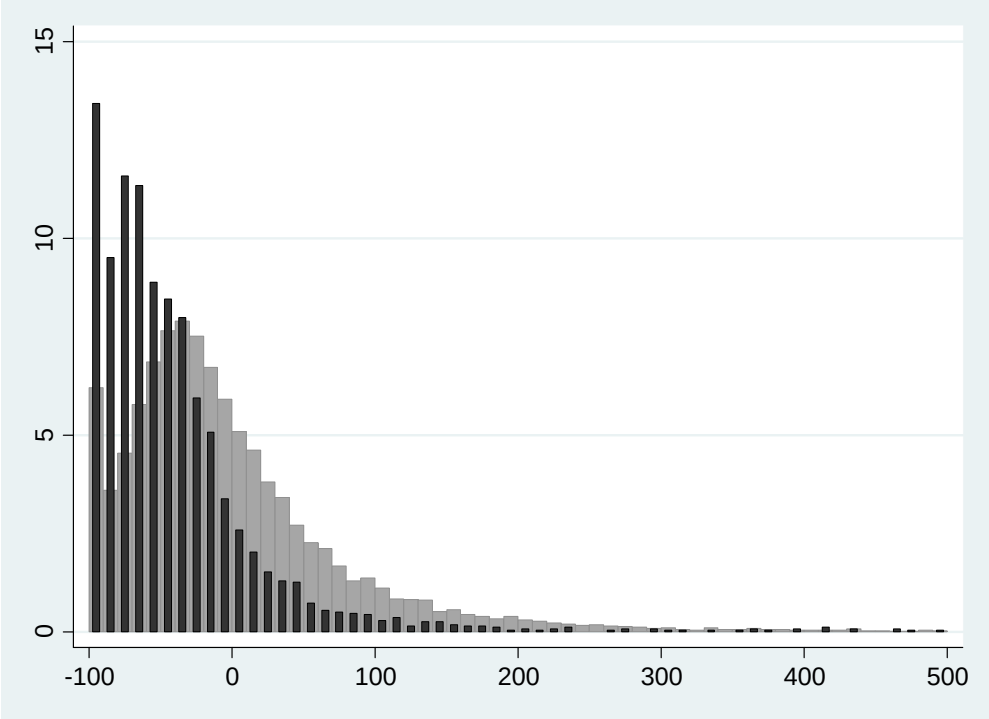
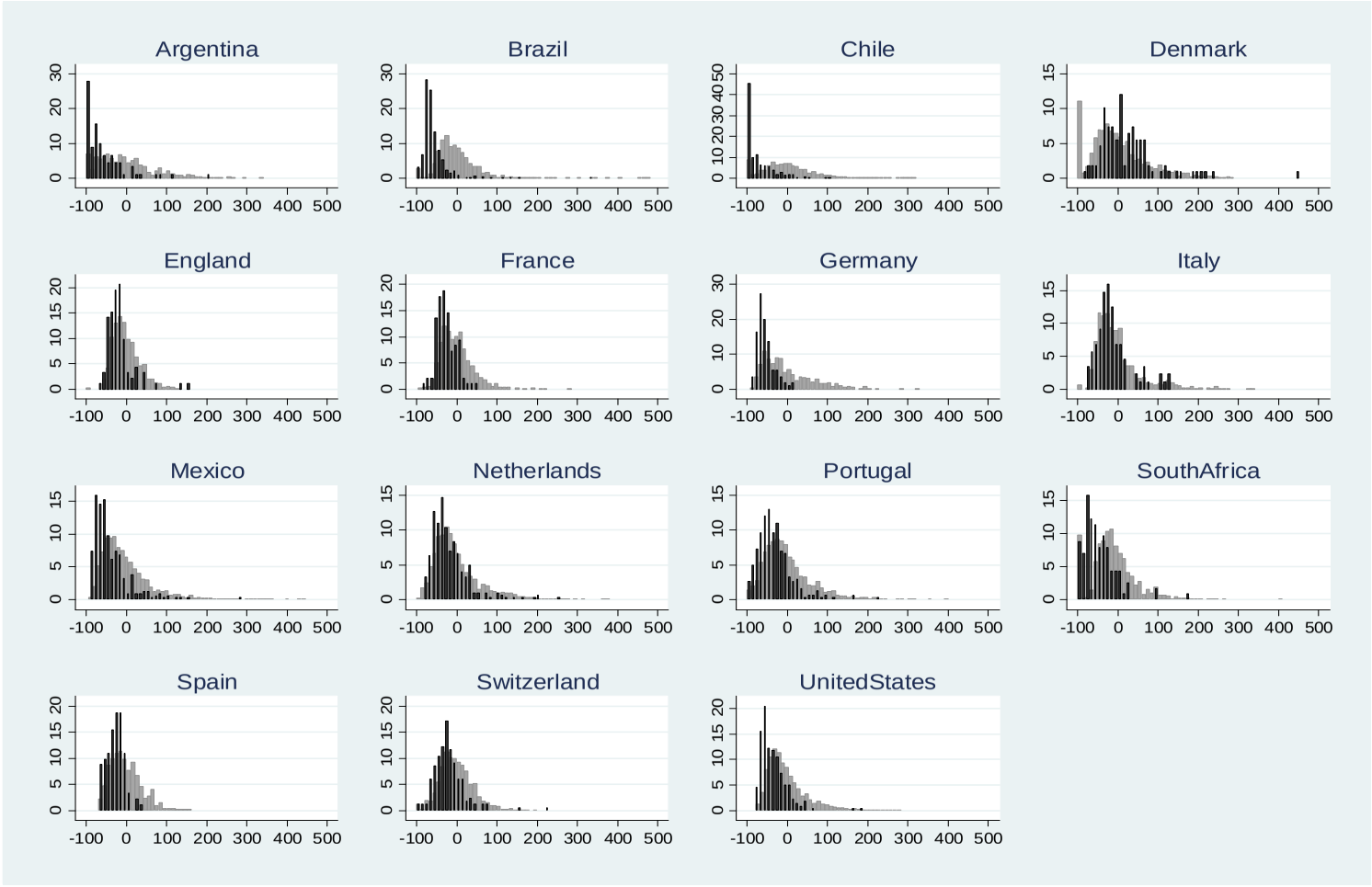


Figure 1b: Abnormal trading volume, for control sample and during own matches at the 2010 World Cup



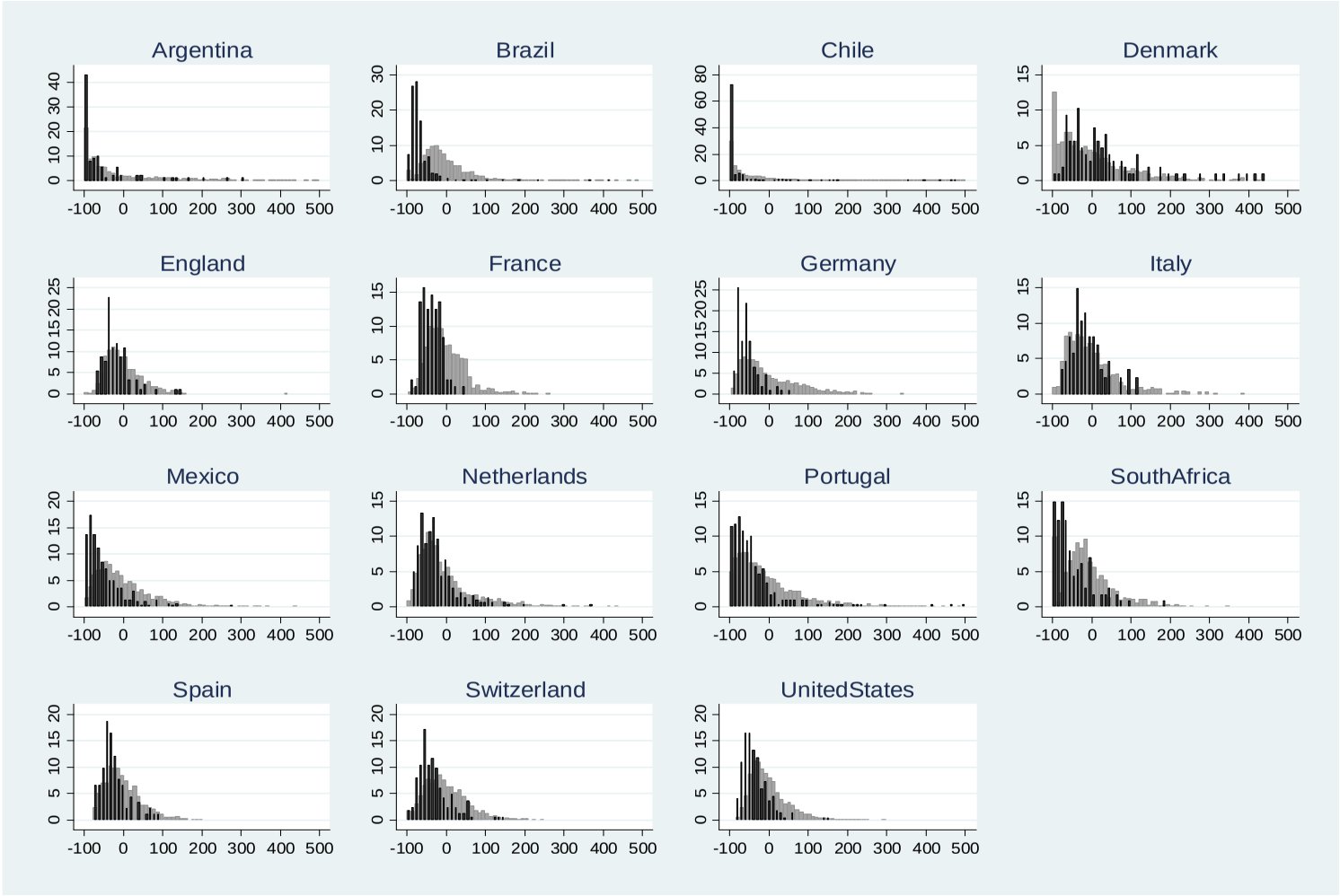
Note: Percentage differences of trading activity compared to the average activity in the same country, at the same time of day and the same day of the week for a control sample covering several weeks before and after the 2010 World Cup. See equations 1 and 2 in the main text. Grey bars represent data for comparison time windows, black bars for time windows during World Cup matches by the national team.

Figure 2a: Histogram of abnormal trades, for control sample and during own matches at the 2010 World Cup, by country



Note: The charts show the percentage difference of trading activity compared to the average activity in the same country, at the same time of day and the same day of the week for a control sample covering several weeks before and after the 2010 World Cup. Grey bars represent data for comparison time windows, black bars for time windows during World Cup matches by the national team.

Figure 2b: Histogram of abnormal trading volumes, for control sample and during own matches at the 2010 World Cup, by country



Note: The charts show the percentage difference of trading activity compared to the average activity in the same country, at the same time of day and the same day of the week for a control sample covering several weeks before and after the 2010 World Cup. Grey bars represent data for comparison time windows, black bars for time windows during World Cup matches by the national team.

Table 1: Country and stock market index coverage

Country	Stock Index	Number of stocks in index	Trading hours (local)	Trading hours (South African time)
Argentina	MERVAL	17	11.00-17.00	16.00-22.00
Brazil	BOVESPA	57	10.00-17.00	15.00-22.00
Chile	IPSA	40	9.30-16.30	15.30-22.30
Denmark	OMX Copenhagen 20	20	9.00-17.00	9.00-17.00
England	FTSE 100	100	8.00-16.30	9.00-17.30
France	CAC40	40	9.00-17.30	9.00-17.30
Germany	DAX	30	9.00-17.30	9.00-17.30
Italy	Dow Jones Italy Titans 30	30	9.00-17.25	9.00-17.25
Mexico	IPC	20	8.30-15.00	15.30-22.00
Netherlands	AEX	25	9.00-17.30	9.00-17.30
Portugal	PSI 20	20	9.00-17.30	9.00-17.30
South Africa	FTSE/JSE 40	40	9.00-17.00	9.00-17.00
Spain	IBEX 35	35	9.00-17.30	9.00-17.30
Switzerland	SMI	20	9.00-17.30	9.00-17.30
United States	DJIA	30	9.30-16.00	15.30-22.00

Note: The table shows the countries covered in the dataset, the name of the respective stock indices, and the number of stocks contained therein. The final two columns show trading hours at the stock exchange in local time and in South African time.

Table 2: Matches during 2010 World Cup covered in the analysis

Date	Start	Teams	Score	Red or yellow cards
Group stage (round 1)				
11-Jun	16.00	SOUTH AFRICA-MEXICO	1-1	4
14-Jun	13.30	NETHERLANDS-DENMARK	2-0	3
15-Jun	16.00	Cote d'Ivoire-PORTUGAL	0-0	3
15-Jun	20.30	BRAZIL-Korea DPR	2-1	1
16-Jun	16.00	SPAIN-SWITZERLAND	0-1	4
Group stage (round 2)				
17-Jun	20.30	France-MEXICO	0-2	6
18-Jun	13.30	GERMANY-Serbia	0-1	9
18-Jun	16.00	Slovenia-UNITED STATES	2-2	5
21-Jun	16.00	CHILE-SWITZERLAND	1-0	10
21-Jun	13.30	PORTUGAL-Korea DPR	7-0	4
Group stage (round 3)				
22-Jun	16.00	MEXICO-Uruguay	0-1	3
22-Jun	16.00	FRANCE-SOUTH AFRICA	1-2	2
22-Jun	20.30	Greece-ARGENTINA	0-2	2
23-Jun	16.00	UNITED STATES-Algeria	1-0	6
23-Jun	16.00	Slovenia-ENGLAND	0-1	4
24-Jun	16.00	Slovakia-ITALY	3-2	8
25-Jun	16.00	PORTUGAL-BRAZIL	0-0	7
25-Jun	20.30	CHILE-Spain	1-2	4
Round of 16				
28-Jun	16.00	NETHERLANDS-Slovakia	2-1	5
28-Jun	20.30	BRAZIL-CHILE	3-0	5
Quarter finals				
02-Jul	16.00	NETHERLANDS-BRAZIL	2-1	6

Note: Start of the match according to time in South Africa. For the countries in capital letters, we can evaluate effects on stock markets during that particular match.

Table 3a: Trades per minute, and percentage change during World Cup matches

	(1) Trades per min, outside World Cup	(2) % change during other nations' matches		(3) % change during own matches		Comparison (2) vs. (3)
All	142	-23.792***	*0.281*	-45.152***	*0.955*	+++
Argentina	4	-40.000***	*1.432*	-72.093***	*4.697*	+++
Brazil	725	-17.061***	*0.708*	-65.312***	*0.821*	+++
Chile	9	-28.409***	*1.066*	-83.333***	*2.608*	+++
Denmark	41	-22.313***	*1.539*	8.094	*9.246*	+++
England	1,370	-23.108***	*0.927*	-21.274***	*1.917*	
France	1,312	-20.523***	*0.965*	-30.266***	*3.383*	+++
Germany	256	-30.140***	*0.839*	-59.008***	*2.094*	+++
Italy	637	-21.857***	*0.929*	-20.473***	*2.477*	
Mexico	82	-17.566***	*1.238*	-52.019***	*1.823*	+++
Netherlands	347	-24.213***	*1.211*	-29.236***	*2.694*	+
Portugal	57	-27.206***	*1.259*	-39.171***	*2.238*	+++
South Africa	13	-5.954***	*1.990*	-54.123***	*4.408*	+++
Spain	424	-22.738***	*0.650*	-26.137***	*2.974*	
Switzerland	237	-26.027***	*1.039*	-23.702***	*3.318*	
United States	1,270	-24.440***	*0.903*	-42.316***	*3.034*	+++
North America	1,270	-24.440***	*0.903*	-42.316***	*3.034*	+++
Latin America	68	-24.050***	*0.638*	-65.337***	*1.008*	+++
Europe	213	-24.238***	*0.371*	-29.221***	*1.184*	+++
Africa	13	-5.954***	*1.990*	-54.123***	*4.408*	+++

Table 3b: Volume traded per minute, and percentage change during World Cup matches

	(1) Volume per min, outside World Cup	(2) % change during other nations' matches		(3) % change during own matches		Comparison (2) vs. (3)
All	276,693	-33.059***	*0.240*	-55.188***	*1.331*	+++
Argentina	16,389	-68.620***	*1.430*	-79.764***	*4.960*	++
Brazil	562,462	-28.494***	*1.198*	-74.549***	*1.178*	+++
Chile	321,560	-79.030***	*1.183*	-99.513***	*0.397*	+++
Denmark	8,098	-30.951***	*2.250*	6.145	*8.984*	+++
England	2,303,583	-32.037***	*0.702*	-26.528***	*5.526*	
France	453,307	-26.720***	*1.223*	-37.745***	*4.059*	+++
Germany	159,641	-36.975***	*0.964*	-59.519***	*2.000*	+++
Italy	3,016,058	-13.852***	*1.753*	-19.399***	*4.979*	
Mexico	410,283	-24.358***	*1.284*	-63.298***	*2.281*	+++
Netherlands	215,749	-32.422***	*1.077*	-33.829***	*2.496*	
Portugal	122,888	-47.333***	*1.811*	-56.985***	*3.266*	++
South Africa	15,789	-14.058***	*2.061*	-62.891***	*5.196*	+++
Spain	594,593	-28.892***	*0.994*	-30.687***	*3.387*	
Switzerland	129,836	-37.535***	*1.182*	-39.972***	*4.658*	
United States	488,720	-23.524***	*0.630*	-42.779***	*2.438*	+++
North America	488,720	-23.524***	*0.630*	-42.779***	*2.438*	+++
Latin America	417,159	-43.182***	*0.622*	-77.405***	*0.758*	+++
Europe	163,045	-31.571***	*0.400*	-37.745***	*1.456*	+++
Africa	15,789	-14.058***	*2.061*	-62.891***	*5.196*	+++

Note: The tables show in column (1) the median number of trades per minute (Table 3a) and the trading volume (Table 3b), for time windows that correspond to match times, yet which lie outside the period when the World Cup was played. These were computed following equation 1 in the main text. Column (2) shows the percentage reduction in the respective numbers observed during matches by other nations, and column (3) the percentage change during matches by the national team. These figures correspond to equation 2 in the main text. The last column tests whether the numbers in column (3) are significantly lower than those in column (2). ***/**/* and +++/++/+ denote statistical significance at the 1%/5%/10% level. All estimations based on median regressions.

Table 4a: Trades per minute, and percentage change during World Cup matches by continent

	% change during other nations' matches						% change during own matches					
			comparison versus						comparison versus			
			(A)	(B)	(C)	(D)			(A)	(B)	(C)	(D)
(A) North America	-24.440***	*0.903*				+++	-42.316***	*3.034*		+++	+++	++
(B) Latin America	-24.050***	*0.638*				+++	-65.337***	*1.008*	+++		+++	+++
(C) Europe	-24.238***	*0.371*				+++	-29.221***	*1.184*	+++	+++		+++
(D) Africa	-5.954***	*1.990*	+++	+++	+++		-54.123***	*4.408*	++	+++	+++	

Table 4b: Volume traded per minute, and percentage change during World Cup matches by continent

	% change during other nations' matches						% change during own matches					
			comparison versus						comparison versus			
			(A)	(B)	(C)	(D)			(A)	(B)	(C)	(D)
(A) North America	-23.524***	*0.630*		+++	+++	+++	-42.779***	*2.438*		+++	+	+++
(B) Latin America	-43.182***	*0.622*	+++		+++	+++	-77.405***	*0.758*	+++		+++	+++
(C) Europe	-31.571***	*0.400*	+++	+++		+++	-37.745***	*1.456*	+	+++		+++
(D) Africa	-14.058***	*2.061*	+++	+++	+++		-62.891***	*5.196*	+++	+++	+++	

Note: The tables show, separately for each continent, the percentage change in the median number of trades per minute (Table 4a) and the volume traded per minute (Table 4b) observed during matches by other nations (left panel) and during own matches (right panel). The tables also provide the result of a test whether the respective numbers are significantly different across continents. ***/**/* and +++/++/+ denote statistical significance at the 1%/5%/10% level.

Table 5: Trading activity and match events: benchmark and robustness

	Benchmark		Quotes		OLS regression		Tobit regression		Shifted time schedule		Alternative definition of abnormal trading	
	Trades	Volume	Trades	Volume	Trades	Volume	Trades	Volume	Trades	Volume	Trades	Volume
Goals	-4.929**	-3.354	-9.658***	-9.401**	-7.960**	-7.921	-9.234***	-12.336**	-3.037	-109.877	-0.199**	-0.132
	(2.446)	*(2.471)*	*(2.740)*	*(4.507)*	*(3.125)*	*(7.587)*	*(3.175)*	*(5.803)*	*(4.265)*	*(244.889)*	*(0.081)*	*(0.083)*
Red or yellow cards	4.528	1.669	-0.806	-3.021*	0.523	-7.657	0.330	-8.552**	-4.546	-99.017	-0.001	-0.002
	(3.407)	*(2.515)*	*(2.509)*	*(1.835)*	*(2.239)*	*(5.887)*	*(2.341)*	*(3.867)*	*(3.252)*	*(173.150)*	*(0.056)*	*(0.057)*
National anthems	7.101***	6.852***	0.265	5.558*	6.293**	14.773**	6.561***	15.749*	-9.627***	-134.102	0.023	0.039
	(2.001)	*(2.417)*	*(2.034)*	*(2.945)*	*(2.461)*	*(6.805)*	*(2.461)*	*(8.651)*	*(3.500)*	*(163.269)*	*(0.062)*	*(0.063)*
Half time	9.683***	10.961***	-0.555	-0.844	8.229***	14.932**	8.044***	14.180	-2.766	-131.072	0.249***	0.206***
	(2.381)	*(2.927)*	*(2.541)*	*(3.463)*	*(2.481)*	*(6.859)*	*(3.051)*	*(9.997)*	*(3.563)*	*(169.670)*	*(0.062)*	*(0.064)*
15 minutes after match	10.979***	13.694**	-3.810	-9.051**	11.067***	9.245	12.395***	14.048**	4.869	-135.015	0.288***	0.273***
	(4.113)	*(6.136)*	*(3.099)*	*(4.225)*	*(3.836)*	*(8.934)*	*(3.215)*	*(5.591)*	*(5.389)*	*(234.529)*	*(0.090)*	*(0.095)*
16-30 minutes after match	12.592***	13.433***	3.062	-3.154	10.503***	7.888	11.829***	12.680**	6.767	-131.651	0.117	0.181**
	(4.526)	*(4.952)*	*(3.052)*	*(4.019)*	*(3.840)*	*(8.935)*	*(3.298)*	*(5.600)*	*(5.394)*	*(233.789)*	*(0.087)*	*(0.091)*
31-45 minutes after match	27.371***	36.105***	4.748	1.269	22.190***	40.811***	23.516***	45.604***	-11.944**	-107.265	0.237***	0.231**
	(4.439)	*(5.867)*	*(3.889)*	*(7.640)*	*(3.840)*	*(8.935)*	*(3.095)*	*(13.872)*	*(5.394)*	*(233.789)*	*(0.087)*	*(0.091)*
Constant	-47.305***	-56.755***	-27.345***	-29.093***	-37.807***	-35.444***	-39.133***	-40.236***	-0.930	129.122*	-0.166***	-0.176***
	(1.179)	*(1.169)*	*(1.167)*	*(1.140)*	*(1.116)*	*(3.121)*	*(1.190)*	*(2.591)*	*(1.614)*	*(71.897)*	*(0.028)*	*(0.029)*
Observations	3,721	3,720	3,487	3,487	3,721	3,720	3,721	3,720	3,638	3,638	3,290	3,290
R2					0.018	0.008					0.012	0.009

Note: The table shows the results of regression model (3), which estimates trading activity during, before and after own World Cup matches and is (for the example of trades per minute) specified as $trades_{c,t} = \alpha_1 + \alpha_2 goal_{c,t} + \alpha_3 card_{c,t} + \alpha_4 anthems_{c,t} + \alpha_5 halftime_{c,t} + \alpha_6 aftermath\_1_{c,t} + \alpha_7 aftermath\_2_{c,t} + \alpha_8 aftermath\_3_{c,t} + u_{c,t}$ For a definition of regressors, please see the main text. Panel "Benchmark" reports benchmark results, based on median regressions. Other columns show additional results, namely replacing trades by quotes (panel "Quotes"), conducting least-squares regressions (panel "OLS regression"), tobit regressions (panel "Tobit regression"), artificially shifting backward the timing of all matches by 120 minutes (panel "Shifted time schedule"), and using an alternative definition of abnormal trading (panel "Alternative definition of abnormal trading"). ***/**/* denote statistical significance at the 1%/5%/10% level. Numbers in italics are robust standard errors.

Table 6: Less comovement with global stock markets during national team matches

	Own lags		Beta		Decoupling		Obs.	R2
All	0.028	***	0.866	***	-0.181	***	442,118	0.235
	0.002		*0.002*		*0.029*			
Argentina	0.327	***	0.031	*	0.071		21,240	0.056
	0.040		*0.016*		*0.075*			
Brazil	0.280	***	0.669	***	0.029		26,145	0.331
	0.025		*0.027*		*0.067*			
Chile	-0.257		0.057	***	-0.102	**	24,570	0.029
	0.190		*0.012*		*0.045*			
Denmark	0.054	***	0.791	***	-0.132		29,450	0.190
	0.018		*0.085*		*0.272*			
England	-0.085	***	1.087	***	-0.310	***	32,130	0.416
	0.013		*0.067*		*0.077*			
France	-0.056	***	1.366	***	-0.375	***	33,150	0.382
	0.015		*0.084*		*0.141*			
Germany	-0.074	***	0.995	***	1.056	***	33,150	0.305
	0.019		*0.050*		*0.209*			
Italy	-0.016		1.532	***	-0.008		32,320	0.359
	0.014		*0.105*		*0.149*			
Mexico	0.139	***	0.465	***	-0.235	***	25,343	0.220
	0.030		*0.067*		*0.087*			
Netherlands	-0.063	***	1.172	***	-0.155		33,150	0.353
	0.013		*0.077*		*0.104*			
Portugal	0.074	***	0.561	***	-0.175	**	32,640	0.082
	0.019		*0.062*		*0.084*			
South Africa	0.054	***	0.798	***	-0.378	**	29,610	0.214
	0.019		*0.070*		*0.149*			
Spain	-0.007		1.695	***	-0.236		33,150	0.344
	0.013		*0.096*		*0.150*			
Switzerland	-0.087	***	0.655	***	-0.021		31,500	0.197
	0.011		*0.037*		*0.077*			
United States	-0.104	**	1.295	***	-0.287	***	24,570	0.709
	0.048		*0.028*		*0.106*			

Note: The table shows the results of regression model (4), which estimates national stock market returns as a function of own lags, global stock market returns, day of the week effects, time of the day effects, time of own matches, and an interaction of global stock market returns and the timing of own matches, and is specified as $r_{c,t} = \alpha_1 + \alpha_2 r_{c,t-1} + \alpha_3 r_{c,t-2} + \alpha_4 r_{c,t-3} + \beta r_{w,t} + \delta r_{w,t} match_{c,t} + \gamma_1 match_{c,t} + \gamma_2 dow_{c,t} + \gamma_3 tod_{c,t} + u_{c,t}$ Column "Own lags" reports the sum of coefficients on the own lags, Column "Beta" the coefficient on the global stock market returns (β), and Column "Decoupling" the coefficient on the interaction term (δ). ***/**/* denote statistical significance at the 1%/5%/10% level. For the pooled results, numbers in italics are panel-corrected standard errors which allow the variance of $u_{c,t}$ to be country-specific, but do not allow for contemporaneous cross-country correlation. For the country results, numbers in italics are White (1980) robust errors.

Table 7: Robustness tests for overall change in trading activity during own matches

		(1) Activity per min, outside World Cup	(2) % change during other nations' matches		(3) % change during own matches		Comparison (2) vs. (3)
Quotes	*Number of quotes*	787	-16.289 ***	*0.286*	-28.39 ***	*1.046*	+++
	Volume quoted	5,706,251	-14.469 ***	*0.386*	-30.10 ***	*0.573*	+++
OLS regression	*Number of trades*	381	-12.897 ***	*-6.224*	-37.148 ***	*6.340*	+++
	Volume traded	610,382	-3.139	*-0.379*	-35.291 ***	*6.316*	+++
Tobit regression	*Number of trades*	381	-13.226 ***	*0.315*	-38.758 ***	*0.919*	+++
	Volume traded	610,382	-7.859 ***	*1.666*	-40.474 ***	*1.687*	+++
German government	*Number of trades*	24	--	--	-28.780 ***	*0.433*	n.a.
bond futures	*Volume traded*	1,491	--	--	-47.940 ***	*0.917*	n.a.
Shifted time schedule	*Number of trades*	222	-7.814	*4.848*	-3.857	*5.430*	
	Volume traded	355,598	-1.079	*5.763*	0.024	*6.788*	
Alternative definition	*Number of trades*	0	-0.018 ***	*0.006*	-0.144 ***	*0.023*	+++
of abnormal trading	*Volume traded*	0	-0.009	*0.006*	-0.156 ***	*0.023*	+++

Note: The table shows the results of a set of robustness tests to Table 3, by testing whether the percentage change in the median number of trades per minute and the volume traded per minute observed during matches in which the national team competed is observed also when replacing trades by quotes given by market makers (panel "Quotes"), when conducting least-squares regressions rather than median regressions (panel "OLS regression"), when using a tobit regression to account for the left-censoring of the dependent variable (panel "Tobit regression"), when using data on German government bond futures for all German soccer cup matches during trading time from 1998-2010 (panel "German government bond futures"), when artificially shifting backward timing of all matches by 120 minutes (panel "Shifted time schedule"), and when using an alternative filtering scheme as in Edmans et al. (2007) and Gallant et al. (1992) to construct mean zero, unit variance series for abnormal trades or trading volumes (panel "Alternative definition of abnormal trading"). ***/**/* and +++/++/+ denote statistical significance at the 1%/5%/10% level. Numbers in italics are robust standard errors. In case of quotes and the shifted time schedule, these standard errors account for clustering by country.

Table 8: Decoupling: different comovement during large and regular movements of global index

	(1)		(2)	
Own lags	0.028 ***	*0.002*	0.028 ***	*0.002*
Beta for regular movements	0.943 ***	*0.010*	1.014 ***	*0.014*
Decoupling for regular movements	-0.395 ***	*0.060*	-0.455 ***	*0.085*
Beta for large movements	0.862 ***	*0.002*	0.862 ***	*0.002*
Decoupling for large movements	-0.130 ***	*0.034*	-0.159 ***	*0.031*
Obs.	442,118		442,118	
R2	0.235		0.235	

Note: See table 6. The results are based on a regression model that further differentiates whether the movements in global stock markets are large or regular-sized. In column (1), global stock market movements are classified as large if they are above the 90th or below the 10th percentile of the sample distribution. In column (2), large global stock market movements are those beyond the 85th or below the 15th percentile of the sample distribution. ***/**/* denote statistical significance at the 1%/5%/10% level. Numbers in italics are panel-corrected standard errors which allow the variance of $u_{c,t}$ to be country-specific, but do not allow for contemporaneous cross-country correlation.

Table 9: Comparing decoupling during soccer matches and lunch hours

	Own lags	Beta	Decoupling during matches	Decoupling during lunch	Obs.	R2
All	0.028 ***	0.868 ***	-0.182 ***	-0.018 **	442,118	0.235
	0.002	*0.002*	*0.029*	*0.008*		

Note: The table shows the results of regression model (5), which estimates national stock market returns as a function of own lags, global stock market returns, day of the week effects, time of the day effects, time of own matches, lunchtime, an interaction of global stock market returns and the timing of own matches, and an interaction of global stock market returns and lunchtime, and is specified as $r_{c,t} = \alpha_1 + \alpha_2 r_{c,t-1} + \alpha_3 r_{c,t-2} + \alpha_4 r_{c,t-3} + \beta r_{w,t} + \delta_1 r_{w,t} match_{c,t} + \delta_2 r_{w,t} lunch_{c,t} + \gamma_1 match_{c,t} + \gamma_2 dow_{c,t} + \gamma_3 tod_{c,t} + \gamma_4 lunch_{c,t} + u_{c,t}$

Column "Own lags" reports the sum of coefficients on the own lags, Column "Beta" the coefficient on the global stock market returns (β), Column "Decoupling during matches" the coefficient on the first interaction term (δ_1), and , Column "Decoupling during lunch" the coefficient on the second interaction term (δ_2). ***/**/* denote statistical significance at the 1%/5%/10% level. Numbers in italics are panel-corrected standard errors which allow the variance of $u_{c,t}$ to be country-specific, but do not allow for contemporaneous cross-country correlation.

Table 10: Results for dispersion of stock returns

	(1) Activity per min, outside World Cup	(2) % change during other nations' matches		(3) % change during own matches		Comparison (2) vs. (3)
Return dispersion	0.114	-19.595 ***	*0.247*	-21.596 ***	*0.879*	+++

Note: See table 3. This table present additional results for the standard devation of all individual stock in a country's index. ***/**/* and +++/++/+ denote statistical significance at the 1%/5%/10% level. Estimations based on median regressions.