

International football results lead to irrationality in the German stock market?



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Abstract

This study intends to find a possible relationship between the football match outcomes of the German national team and the German stock market. This will be done by using daily data from the DAX index in the period of 1 June 1990 to 15 July 2016. During this period, all matches played by the German national team in the World Cup and the Euro Cup will be taken into investigation. The method that is applied to test for a possible relationship between the index returns and the match outcomes is an Ordinary Least Squared (OLS) statistical regression model. After conducting the research with the statistical model, no statistical significant relationship was found between the index returns and the match outcomes. This finding indicates that the German stock market is unaffected by the outcomes of the football matches in major football events. This conclusion is not in line with the findings of major studies in this field, examples are studies of Ashton, Gerard and Hudson (2003) and Edmans, Garcia and Norli (2007), in both which there was documented a significant relationship between football results and particular stock markets.

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Chapter 1: Introduction

Certain events can cause a change of mood of investors, which can directly influence the investment choices of investors. Empirical studies have shown the existence of the Calendar effects, where returns tend to show higher (or lower) than average returns in specific calendar periods. In specific, Białkowski, Etebari & Wisniewski (2012) conclude that stock returns, for several predominantly Muslim countries, during Ramadan are significantly higher and less volatile than during the rest of the year. They found this consistent with a notion that Ramadan positively affects investor psychology.

That psychological factors may play a role in investors' decisions is widely discussed in the Finance world nowadays. Moreover, anomalies that are the possible cause of market inefficiency is largely debated in the field of behavioral finance. Several studies have studied the effect of investors' mood, related to psychological factors that causes irrationality, on the stock market. For instance, research in psychology has shown that temperature significantly affects mood and as an example, Cao & Wei (2005) found a negative correlation between temperature and returns across the whole range of temperature. Furthermore, psychological studies associate full moon phases with depressed mood. Yuan, Zheng and Zhu (2006) investigated the relation between lunar phases and stock market returns for 48 countries. Their findings indeed confirm that market returns are lower on days in which a full moon is present, compared to days around a new moon.

Sports, and in specific football, is another great field of influence on (investors') mood. Moreover, there are not many events that are of national interest as football events, where a large proportion of the country undergoes the same mood swings. As Edmans, Garcia & Norli (2007) stated, "these characteristics provide strong a priori motivation for using soccer game results to capture mood changes among investors". The first study in this field was that of Ashton, Gerrard & Hudson (2003), who found a significant relationship between the football results of the English national team and the London Stock Exchange. Edmans et al. (2007) conducted a cross section study for 39 countries to examine the relationship between sports results and stock returns, in which they document a strong negative stock market reaction to

losses by national football teams. However, they didn't find evidence of a corresponding reaction to wins.

In this thesis, research of the previous studies mentioned will be extended and further research will be performed, to investigate whether football results lead to market anomalies. The main motivation to extend this subject and particularly choose for Germany is the fact that Germany won the FIFA World Championship Football (WC) in 2014, the last WC till now. Furthermore, football is largely adored in Germany. Based on the official Television Audience Report of FIFA for the WC 2014 in Brazil, the final match between Germany and Argentina has reached an all-time TV audience record of 34.5 million people watching. These statistics confirm that football is the most popular sport in Germany and has a rather large psychological impact on people. Hence, this study will examine whether the victory in 2014 and the results in other WC's and EC's, in the case of the German national football team, had a significant psychological effect that lead to market inefficiency. Thus, the research question is defined as follows:

Do the football results of the German national team have a significant influence on the German stock returns?

1.1 The German Stock Market

As can be found on the official website of the German Stock Exchange (GSE), the entire GSE consists of eight stock exchanges situated in different parts of Germany. "These Stock Exchanges are enormously potent and significant to the world economy. Being the largest in Europe, the German economy is a close third behind those of the US & Japan"¹. The largest stock exchange in Germany is the Frankfurt Stock Exchange (FWB Frankfurter Wertpapierbörse), which is based in Frankfurt and owned by Deutsche Börse. With a share in turnover of approximately 85 percent, the Frankfurt Stock Exchange is one of the major securities trading centers of the world. The DAX or DAX 30 (Deutsche Aktien Xchange 30) index is the biggest trading index which is exchanged In Frankfurt. Because the DAX index will be

¹ <http://www.economywatch.com/stockexchanges/german.html>

used in this study to research the market returns after football match outcomes, further information will be provided regarding the DAX index.

The DAX index is found in 1988. It essentially is the benchmark index for the German equity market. The DAX index keeps track of the performance of 30 particular German “blue chip stocks”, traded on the Frankfurt Stock Exchange. Furthermore, the index represents approximately 80 percent of the market capitalization listed in Germany². “Just like the FTSE 100 and S&P500, it is a capitalization-weighted index, so it essentially measures the performance of the 30 largest, publicly traded companies in Germany. It is therefore a strong indicator of the strength of the German economy and investor sentiment towards German equities”³.

1.2 FIFA World Cup and UEFA Euro Cup

The FIFA World Cup, often simply referred to as the World Cup, is an international football event in which the senior men’s national football teams from the 208 member associations of Fédération Internationale de Football Association (FIFA) compete. The FIFA is the main entity which governs football and the corresponding events worldwide. The championship is played every four years since the inaugural tournament in 1930, excluding 1942 and 1946 when the event was not held due to the Second World War. The current champion is Germany, which won its fourth title at the 2014 tournament in Brazil. The contemporary format of the competition includes an initial qualification phase, which takes place over the preceding three years to the WC, in which the national teams of the member associations compete to qualify themselves for the WC. The second stage is the event itself, which is often called the World Cup Finals. The World Cup Finals consists of 32 teams, including the automatically qualified host nation(s). The World Cup takes place at venues within the host country over a period of approximately a month⁴. The national teams have to successfully pass the Group Stage to

² <https://tradingeconomics.com/germany/stock-market>

³ <http://www.sharptrader.com/new-to-trading/stock-indices/overview-of-the-dax-30-stock-market-index/>

⁴ <http://www.fifa.com/aboutfifa/worldcup/index.html>

qualify themselves for the Knockout Stage, with the ultimate goal to reach the final match and become victorious.

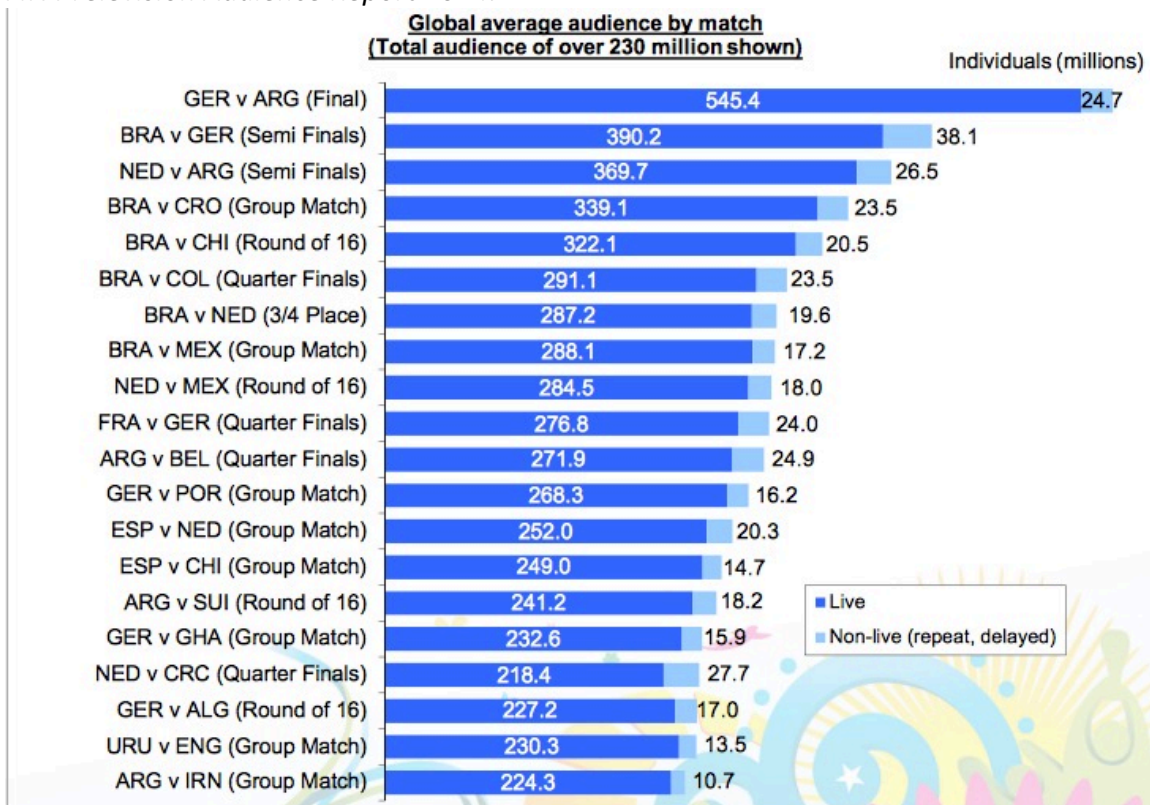
From the 20 World Cup tournaments that have been played till date, eight different national teams became victorious. Brazil is the only national team that has played in each tournament and has, next to that, won the most World Cups with an amount of five titles. Germany and Italy are the runner-ups with four titles each; Argentina and Uruguay have both won two titles and lastly France, England and Spain won one title each⁵.

“The World Cup is considered as the most prestigious association football tournament in the world, as well as the most widely viewed and followed global sporting event, exceeding even the Olympic Games”⁶. In Germany, evidence has proven this once again: The final match in 2014 between Germany and Argentina attracted the biggest audience in German TV history, breaking the record that was set in the semi-finals, with an average of 34.5 million viewers (nearly half of the German population on average) on the German television channel ARD. As a matter of fact, all-time high TV viewing records were set in Germany, the Netherlands and Belgium.

⁵ http://resources.fifa.com/mm/document/fifafacts/stats-matches/67/61/93/144034-factsheet-fifacompetitionwinners_neutral.pdf

⁶ https://en.wikipedia.org/wiki/FIFA_World_Cup

Figure 1: Global average audience of WC2014 by match in millions, as reported by the official FIFA Television Audience Report 2014.



The Union of European Football Associations (UEFA) Euro Cup (EC), founded in 1960, is considered the second largest football event worldwide. Excluding the fact that the participants must be European countries, the set-up and format of the EC is similar to that of the WC. Germany and Spain are the record holders, who both won three titles each.

1.3 The study's purpose

This study aims to question the Efficient Market Hypothesis (EMH). This will be conducted by researching whether the WC's and EC's (major football events), influence the sentiment of investors, and hence, lead to an inefficient market with abnormal returns.

1.4 Contributions of the study

The contribution of this study to existing literature is significant. While research is done for other countries to test for football sentiments on stock returns, there has not been a study that exploits the national football results of Germany and its effect on the stock market.

Although Germany, among 38 other countries, is included in the study of Edmans et al. (2007), the magnitude of the impact in Germany, as well as a possible explanation, will be captured in this study. Furthermore, this study extends the research to the latest football event in 2016, including WC2014 where Germany became the winner. Where Edmans et al. (2007) documented that there is a significant negative reaction of the market after a national loss, this study will provide new evidence with the latest results to support or contradict their findings.

1.5 Outline

The structure of this study after the introduction is as follows; Chapter 2 will continue with the theoretical framework of this study. In Chapter 3, a review of previous literature within this field of research will be presented. Chapter 4 continues with a description of the data and the methodology used for this study. The empirical results of this study will be provided in Chapter 5. Finally, the conclusions and limitations together with the recommendations for further research, will be given in Chapter 6.

Chapter 2: Theoretical Framework

2.1 Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) was developed by Eugene Fama in 1970, when he provided strong empirical evidence for the theory. The EMH is a theory that states that an asset's price fully reflects all available information (Fama, 1970). Malkiel describes the EMH as follows: "A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set, \emptyset , if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set, \emptyset , implies that it is impossible to make economic profits by trading on the basis of \emptyset " (Malkiel, 1989). Furthermore, a requirement for the EMH to be true is that agents should have rational expectations and the population is, on average, right about their expectations. Moreover, the EMH requires that investors update their expectations appropriately when new information becomes available. It is however not required that the agents should be rational, EMH allows overreacting and underreacting to new information by agents. What is required by the EMH is, that the reaction by investors are random and follow a normal distribution pattern, so no abnormal profits could be made. Thus, according to the theory, individuals are allowed to have wrong expectations, but the market as a whole is always right. The EMH is, since Roberts (1967), commonly distinguished in three levels of market efficiency. These forms of market efficiency will be briefly discussed in the next subsections.

2.1.1 Weak-form efficiency

The first form, weak-form efficiency, states that the current prices already reflect all past publicly available information. This form of market efficiency implicates that investors can not earn abnormal profits by implementing investing strategies based on historical price patterns, which is called technical analysis (Malkiel, 1989).

2.1.2 Semi-strong-form efficiency

The semi-strong-form is the second form of market efficiency. In this form, all asset prices fully reflect the relevant assets' historical information and all publicly available information. Hence, this form implies that investors cannot gain excess returns by implementing investing strategies based on new (public) information (Malkiel, 1989). To test for the semi-strong-form efficiency, the speed of adjustment of the prices to new information should be determined. The main research tool for these tests are event studies. An explanation for the use of this tool is that, an event study is a statistical method that captures the impact of an event on the value of stock prices. This is done by first measuring the performance of the stock before the event. To determine whether the event was followed by abnormal returns of the stock, the performance of the stock after the event should be measured.

2.1.3 Strong-form efficiency

The third and last form is the strong-form efficiency. This form implies that both public and private information are instantly reflected in the assets' prices. Hence, no one can earn abnormal profits.

2.2 Behavioral Finance

Criticism of the EMH theory began with the behavioral finance theorists, who gained a large influence throughout the years, in the field of finance. The major objective in behavioral finance is to capture and explain the irrationalities that occur, with regard to the financial decisions that people make. As time went on, academics started to find anomalies and behaviors that could not be explained by the conventional finance theories. These anomalies triggered academics to look at psychological factors, which may account for the irrational behavior that conventional finance fails to explain. The duo Kahneman & Tversky (1979) can be considered as a major contributor to the study of (ir)rationality in finance. Their study introduced the Prospect Theory and the concept of loss aversion, a theory that states that people prefer to avoid loss than to gain profit. Thaler can also be considered a one of the major behavioral economists who counters the belief of the EMH. Studies of Thaler include Nudge (2008) and Misbehaving: The Making of Behavioral Economics (2015), where he argues

for the existence of deviations where individuals do not act in rational and efficient form. The presence of regularly occurring anomalies in the conventional finance theory was a big contributor to the formation of behavioral finance. These anomalies and their continued existence violate conventional financial and economic theories, which assume rational behavior.

2.3 Financial Market Anomalies

Kahneman & Tversky (1986) defined market anomalies as: “An anomaly is a deviation from the presently accepted paradigms that is too widespread to be ignored, too systematic to be dismissed as random error and too fundamental to be accommodated by relaxing the normative system”. Performances of stock that deviate from the assumptions of the EMH and cannot be explained by the standard finance theory, are called financial market anomalies. These financial market anomalies can be divided into three basic types.

2.3.1 Fundamental Anomaly

Fundamental anomaly deals with the fundamental analysis of the financial information of the firm. The fundamental financial information includes among others the revenue, liabilities, expenses, cash flows etc. An example is the value anomaly, that was first documented by Graham & Dodd (1934), this anomaly occurs due to false prediction of investors, who overestimate the future earnings and returns of companies with ‘growth potential’ and underestimate these measures of ‘value companies’.

2.3.2 Technical Anomaly

Technical anomalies come with the ‘Technical Analysis’ and includes analyzing techniques. These techniques are used to forecast future prices of assets based on the historical price patterns and other relevant historical information. This anomaly contradicts the weak-form of the EMH, which implies that investors cannot ‘beat the market’ and earn abnormal returns based on past information. Common technical analysis use techniques like Moving Averages, which was documented by Brock, Lakonishok & LeBaron (1992).

2.3.3 Calendar Anomaly

Calendar anomalies are related with specific time periods and creates patterns in stock returns. These anomalies include, among others, the Weekend Effect, where the stock prices are likely to fall on Monday (Smirlock & Starks, 1986) and the January Effect, where the returns on small firms' stock are higher in January than in any other month (Keim, 1983).

Chapter 3: Literature Review and Hypotheses

3.1 Literature Review

As discussed before, Ashton et al. (2003) were the first to conduct a study within the field of the impact of football results on the domestic stock market. Various other studies followed, in which the studies differed in their methods and conclusions.

Ashton et al. (2003) examined whether there is a relationship between the match results of the English national football team and the consecutive changes in the FTSE 100 index. Their study applied event-study analysis of the changes in the index returns following the international matches by the English national football team. To conduct this research, daily data from the FTSE 100 index was collected for the period from 6 January 1984 to 3 July 2002. Their study documented a significant relationship between the match outcomes of the English national football team and the consecutive changes in the FTSE 100 index. The main conclusion was that good performances of the national team are followed by positive changes in the market returns. Vice versa, bad performances by the national team are followed by negative changes in the market returns. A typical characteristic of this documented relationship is that, the more important the match gets, the more influence a match outcome has on the stock returns.

However, Klein, Zwergel & Fock (2009) rebuild the study of Ashton et al. (2003) and detected inaccuracies in their applied research method. Furthermore, they argued that little pitfalls in the methodology can have a major impact on the findings of such a study. They provided a review of possible flaws in such event studies. For example, they documented that the event studies, and in specific the study of Ashton et al. (2003), have to take in account the holiday effect, the “copy and paste” effect and the globalization effect. These are possible distortions which may have caused biased results in the study of Ashton et al. (2003), according to Klein et al. (2009). Lastly, they find that the study of Ashton et al. (2003) was inaccurate and conclude that no relationship exists between the performance of the English national football team and the FTSE 100 index.

Tufan (2004) examines whether the international football results of the Turkish national team affect the Istanbul Stock Exchange 100 Index (ISE100). The sample data includes the World Cup event in 2002, using hourly returns from 31 May 2002 to 28 June 2002 of the ISE100. The research methodology employed concerns descriptive statistics and a Mann-Whitney U-Test. He concluded his research with the finding that the Turkish national football results from the World Cup event did not affect the stock returns of the ISE100.

Edmans et al. (2007) examines the effect of sports sentiments on stock returns. Motivated by psychological evidence of a strong link between football outcomes and mood, they use international football results as their primary mood variable. They conduct a cross section study for 39 countries to examine the relationship between sports results and stock returns, in which they also find a significant relationship. Their main finding is that the market reacts significantly strong to a loss by a particular national football team. They do also document a significant, but less strong relationship between losses and market returns for cricket, rugby and basketball games. Furthermore, the loss effect is more present in the following situations: In countries where football is a major sport; for more important games (such as the major football events) and for other knockout stage games. The underlying thought is that under these circumstances, the matches have more influence on investors' mood and thus have a larger impact on the market returns. Moreover, they document that small stock are more underlying to the loss effect. This is explained by mentioning that small stocks are more subject to investor sentiment, because they are held more by domestic investors. According to their study, no statistical significant effect exists on the returns after wins in any of the previous mentioned sports.

Motivated by the study of Edmans et al. (2007), Kaplanski & Levy (2010) investigate the effect of World Cup events on the U.S. stock market. In this study, the focus is not on the effect of the performance of the playing national football team(s) on the domestic stock market, but rather on the U.S. stock market. Kaplanski & Levy state that, because the U.S. stock market is not dependent on the match results, the market can possibly be exploited. They draw a null hypothesis which states that the U.S. stock market is efficient and no abnormal profits could be gained. The alternative hypothesis states that the U.S. stock market is inefficient. The methodology applied by Kaplanski & Levy is similar to that of Edmans et al (2007). They

conclude their study with the finding that the World Cup effect is highly significant, large and persistent: The mean return on the U.S. stock market during the World Cup event's is -2.58%, in comparison to a mean return of +1.21% for all days, during a sample period of 1950 to 2007.

Klein, Zwergel & Heiden (2009) extend the study by Ashton et al. (2003) in different ways. Namely, Klein et al. (2009) use a sample period of 1990 to 2006 and they add several other national European football teams in the sample. Furthermore, they only account for results in World Cup, European Championship and qualification games. In order to prevent distortion of the data, holiday returns were removed from the data and only price indices were used, to avoid that dividend payment on the event day will distort the data. Bearing in mind that the results of an empirical study are always prone to influence by the chosen econometric framework, two different event study methodologies are applied: a constant mean model and a Markov-switching two-state market model. According to Klein et al. (2009), their models provided sufficient evidence that no relationship exists between match outcomes and stock returns.

To find out how the market responds to the football results of national club matches, Scholten and Peenstra (2009) conducted research with a sample of eight listed football teams, including 1247 match results of these teams. Their research tool concerns the event study method, to analyze whether match outcomes lead to abnormal stock returns of a particular listed football team. Their finding is that there indeed exists a relationship between the stock market and the performance of the teams: a win has a positive market effect and a loss has a negative effect on the market. Besides, they conclude that the market has an asymmetrical response, the 'loss effect' is stronger than the 'win effect'.

To summarize, one can divide the previous mentioned research into two groups. One group includes studies of, for instance, Ashton et al. (2003) and Edmans et al. (2007), in which significant relationships between football (sports) results and the respective index returns is documented. Ashton et al. (2003) presented significant results of both a win and a loss effect for the case of the English national team, with the side note that more important matches have more influence on the stock returns relative to less important matches. Alongside Ashton

et al. (2003), Edmans et al. (2007) found an overall significant effect after a loss: the returns after a loss tended to be lower.

However, these results are not in accordance with the results of the other group. The other group, including among others Klein et al. (2009), found no evidence of any relationship between football results and stock returns. Klein et al. (2009) even criticized the methods of the research that did find significant relationships, by noting that the data could be manipulated in such a way to find the desired relationship. Regarding the methodology, the studies do all seem to follow the same pattern and recognize the importance of control variables. The important differences between the various articles are the countries and time horizons for which research is done.

3.2 Hypotheses

Following the literature review, a set of hypotheses could be developed, which will test whether the impact of the football events on the stock market is significant. The first hypothesis is defined as follows:

H₁: The day-of-the-week effect does not exist in the German stock market

The first hypothesis aims to test whether the day-of-the-week effect exists in the German stock market and thus, has a significant impact on the stock returns. This will be tested by including control variables for the days of the week in the statistical regression model. By doing this, there will be intended to control for day-of-the-week effects and hence, lead to more accurate estimates of the impact of the football events on the stock returns. The next hypothesis states:

H₂: The non-weekend holiday effect does not exist in the German stock market

Similar to the first hypothesis, the second hypothesis also aims to control for confounding effects. This hypothesis is linked to the non-weekend holiday control variables in the model. The third and last hypothesis will test whether the football matches have a significant impact on the German stock returns:

H₃: Winning matches have a positive effect on the stock returns and losing matches have a negative effect on the stock returns.

The third and major hypothesis of this study is motivated by the possible association between match outcomes and investor mood, as was documented by Edmans et al. (2007). The residuals of the statistical regression model should support (against) this hypothesis, after including all the confounding effects in the model.

Chapter 4: Data and Methodology

4.1 Data

The sample period is 1 June 1990 through 15 July 2016. For this period, the international football results of Germany are obtained from www.soccerbase.com. This data includes 7 WC's and 7 EC's where Germany has participated in, with a total of 79 matches, consisting of 53 wins, 11 draws and 15 losses. The returns of the German DAX stock index will also apply to the same period, whereas the data on the index returns will be on a daily basis, consisting of the five trading days per week. The index returns are collected from Yahoo Finance. Furthermore, the national holidays in Germany are gathered to capture the non-weekend holiday effect on the index returns. These national holidays include: New Year's Day; Christmas; German Unity Day (3 October); Good Friday; Easter; Labour Day (1 May) and Whit Monday⁷. To assess the effect of the international football results of Germany on the index returns, the returns of the first trading day after the match day will be used. This will be done because the matches are usually played in the evening, when the markets are closed. Furthermore, it is believed that investor sentiment will be optimally captured the next trading day after the match day. The index returns are measured as the daily percentage change of returns. These daily percentage change of the returns are achieved by using the following calculation:

$$R_t = \ln(I_t) - \ln(I_{t-1})$$

Equation 1

Where R_t is the return for period t , I is the return for index period t and \ln is the natural logarithm.

4.2 Econometric Approach

Initially, to test for a possible relationship between the football results of the German

⁷ These days are considered national (market) holidays
<http://markets.on.nytimes.com/research/markets/holidays/holidays.asp?display=market&timeOffset=0&exchange=FRA>

national team and the German stock returns, descriptive statistics of the DAX returns after a win, loss or draw will be recorded and presented.

The next stage of the research will estimate the impact of the World Cup football results on stock returns in an econometric approach. Hence, the hypotheses as stated in section 3.2 will be tested by applying the same model as in previous studies like Edmans et al. (2007) and Kaplanski & Levy (2010). That is, the following model will be estimated with an Ordinary Least Squares (OLS) regression:

$$R_t = \gamma_0 + \gamma_{1i}R_{t-1} + \sum_{i=1}^4 \gamma_{2i} D_{it} + \sum_{i=1}^5 \gamma_{3i} H_{it} + \varepsilon_t$$

Equation 2

Where R_t is the daily return; γ_0 is the regression intercept coefficient; R_{t-1} is the previous day return (included to account for first order serial correlation); D_{it} for $i = 1, 2, 3, 4$ are dummy variables for the days of the week Monday, Tuesday, Wednesday and Thursday respectively; H_{it} for $i = 1, 2, 3, 4, 5$ are dummy variables for trading days after a non-weekend holiday Monday, ..., Friday.

As mentioned, the original model is introduced by Edmans et al. (2007). However, the model in this study is a modified version of theirs; Edmans et al. (2007) also included a market index in their model, while they conducted a cross-section study with 39 countries. Since this research only focuses on Germany, world market index is not necessary to be included in this model.

The effect of the World Cup football match result can be estimated by using the residuals ε_t of the following regression:

$$\hat{\varepsilon}_t = \beta_0 + \beta_W W_t + \beta_L L_t$$

Equation 3

Where W_t is a dummy variable that takes the value one if Germany wins and L_t is a dummy variable that takes the value one if Germany loses.

Chapter 5: Results

The empirical results of the research will be provided in this section, starting off with descriptive statistics of the sample. After this, the modelling results will be displayed and analyzed.

5.1 Descriptive Statistics

The sample includes a total of 6603 observations, in the period of 01-06-1990 to 15-07-2016. This period includes 7 FIFA World Cups and 7 UEFA European Championships. Altogether, the German national team has played 79 matches in these tournaments. The average return of the total sample period is 0.026% and the standard deviation is 1.450. The descriptive statistics for the sample period are presented in Table 1, including the mean and the standard deviation in parentheses.

Table 1: Descriptive Statistics of the DAX index from 01-06-1990 to 15-07-2016. The total sample period consists of 6603 observations and has a mean return of 0.026%. The table provides the mean and standard deviation of the returns after match outcomes. These matches are divided into three subcategories: All matches; Group Stage; Knockout Stage. The first trading day after a match has been used for the returns.

DESCRIPTIVE STATISTICS		WINS	DRAWS	LOSSES
TOTAL SAMPLE PERIOD		0.026 (1.450)		
	N			
ALL MATCHES	79	-0.133 (1.367)	0.399 (1.004)	0.578 (1.502)
GROUP STAGE	42	0.001 (1.189)	0.399 (1.004)	0.473 (1.199)
KNOCKOUT STAGE	37	-0.253 (1.520)	-	0.648 (1.743)

The statistics are divided in three subcategories; All matches; Group Stage and Knockout Stage. At first sight, the descriptive statistics show contradicting outcomes to what one could have expected. We can see that the returns after wins have a trend to be negative, even with the more important matches (Knockout Stage), that has a larger negative mean return (-0.253) than the overall wins (-0.133). Surprisingly, the returns after draws and losses are positive. Moreover, a loss after a match that is more important, leads to higher positive returns the next trading day: Returns after a Group Stage loss is on average 0.473, after a Knockout Stage loss this average is 0.648. These results are not in line with the findings of Ashton et al. (2003), in which they documented a positive (negative) market effect after a positive (negative) football match outcome. Furthermore, they stated that the effect on the returns become larger when the football match is of more national importance. These findings are both contrary to what the descriptive statistics of this study imply.

5.2 Modelling Results

Initially, for the sake of stationarity of the data, an Augmented Dickey Fuller (ADF) test should be performed. The following hypotheses are drawn up:

H_0 : *There is a unit root in the data*

H_a : *The time series data is stationary*

Performing the ADF test in STATA gives a t-statistic of -77.104, which exceeds the 1% critical value of -3.430. Hence, the null hypothesis can be rejected and we can conclude that the data is stationary.

Following this, the OLS regression model will be performed to test for day-of-the week- and holiday effects on the DAX index returns during the sample period. This will be done by including dummy variables (as explained in the methodology) to control for these effects. The output of this regression is provided in Table 2b.

Table 2a: OLS regression model statistics

n	6601
R^2	0.0018
Prob > F	0.6296

Table 2b: OLS Regression output. The independent variable R_t is regressed on the previous day return, day-of-the-week dummy variables and non-weekend holiday dummy variables. The table shows whether a day-of-the-week effect or holiday effect exists in the German stock market during the sample period (01-06-1990 – 15-07-2016). These variables are added in the regression to control for these confounding effects and let the football events effect in the residual.

R_t	Coefficient	t-statistic	P> t
constant	0.0032	0.08	0.933
R_{t-1}	-0.003	-0.19	0.847
D_{Mon}	0.056	0.94	0.345
D_{Tue}	0.027	0.50	0.616
D_{Wed}	-0.017	-0.33	0.741
D_{Thur}	0.016	0.30	0.766
H_{Mon}	0.652	1.89	0.058**
H_{Tue}	0.156	0.65	0.519
H_{Wed}	0.091	0.22	0.827
H_{Thur}	0.255	0.41	0.679
H_{Fri}	0.618	1.20	0.228

*significant at 5% **significant at 10%

The coefficient for the day after non-weekend holiday Monday is significant at 10%. The other coefficients are not statistically different from zero, implying that the day-of-the-week and holiday effects barely exist in the German stock market. To capture the effect of the major football events on the stock returns, the consecutive step is to predict the residuals of this model and regress this against dummies for match wins- and losses. The results of this regression are provided in Table 3.

Table 3: Residuals regression output. The residuals are regressed against dummy variables for both a win and loss. This is done to measure the impact of the German football matches on the index returns during the sample period.

$\hat{\epsilon}_t$	Coefficient	t-statistic	P> t
constant	0.000	0.02	0.981
β_W	-0.208	-1.13	0.259
β_L	0.549	1.46	0.143

The output shows rather counterintuitive results, as already was implied by the descriptive statistics. The coefficient for the win dummy is namely negative and the coefficient for the loss dummy is positive. However, both win- and loss dummies lack statistical significance. These findings indicate that match outcomes (wins and losses) do not affect the German stock market. Hence, the hypothesis that states that wins lead to positive returns and losses lead to negative returns should be rejected, implying that the German stock market is efficient. This conclusion is in line with the view of the Efficient Market Hypothesis.

Chapter 6: Conclusions

The purpose of this study was to question the Efficient Market Hypothesis. This is conducted by researching whether major football events, such as the WC and EC, influences investors' sentiment and hence, leads to an inefficient market. This was inspired by previous studies by Ashton et al. (2003) and Edmans et al. (2007). Based on these previous literature, this study had the following research question:

Do the football results of the German national team have a significant influence on the German stock returns?

To answer the research question, a set of hypotheses were developed, which included the following:

H₁: The day-of-the-week effect does not exist in the German stock market.

As can be seen in the results section, the regression model showed insignificant dummy variables for the days-of-the week. Thus, the first hypothesis can be accepted: The day-of-the-week effect does not exist in the German stock market.

H₂: The non-weekend holiday effect does not exist in the German stock market

Regarding the non-weekend holiday variables, the model showed a significant effect for the Monday after a non-weekend holiday. The four other days after non-weekend holidays lacked any significance. Hence, the second hypothesis cannot be accepted because there exists at least one day for which the stock market is inefficient.

H₃: Winning matches have a positive effect on the stock returns and losing matches have a negative effect on the stock returns.

Lastly, the result section showed that the third hypothesis cannot be accepted, because a lack of significance of wins and losses on the index returns. This finding implies that the German stock market is unaffected by match outcomes of the German national team. This supports the view that the Efficient Market Hypothesis holds. Thus, it can be concluded that the football results of the German national team do not have a significant influence on the German stock returns.

These findings are not in line with the findings of Edmans et al. (2007), in which a significant effect on the returns after a loss was documented. Moreover, Ashton et al. (2003) found both a positive market reaction after a win and a negative market reaction after a loss in the English stock market.

The fact that the findings of this study is not coherent with the previous mentioned studies can possibly be explained by the large proportion of foreign investors in Germany. According to the Investment Climate Statements for 2016, that is published by the Bureau of Economic and Business Affairs, "Germany is a major destination for foreign direct investment", as the largest market in Europe. Moreover, "Germany is consistently ranked as one of the most attractive destinations for Foreign Direct Investment (FDI)"⁸. Thus, the finding that the German stock market is unaffected by national football results, may be explained by the presence of the large proportion of foreign investors in Germany who are not affected by the German national football results.

6.1 Limitations and Recommendations

The purpose of this thesis was to study the effects of the major football events on the German stock market. This was done by using the returns of the German DAX index for a sample period of 26 years. Thus, although the DAX index represents around 80 percent of the market capitalization listed in Germany, the first limitation of this study can be point out by mentioning that solely one index may not be fully representative for the entire German stock market. Furthermore, the sample period of 26 years could be extended to a longer period to

⁸ <https://www.state.gov/e/eb/rls/othr/ics/2016/eur/254367.htm>

include more events and hence, capture the effect of the events on the stock returns more accurately. Also, it is worth mentioning that the OLS regression model that is used may not control for all other confounding effects on the returns, therefore the residuals might not fully capture the effect of the football match results on the returns. Lastly, an OLS model might not be the best method to capture the effect of major football events on stock returns, because of the constant-volatility assumption that is made.

Recommendations that could be made for future research are therefore improvements to previous mentioned limitations. That is, one could include more than one index in the sample to make inferences on a broader level. Moreover, the event period could be extended to include more football events. Regarding the statistical approach, for future research more control variables could be included in the regression model to capture the effect of the football events more accurately. Finally, besides the OLS method, other statistical methods could be adopted to obtain more accurate estimations of the impact of the football events on the stock returns.

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