Testing the market: How do referendums affect the stock market?

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Bachelor Thesis Financial Economics

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Abstract

The aim of this paper is to find the possible effect that the Great Britain referendum, which took place on 23 June 2016, had on the British stock market. To test for these effects, an event study methodology has been used. For the event study, daily data from 36 firms listed on the FTSE100 index over the period of 1 May 2015 to 1 August 2016. Alongside the event study, an OLS regression has been conducted to measure certain variables that could affect the stock returns as well. The results of this paper have shown statistical positive abnormal returns for the days surrounding the referendum. This indicates that the Great Britain referendum indeed did affect the stock market in a positive way. An explanation for this effect is given by Gurtas and Gonultas (2017), they state that if the uncertainty regarding the referendum resolves, a positive effect on the stock market should be expected. The results also indicate that certain industries are more exposed to the political uncertainty caused by the referendum than others.

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1. Introduction

The introduction will cover the research topic, state the research question and introduce the next chapters.

Many referendums were held in several counties in the past, which leaves the outcome in the hands of the citizens. Past referendums such as the referendum in Great Britain and the Turkish Constitutional Referendum are two of which have caused many uproars over the world. These referendums cause uncertainty, seeing in most cases both outcomes have different consequences which should be considered.

On the 27th of May 2015 Queen Elizabeth II announced that a referendum will be held on the UK's membership in the European Union. Although there was a call for a same referendum in 2012, Prime Minister David Cameron rejected this call but mentioned a possibility for the referendum to be held in the future (Watt, 2012). On 22 February 2016 in a speech to the House of Commons, Cameron announced the referendum to be held on 23 June 2016 (House of Commons Hansard Debates for 22 Feb 2016).

The referendum resulted in an exit of the EU, also known as Brexit, where 51,9% voted for leaving the EU and 48,1% for staying. The referendum turnout was 71,8%, with over 30 million people voting (Alex & Brian, 2017). Immigration, the Labour party failing to connect with the voters and the public stopping to listen to the Prime Ministers are a few reasons in favor of the leave campaign to win (Eight reasons Leave won the UK's referendum on the EU, 2016).

These referendums could have several effects on the respective countries. Dhingra and Swati (2016) state in their article that "The economic consequences of leaving the EU will depend on what policies the UK adopts following Brexit. But lower trade due to reduced integration with EU countries is likely to cost the UK economy far more than is gained from lower contributions to the EU-budget."

Aside of the effects of the referendums on the countries themselves, the effect of the referendums on the stock market should be considered as well. As Gurtas and Gonultas (2017) commented, the uncertainty caused by the referendums have a certain effect, which will convert to a positive effect if this uncertainty disappears. Brown, Harlow and Ticnic (1988) also agree

with this effect. They discussed the role of uncertainty in financial markets and concluded that as uncertainty resolves, positive price changes should be expected.

The objective of this paper is to examine the short-run effect of the political uncertainty caused by the Great Britain referendum on the stock market. This paper shall provide relevant information to this topic, since several referendums have taken place and many more will probably take place.

This paper contributes to existing literature while some papers concerning referendums have covered Brexit but none to my knowledge have covered this referendum in depth.
While the Brexit is a fairly new event, much literature is not available and therefore this paper shall shed light on this event.

As stated earlier the focus lies within the stock market to capture the effect of the referendum. The rationale behind this is the Efficient Market Hypothesis (EMH), which states that an asset's price fully reflects all available information (Fama & E., 1970). Thus, it is interesting to examine the stock markets to research if the information concerning the referendums is incorporated in the stock prices.

This paper focusses on the following research question:

Is the British stock market significantly effected by the Great Britain referendum?

This paper shall focus on the effects caused by the referendum for the period of the announcement of the referendum until the actual referendum was held, the outcome of this referendum isn't of importance for this paper. The rationale behind this is the interest on the effects caused by the referendum on the stock market and not the effect of the outcome. That said, the interest lies within the effects caused to the stock market in the referendum period. However, the interpretation of the outcome of the referendum shall be discussed in the conclusion.

As mentioned earlier, referendums and other political events, such as elections, occur all over the world. While the outcome and content of these referendums differ, the process is more or less the same. All these referendums start with an announcement and end with the referendums

being held themselves. Therefore, the overall effects caused in this period could be the same for different countries and situations.

For this paper a sample of firms listed on the FTSE 100 shall be used to research the effects of the Great Britain referendum. This is a capitalization-weighed indices, which includes the 100 most highly capitalized firms traded on the London Stock Exchange (LSE). Thus, it's believable that this index strongly reflects the economy and political changes of the respective country. This paper shall also cover the effects on the different industries in the index, the tangibility of the firms and the effect on multinationals.

The body of this paper is organized in eight sections. Section 2 contains a literature review. In section 3, the methodology of this paper shall be discussed. In section 4, the data used will be presented. In section 5, the results of the study will be shown. Section 6 contains the conclusion of this paper and finally in section 7 the limitations and recommendations will be discussed.

2. Literature Review

In this section a review of the relevant literature for this paper shall be given.

2.1 Referendums

Since the referendum is a fairly recent event, much research concerning this referendum has not been conducted yet. Although several research has been done regarding the potential consequences of Brexit, none has covered the effect of the referendum on the stock markets.
As stated earlier, Dhingra and Swati (2016) analyzed the consequences of Brexit for the UK trade and living standards. As long as the UK is a member of the European Union (EU), it will benefit from reduced trading costs between the UK and the rest of Europe. For members of the EU there are no import or export tariffs, which means these countries can benefit from free trade amongst themselves. These benefits lead to a higher trading volume, this has benefits for the UK consumers, while the consumers have access to better goods and services with lower prices.
In their article they focus mainly on the trade consequences of the Brexit. To estimate these effects on the UK's trade they use a modern quantitative model of the global economy. These models incorporate the channels through which trade affects consumers, firms and workers. The model provides real income changes under different trade policies and is therefore suitable to measure the effects of the Brexit. They conclude in their article that the UK will be negatively effected by Brexit. The decrease in income per capita resulting from lower trade offsets the savings that the UK obtains from reduced fiscal contributions to the EU budget. They estimated that the UK income will decrease between 1,3% and 2,6% which equals a decline in average annual household income of between £850 and £1,700.

Bouoiyour and Selmi (2016) not just look at the effects for the UK, but also investigate the effects for countries such as Germany and France. They seek to asses the costs of uncertainty over Brexit for these countries. They conduct a quantile regression (QR) approach, which is more favorable than the standard OLS approach due to its accurate assessment of each link across random variables. Using this technique, they've shown heterogeneous outcomes regarding UK and EU equities reactions to Brexit. They concluded that Germany will suffer the most if Brexit would happen, followed by France and the UK.

2.2 Event Studies

Since this paper will have the form of an event study, some literature with regard to this topic shall be discussed.

In his paper, MacKinlay (1997) reviews event study methods. He states that by using financial market data, an event study can "measure the impact of a specific event on the value of a firm". The usefulness of an event study comes from the fact that, as the market is rational, the effects of an event will be reflected in security prices. This corresponds with the EMH introduced by Fama (1970), which states that an asset's price fully reflects all available information. Event studies have many applications in accounting and finance researches such as mergers and acquisitions and earnings announcements, but it's not limited to these fields only. Since the referendums contain new information, this should be captured by the stock market returns.

An example of this is given by Beaulieu, Cosset and Essaddam (2006), who investigated the short run effect of the 30 October 1995 Quebec referendum on the common stock returns of Quebec firms. To examine this short-run effect they considered an event study. Their sample initial consisted of 102 firms, headquartered in Quebec and listed on the Montreal Stock Exchange and/or on the Toronto Stock Exchange. This sample was broken down to 71 Quebec firms. They estimate abnormal returns using a multivariate linear regression, since the referendum date is similar for all portfolios. A Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is used to help determine if the abnormal returns are affected by changing volatility. Their results indicate that the short-run effect of the referendum results in a significant positive effect on the stock returns for Quebec based firms, this therefore indicates that the outcome was not predictable. With their obtained results, they stated that it can be concluded that political uncertainty can have a certain effect on the short-run stock market returns in financial markets where the uncertainty cannot be anticipated.

2.3 Efficient Market Hypothesis (EMH)

The Efficient Market Hypothesis was first introduced by Eugene Fama who mentioned that stocks were traded at their fair value. Thus, Fama believed that stocks can't be overpriced or undervalued. A efficient capital market is defined by Malkiel (1989) as following: "A capital market is said to be efficient if it fully and correctly reflects all relevant information in

determining security prices". This yet again implies that it is impossible to make a profit by trading on basis of a certain information set and thus it is impossible to outperform the market.

The efficient market consists of three levels based on three different types of information: The weak form, the semi-strong form and the strong form.

The weak form, as defined by Malkiel (1989), states that prices fully reflect the information in the historical sequence of prices. In the weak form, it is impossible to earn abnormal returns by using strategies based on historical share prices. This technique of analyzing historical data is also known as technical analysis.

The semi-strong form asserts that both historical and publicly available information is reflected by the current stock prices. In the semi-strong form, it is impossible to earn abnormal returns by using strategies based on analysis of firm financials such as balance sheets and income statements. This technique of analyzing firm financials is known as fundamental analysis.

The strong form states that all known information, both public and private, is reflected in the share prices. In the strong form it is impossible to earn abnormal returns.

Thus in the weak form it is impossible to gain abnormal returns by conducting technical analysis, in the semi-strong form this regards to the fundamental analysis and in the strong form no one can earn abnormal returns.

2.4 Uncertainty

Uncertainty occurs when there is a situation where there is imperfect or unknown information. Moschini and Hennessy (2001) stated that the immediate implication of uncertainty is that many possible outcomes are associated with any one chosen action. Thus decision making under uncertainty is characterized by risk. In several articles, the standard deviation is used as a proxy for uncertainty. Miller and Reilly (1987) also commented that in addition to the standard deviation, the trading volume and bid-ask spread is also related to uncertainty.

2.5 Factor Influencing Stock Returns

Since the EMH notes that the stock market returns capture all available information, it is interesting to examine what other variables influence the stock market returns. Galbraith (2004) summed op several factors influencing stock market returns.

Chen, Roll and Ross (1986) stated that the stock prices can be written as expected discounted dividends:

$$p = \frac{E_{(c)}}{k} \tag{1}$$

where *c* is the dividend stream and *k* is the discount rate. Thus, one can see that the stock returns are influenced by the dividend stream and the discount rate and therefore, anything that affects these variables also affect the stock returns.

An obvious factor influencing the stock returns is the dividend yield, since the stock returns is influenced by the dividend stream. A positive relationship can be found between the dividend yield and the stock returns. Galbraith defines the dividend yield as the sum of the annualized dividends paid on all the stocks in an index divided by the price of the index itself.

Another factor that could influence stock returns is the industrial production. Galbraith mentions that high industrial activity signals strong future dividends. Therefore, industrial production and stock returns are positively correlated where an increase in industrial production leads to an increase in stock returns.

The expected discounted dividend model by Chen et al. show that the expected dividends need to be discounted by an interest rate (discount rate). A change in the interest rate leads to a change in the stock prices. As shown in the model, the current value of the future dividends decreases as the interest rate increases.

Inflation, exchange rates and default spread are also mentioned by Galbraith as factors that influence stock returns.

2.6 Exposure to Political Risk

Since firms differ per industry, the effect of the referendum can differ per industry as well. Therefore, the exposure to political risk that arises from the referendums should be considered per industry.

Phillips-Patrick (1989) mentions in his article that certain firms can influence the political process. The firms considered are foreign firms with sufficient growth options. For these firms, relocation of future investments is an option if they are heavily taxed. When a firm has its assets located completely in the domestic country, its investments are country-specific. For these firms, relocating is difficult and expensive. A multinational firm however, can relocate its assets and resources at a lower marginal cost than domestic firms. Therefore, multinational firms are less exposed to political risk than domestic firms, because they can evade political consequences, such as taxes, easier.

With regard to this, three hypotheses can be set up:

H1: There is a stronger effect in returns for firms with relative more tangible assets

H2: There is a stronger effect in returns for multinational firms

H3: The referendum has a different effect per industry

3. Methodology

To measure the impact of an event on the stock markets an event study methodology is preferable. Beaulieu et al. (2006) stated that an event study can measure the impact of a specific event on the value of a firm. Therefore, an event study methodology shall be used in this paper. To test if the stock market is affected by the referendum, tests shall be conducted to measure if significant coefficients are realized.

For this paper the event study methodology as described by MacKinlay (1997) and van der Sar (2015) shall be referred to.

3.1 The Event Study

An event study can be described as a method to assess what for effect an event has on the value of a firm. This is done by measuring if there are abnormal returns and if these are influenced by the event. Analyzing whether an announcement of any kind creates or destroys firm value is an example of an event study. The methodology of an event study is as follows: the normal stock returns of the affected firm is estimated for the event date and for an event window consisting of a few days before and after the event date. Once these normal returns are measured, these are subtracted form the actual returns to receive the abnormal returns. Afterwards, a t-test is conducted to test significance of the abnormal returns.

The market return is defined as the return on the overall theoretical market portfolio which includes all assets (businessdictionary, 2017). As stated earlier, normal returns and actual returns are used to measure the abnormal returns. The return is the gain or loss on a security for a particular period. The abnormal return is a return of a security that is different than what is expected. The importance of these returns lies in the determinacy of a portfolio's performance when compared to the overall market.

3.2 The Industries

As stated earlier, certain firms are exposed more or less to political risks than other firms. This difference can be explained by the country-specificity of the firms, where a multinational firm is less affected than a domestic firm due to its ease in relocating its assets. This can also be linked to the industry in which the firm is active. An example given by Beaulieu et al. (2006) is the pharmaceutical industry and the aluminum industry. A firm in the pharmaceutical industry is less exposed to political risks because they can easily relocate their investment

activities. A firm in the aluminum industry however, can't relocate its activities and is therefore more exposed to the risks.

Therefore, in this paper, besides looking at the index as a whole, the different industries in the index shall be examined as well. This shall be done by creating dummy variables for each industry. The rationale behind this lies within the different level of exposure to political risk for each industry, where e.g. an industry such as the mining industry can not relocate as easily as the technological industry and is therefore more exposed to political risks.

3.3 Event Study Methodology

As mentioned earlier, an even study shall be conducted. MacKinlay (1997) states that an event study is used to measure the impact of a specific event on the value of the firm. He believes that the effects of such an event shall be reflected immediately in the security prices due to the rationality of the market. This is in line with the EMH proposed by Fama (1970)

The first step is to identify the event and choose an event window. In this paper the event is the Great Britain referendum, which has taken place on the 23 June 2016. The event windows of [-5+5], [-3+3], [-1+1] and [0+3] shall be examined in this paper. The estimation window is [-284 -11]

3.3.1 The Normal returns

For an event study it is important to compare the realized returns, with the returns that would have been realized if the event had not occurred. These so called "normal returns" are necessary to calculate the abnormal returns. The most widely used method to measure these normal returns is the market model. This model is a statistical model which relates the return of the security to the market return of the portfolio (MacKinlay 1997). The model is as follows:

$$R_{it}^{*} = a_i + \beta_i R_{mi} + \varepsilon_{it} \quad (2)$$

Where:

$R_{it}^{*} = Normal\ return$

$R_{mi} = Return\ of\ the\ market\ portfolio$

$\beta_i = Beta$

$\varepsilon_{it} = Zero\ mean\ disturbance\ term$

In this model the intercept a_i is a parameter of the stock returns which interpreted as the part of the stock return that represents the constant influence of firm specific factors with time. The beta β_i can be interpreted as the part of stock return that is dependent on market-wide influences (van der Sar, 2015) .

3.3.2 The Abnormal Returns

With the normal returns given, the abnormal returns can be calculated as well.

$$AR_{it} = R_{it} - R_{it}^{*} \quad (3)$$

Where:

$R_{it} = Realized\ return$

$R_{it}^{*} = Normal\ return$

By inserting equation (2) in (3) the following formula is obtained:

$$AR_{it} = R_{it} - a_i - \beta_i R_{mi} \quad (4)$$

This equation will be used to estimate the abnormal returns.

3.3.3 The Cumulative Abnormal Returns(CAR)

Since it is assumable that the effect of the announcement on the returns concerns a longer period than the event date, the cumulative abnormal returns (from now on CAR) shall be calculated. The CAR is the sum of the abnormal returns for a firm over the event window period. The CAR for a 10-day event window is as follows:

$$CAR_{-5,5} = \sum_{t=-5}^{t=+5} AR_{it} \quad (5)$$

Since this paper focuses on the total effect of the announcement of the referendum on all the whole FTSE100 index and not on the individual companies, the average abnormal return (AAR) is measured to capture this effect.

$$AAR = \frac{1}{N}\sum_{x=0}^{N} AR_{it} \quad (6)$$

Finally, to capture the total effect of the multiple observations over the whole period, the cumulative average abnormal returns (CAAR) are calculated.

$$CAAR = \sum_{t=0}^{t} AAR_t \quad (7)$$

3.3.4 Parametric Test Statistics

To test the significance of the event, the CARs and CAARs are tested if they differ significantly from zero. This is done by testing the null hypothesis that no abnormal returns have occurred. There are two different statistical test methods available to measure the significance levels. These are parametric and non-parametric tests. The latter is preferred, while parametric t-tests are not sensitive when there are outliers and thus non-parametric tests have to be applied (Cleophas & Zwinderman, 2011). Besides this, three assumptions have to be met in order to use the parametric tests: the sample needs to be normally distributed, independent and the variances need to be homogeneous. However, van der Sar (2015) states that according to the Central Limit Theorem, parametric tests can still be used for a sufficiently large sample size. Therefore, for this paper the parametric t-tests shall be applied.

The t-test statistic formula for the CAAR is as follows:

$$t_{test} = \frac{CAAR}{s_c/\sqrt{N}} \quad (8)$$

The t-test statistic formula for the AAR is as follows:

$$t_{test} = \frac{AAR_t}{s_c/\sqrt{N}} \quad (9)$$

3.4 Ordinary Least Squares (OLS)

To test what variables influence the abnormal returns, an Ordinary Least Squares (OLS) regression method will be used. The variables included in the model are the industry dummies, the tangibility of the firm and a dummy for multinational firms.

The regression is as following:

$$CAR_i = \alpha_i + \beta_1 Tangibility + \beta_2 DMultinational + \beta_3 DIndustry + \cdots + \beta_i DIndustry + \varepsilon_j \quad (10)$$

Where:

$CAR_i = The\ cumulative\ abnormal\ return\ of\ stock\ i$

$Tangibility = \frac{Tangible\ Assets}{Total\ Assets}$

$DMultinational =$

$Dummy\ variable\ that\ equals\ (1)\ if\ the\ firm\ is\ a\ multinational\ firm\ and\ (0) otherwise.$

$DIndustry = Dummy\ variable\ for\ each\ industry$

The following 7 industries shall be examined: Mining, Aerospace & Defense, Banking, Financial services, Media, Travel & Leisure and Pharmaceuticals & Biotechnology.

The tangibility of the firms is measured by dividing the tangible assets by the total assets of the firm.

4. Data

In this section the data gathering procedure for the FTSE100 firms shall be discussed.

4.1 The Sample of the Firms

The sample of British firms consists of 36 firms. These firms are all located in Great Britain and listed on the FTSE100 (UKX). In order to test the model, the data for the FTSE100 firms is collected from Google Finance. Daily data is used because the interest of this paper lies within the daily effects caused by the referendums on the stock market.

The data is gathered for the period 01-05-2015 until 01-08-2016. The rationale behind this period is due to the announcement date of the referendum, which was announced on the 27th of May 2015 by Queen Elizabeth II and the date the referendum was held which was on 23 June 2016. The period is extended beyond and before these dates to capture any effects prior to the announcement and past referendum itself.

Below a summary of the sample of firms per industry is displayed.

Industry	Number of Firms	Type of data	Gathered From	Period
Mining	7	Daily data	Google Finance	01-05-2015/ 01-08-2016
Aerospace & Defense	2	Daily data	Google Finance	01-05-2015/ 01-08-2016
Banking	5	Daily data	Google Finance	01-05-2015/ 01-08-2016
Financial Services	5	Daily data	Google Finance	01-05-2015/ 01-08-2016
Media	6	Daily data	Google Finance	01-05-2015/ 01-08-2016
Travel & Leisure	8	Daily data	Google Finance	01-05-2015/ 01-08-2016
Pharmaceuticals & Biotechnology	3	Daily data	Google Finance	01-05-2015/ 01-08-2016

Table 1: Summary Sample Firms

The data contains days in which no trading occurs, thus the returns on these days are considered zero. These days are extracted from the sample and are therefore not included in the model.

Data concerning the tangibility of the firms is retrieved from annual reports of 2015.

For a list of detailed company information names per industry see Appendix Table 2

4.2 The Returns

Once the data for all the indices is collected, the returns needed to be calculated. Since the closing prices for all indices are present, these closing prices shall be used to determine the returns. A simple formula is used to calculate the returns for the indices:

$$Log\ Returns = \left(Ln(Closing\ Price_t) - Ln(Closing\ Price_{t-1}) \right) * 100$$

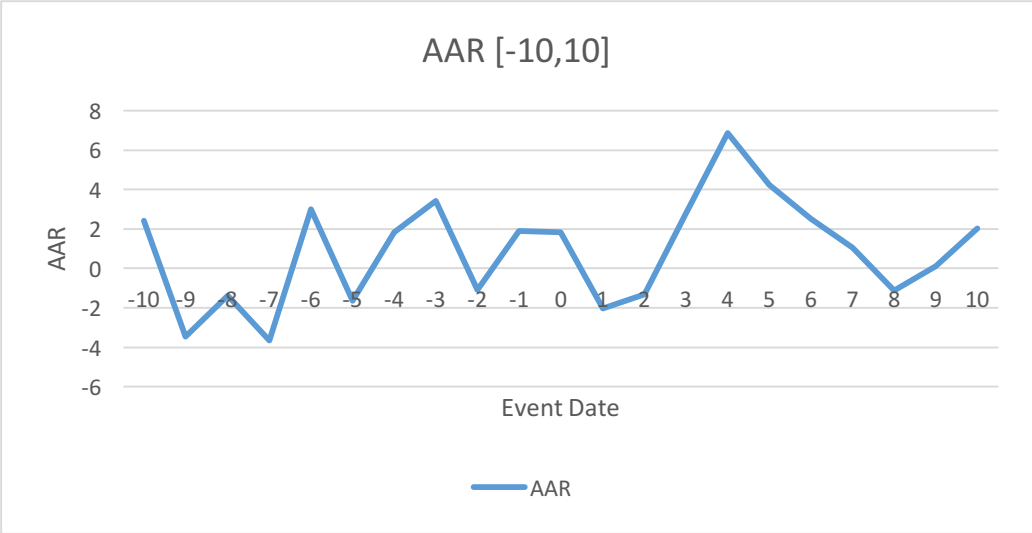
With this formula, the daily log returns across the indices are calculated. The rationale behind using log returns lies within the fact that log returns improve the normality of the return distribution (Henderson Jr, 1990).

4.3 Descriptive Statistics

After importing the the Average Abnormal returns over a [-10, 10] event window into STATA and summarizing the returns the total amount of observations is 21 with a mean of 0.8718003 and a standard deviation of 2.67889. The minimum AAR for the event window equals -3.655262 and its maximums is 6.875092. The minimum AAR occurred on 14-06-2016 which is on event date [-7] and the maximum AAR occurred on 29-06-2016 which is on event date [+4].

Variable	Observations	Mean	Std. Dev.	Min	Max
AAR	21	0.8718003	2.67889	-3.655262	6.875092

Table 3: Descriptive statistics AAR [-10,10]



Graph 1: Trend AAR over [-10,10]

The Graph above shows the trend of the AAR over the [-10,10] event window. This graph clearly shows a sharp increase in the AAR starting on event day 2 (27-06-2016). Hereafter the AAR reached its peak on event day 4 (29-06-2016) with a AAR of 6.875092.

In Table 4, the average tangibility per industry is shown. From this table it is clear that the Mining industry, followed by the Travel & Leisure industry, is on average the highest tangible industry. This is mainly due to the fact that firms in the mining sector require large machinery in their operations. The Financial Services industry has the lowest tangibility, which can be explained by the Financial industry being mainly operated with Human Resources(HR) thus yielding a much lower tangibility.

Industry	Average Tangibility
Mining	58,16%
Aerospace & Defense	12,03%
Banking	0,79%
Financial Services	0,67%
Media	4,45%
Travel & Leisure	47,46%
Pharmaceuticals & Biotechnology	15,69%

Table 4: Average Tangibility per industry

5. Results

In this section the results of the event study and the OLS regression shall be presented and discussed. The event study was conducted to measure the reaction of the stock market on the Great Britain referendum. The critical values used throughout the event study is as follows: 1.645*, 1.960** and 2.576***

With:

* Significant at 10%

** Significant at 5%

*** Significant at 1%

5.1 Empirical Results Abnormal Returns

In order to identify the effect of the referendum on the stock market, the AARs and CAARs were calculated. The statistical significance for these returns were tested to measure if the effects were significant.

Table 5 displays the AARs of the whole sample of 36 firms over the window [-10,10]. This window covers 10 trading days before and 10 trading days after the referendum on 23 June 2016 and thus covers the period of 09-06-2016 till 07-07-2016.

Day	AAR %	T-stat	Day	AAR %	T-stat
-10	2,43***	5,43	**1**	-2,03***	-4,55
-9	-3,45***	-7,73	**2**	-1,31***	-2,93
-8	-1,38***	-3,10	**3**	2,81***	6,29
-7	-3,66***	-8,19	**4**	6,88***	15,40
-6	2,99***	6,69	**5**	4,23***	9,48
-5	-1,65***	-3,69	**6**	2,50***	5,59
-4	1,85***	4,13	**7**	1,06**	2,38
-3	3,43***	7,69	**8**	-1,17**	-2,48
-2	-1,10**	-2,45	**9**	0,10	0,23
-1	1,88***	4,22	**10**	2,02***	4,52
0	1,82***	4,07			

Table 5: Summary AAR [-10,10] event window

The results of the AARs show statistical significance at 1% for almost all of the event dates. The event dates -2, 7 and 8 show a significance at 5% while only day 9 (06-07-2016) shows no significance. 5 out of the 10 event dates prior to the referendum show negative significant AARs, this decreases to 3 out of the 10 for the 10 day after the referendum. Days 1 and 2 show negative AARs, this could imply the outcome of the referendum being viewed as unfavorable. The significant negative AARs prior to the referendum could be explained by the level of uncertainty of the referendum, which was very high prior to the referendum.

Day	CAAR[-5+5] %	CAAR[-3+3] %	CAAR[-1+1] %	CAAR[0+3] %
-5	-1.65			
-4	0.20			
-3	1.79	3.43		
-2	-2.74	2.34		
-1	0.24	5.32	1.88	
0	0.17	-5.25	3.70	1.82
1	-3.68	1.40	**-0.15**	0.51
2	-2.95	2.13		4.62
3	1.16	**6.24*** **		**8.69*** **
4	5.23			
5	**2.56*** **			

Table 6: Summary CAARs for all event windows

Table 6 displays a summary of the CAARs over the 4 event windows. The table indicates that the highest CAAR was realized on day 3 of the event window [0+3]. This high CAAR can be associated with the fact that the uncertainty of the referendum resolved as of the event date [0]. The stock prices have a tendency to react stronger in the days after the referendum than prior to the referendum. Table 7 in the appendix shows the CAAR for the event windows with the calculated t-statistics per event window. From this table, high t-statistics for all of the significant event windows can be seen indicating highly significant CAARs for the respective event windows.

5.2 OLS Regression Results

In this section of the results, the results of the OLS regressions mentioned in the methodology shall be displayed.

Recall the OLS regression for the CAR:

$$CAR_i = \alpha_i + \beta_1 Tangibility + \beta_2 DMultinational + \beta_3 DIndustry + \cdots + \beta_i DIndustry + \varepsilon_j \quad (10)$$

The regression is imported in STATA from which a total number of 36 observations are shown.

CAR	Coefficient	Robust Std. Err.	t	P>| t |
Tangibility	**-.0247789**	**.0398246**	**-0.62**	**0.539**
DMultinational	**-.0064354**	**.0313987**	**-0.20**	**0.839**
DMining	**.0065497**	**.0305414**	**0.21**	**0.832**
DAero	**.0244589**	**.0099931**	**2.45**	**0.021**
DBanking	**.0441167**	**.0222326**	**1.98**	**0.057**
DFinancial	**..0758089**	**.017629**	**4.30**	**0.000**
DMed	**.0260088**	**.0155312**	**1.67**	**0.106**
DTravel	**.0196317**	**.0199582**	**0.98**	**0.334**
_cons	**.0461047**	**.033409**	**1.38**	**0.179**

Table 8: STATA output OLS regression for FTSE100

The value of R-squared (0.4571) gives a good indication of the predictive power of the model. The model explains 45% of the variation, which is considered as a relative good percentage thus making this an interesting model. The model shows 6 out of the 7 industries, this is explained by the properties of dummy variables where the amount of dummy variables equals N-1. The industry left out is the Pharmaceutical & Biotechnology industry. By examining the regression output in table 8, some interesting results have been obtained. The Tangibility

variable shows no statistical significance, indicating that the tangibility of the firm has no significant effect on the CAR. The DMultinational dummy variable represents if the firm is a multinational or not. This variable shows no significant relationship with the CAR. By taking a closer look at the industry dummy variables, several industries show a significant relationship with the CAR. The Aerospace, Banking and Financial Services show a significant relationship with the CAR, while the other industries do not. The Media industry however, could be considered significant as well, while the P>| t | equals 0.106 which is near the statistical significance level of 10%. This is an interesting result while all these industries have, in comparison with the other industries, a relative low tangibility.

5.3 Hypothesis Results

In this section, the three hypotheses presented in chapter 2 shall be answered and discussed.

With regard to the OLS regression mentioned above, the three hypotheses can be answered. The regression measured the impact of several independent variables on the CAR, these independent variables are in their turn linked to the three hypotheses.

Recall the hypotheses:

H1: There is a stronger effect in returns for firms with relative more tangible assets

H2: There is a stronger effect in returns for multinational firms

H3: The referendum has a different effect per industry

The variable linked to the first hypothesis is the Tangibility variable. As stated before the tangibility is measured by the tangible assets divided by the total assets. The data regarding this variable is gathered from annual reports of 2015. The regression result showed no statistical significant relationship between the independent variable Tangibility and the CAR. This result indicates that the tangibility of the firm has no significant effect on the CAR. Therefore, the first hypothesis, that there is a stronger effect in returns for firms with relative more tangible assets, can be rejected.

The Multinational dummy variable is linked to the second hypothesis. This variable indicates if the firm is a multinational. The regression results show no statistical significant relationship between the dummy variable DMultinational and the CAR, indicating that being a multinational firm or not has no significant effect on the CAR. Therefore, the second hypothesis, that there is a stronger effect in returns for multination firms, can be rejected as well.

The third hypothesis is linked to the industry dummy variables. A dummy variable was created for each industry, except the Pharmaceutical & Biotechnology industry which was left out to avoid multicollinearity. The OLS results show that some industries have a statistical significant relationship with the CAR. Therefore, the third hypothesis, that the referendum has a different effect per industry, can not be rejected.

6. Conclusion

The objective of this paper is to examine the short-run effect of the political uncertainty caused by the Great Britain referendum on the stock market. The stock market returns have been analyzed in an effort to investigate if these returns are affected by the Great Britain referendum regarding its position within the EU. This effect was investigated for the countries' primary index, the FTSE100. However, by using a regression with dummy variables for the several industries in the index, the effect of the referendum on these industries have been examined as well. The industries considered are the following: Banking, Mining, Aerospace & Defense, Financial Services, Travel & Leisure, Media and Pharmaceuticals & Biotechnology. Besides accounting for the different industries, the tangibility and the multinationality of the firms were taken into account as well.

The effect on the industries were studies by regressing the CAR on the dummy variables of the industries, the multinational dummy variable and the tangibility of the firm.

The regression analysis showed a significant relationship between the CAR and the dummy variables of the following industries: Aerospace & Defense, Banking, Financial Services and Media. By studying these specific industries, it can be seen that these industries are the ones with lowest tangibility's. However, no significant relationship has been found between the CAR and the tangibility and therefore it can't be stated that the tangibility affects the CAR of the firms.

The research question of this paper is as follows:

Is the British stock market significantly effected by the Great Britain Referendum?

By conducting an event study, with daily returns of 36 firms across different industries listed on the FTSE100, the research question can be answered. The test results indicate that the market is definitely affected by the referendum. The CAARs of the time windows [-5 +5], [-3 +3] and [0 +3] show significant results. These CAARs show positive significant relationships, indicating that the Brexit was considered as good news by the financial markets. To conclude, the British stock market is definitely significantly effected by the Great Britain Referendum.

7. Limitations and Recommendations

Although conclusions have been made regarding the research question, this paper has some limitations which should be accounted for. For the second hypothesis regarding the multinationality of the firms, our sample consisted of a total of 32 multination firms and 4 firms who are not. The sample thus exists of a limited amount of non-multinational firms. This may very well be the reason multinationality variable showed no significant relationship. Therefore, in order to get a more precise image of this characteristic, it is recommended to include more non-multinational firms.

While this paper only focused on few variables, many other relevant variables could be added to the model to increase its predictive power. Anomalies such as the Monday effect, turn of the month effect and the twist on the Monday effect are such variables.

Since the referendum has occurred fairly recent, some data for the event is scarce. Therefore, a recommendation for future research on this subject is to gather more data for a longer period. With future data available, an interesting topic for further research is to measure the impact caused by the outcomes of the referendum on the long run for the firms listed on the FTSE100.

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9. Appendix

Company	Industry	Tangibility	Mutlinational
Anglo American	Mining	56.90%	yes
Antofagasta	Mining	63.50%	yes
BHP Billiton	Mining	75.50%	yes
Fresnillo	Mining	55.40%	no
Glencore	Mining	47.70%	yes
Randgold Res.	Mining	41.40%	yes
Rio Tinto	Mining	66,7%	yes
BAE Sys.	Aerospace & Defense	8.45%	yes
Rolls-Royce HLG	Aerospace & Defense	15.6%	yes
Barclays	Banking	0.31%	yes
HSBC HLDGS. UK	Banking	0.41%	yes
Lloyds GRP.	Banking	1.57%	yes
Royal Bank Scot	Banking	0.55%	yes
Stand. Chart.	Banking	1.10%	yes
3I GRP.	Financial Services	0.08%	yes
Hargreaves Lans	Financial Services	1.83%	no
London Stock Exchange Group	Financial Services	0.02%	yes
Provident Fin.	Financial Services	1.20%	no
Schroders	Financial Services	0.23%	yes

Informa	Media	0.57%	yes
ITV	Media	7.83%	no
Pearson	Media	2.75%	yes
Relx	Media	2.05%	yes
Sky PLC	Media	10.72%	yes
WPP	Media	2.77%	yes
Carnival	Travel & Leisure	81.27%	yes
Compass Group	Travel & Leisure	8.73%	yes
Easyjet	Travel & Leisure	59.59%	yes
Intercon. Hotel	Travel & Leisure	11.36%	yes
INTL Consol Air	Travel & Leisure	48.43%	yes
Merlin	Travel & Leisure	54.66%	yes
TUI AG	Travel & Leisure	27.90%	yes
Whitbread	Travel & Leisure	87.70	yes
Astrazeneca	Pharmaceuticals & Biotechnology	24.00%	yes
Glaxosmithkline	Pharmaceuticals & Biotechnology	18.09%	yes
Shire	Pharmaceuticals & Biotechnology	4.99%	yes

Table 2: Detailed summary per company

Event Window	CAAR %	T-Stat
[-5+5]	2.56***	3.21
[-3+3]	6.24***	8.80
[-1+1]	-0.15	-0.13
[0+3]	8.69***	4.80

Table 7: CAARs for all event windows with T-stat