

THE IMPACT OF BREXIT ON STOCK PRICES OF LISTED FINANCIAL SERVICE
COMPANIES IN THE UK

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Abstract

The objective of this thesis was to determine the impact of Brexit on financial service companies listed in the London Stock Exchange. In order to achieve this objective, changes in stock prices of listed financial service companies were evaluated and tested for significance. The analysis of the London Stock Exchange and FTSE 100 index showed that substantial volatility was present during the Brexit events. Following an analysis detailed in the thesis, the most important industry, which has material impact on the economy of the United Kingdom, was determined and chosen for further research. Furthermore, relevant scientific literature on the impact of an economic, political event on stock prices was analysed and it was determined that the most appropriate and expedient procedure for testing was an Event study. Therefore, an Event study method was used to analyse the impact on three financials industry sectors: banking, insurance and financial services. All companies that were included in the research displayed abnormal returns during the three analysed Brexit events. Additionally, the results presented by the study highlighted that Brexit events had a significant negative effect on banking, insurance and financial service sectors. Ultimately, out of the three events that were analysed, Brexit referendum was deemed to be most influential on all three sectors, recording the highest negative abnormal returns.

Keywords: Brexit, Financial Service, London Stock Exchange, Event study, 14178 Words

Table of Contents

Introduction	7
Situation analysis	9
Brexid	10
Brexid political impact	10
Brexid economic impact	14
Brexid impact on stock market.....	18
Brexid impact on financial service sector	21
Literature overview and research methodology.....	23
Literature overview	24
Efficient market hypothesis	31
Research methodology	32
Event study	32
Drawbacks of Event Study methodology	39
Empirical research.....	41
Industry analysis	41
Empirical research	43
Normal returns estimation.....	43
Testing procedure	46
Abnormal returns	46
Aggregation of standardized residuals	48
Research results	54

Research limitations.....	55
Conclusions	56
References	59
Appendices	64

List of figures

Figure 1. Slump of pound sterling in key moments.....	15
Figure 2. United Kingdom GDP growth rate compared to Eurozone.....	17
Figure 3. FTSE 100 index value during the period 2016 January to 2017 March.....	20
Figure 4. British pound performance comparison to FTSE 100 index.....	21
Figure 5. Quantification of first order and ecosystem effects of the UK's exit from the EU.	26
Figure 6. The Estimation Period (EP) and the Test Period (TP).....	34

List of Tables

Table 1. Analysis of companies selected for research.....	42
Table 2. Fitted models' estimates and statistics.....	44
Table 3. Standardized abnormal returns.....	47
Table 4. Portfolio abnormal returns.....	48
Table 5. Cumulative abnormal returns and test statistics.....	49
Table 6. Test statistics for each event evaluated.....	52

Introduction

Topic relevance. Brexit is a topic that has been discussed extensively ever since the 2016 June referendum and the announcement of withdrawal from the European Union. The United Kingdom has been a key member of the European Union and has benefited heavily from the single market union and free trade. The politicians who were trying to gain favor with the Eurosceptic voters have brought down what seemed to be a symbiotic relationship between the European Union and the United Kingdom. The relationship was extremely valuable to international companies, which could operate freely and without tariffs in many different European countries.

However, it is worth noting that not all firms were impacted equally, as some industries are naturally more sensitive to economic and political changes. One of the most important industries for the United Kingdom is the financial services sector, which plays a key role in the British economy. Many economists and politicians argue that the changes to regulation and the single market that may occur because of Brexit could extensively affect banks, insurance and asset management companies based in the United Kingdom. One of the ways to analyse the impact is to consider the volatility the share prices of the affected companies after the announcement of the Brexit results. In order to achieve appropriate and sufficient analysis, stock prices of listed companies ought to be analyzed and should provide insights on how Brexit affected the market, assuming the market efficiency theorem. More importantly, analysis of the listed companies on the London Stock Exchange could provide with valuable information on financial service industry, which in turn could be extremely useful to investors that are uncertain about the future of the industry. Moreover, a study of different financial service sectors could provide an understanding of the severity of the impact of various post-Brexit events.

Ultimately, it is crucial to evaluate the affects on prominent British banks, insurance and other financial service companies, due to these listed firms being global leaders in their industry, which makes many different investors and stakeholders severely interested in the performance and future of these corporations. Therefore, the assessment of the impact of Brexit events on the share prices of listed financial service companies is the key to providing useful and valuable information to a great amount of related parties.

Research problem: What is the impact of Brexit on listed financial service companies in light of their stock price fluctuations?

Thesis objective: To assess the impact of Brexit on financial service industry by analysing stock price changes of listed FTSE 100 financial service companies during the Brexit process and post-Brexit.

Thesis tasks:

1. Analyse Brexit and its impact on the British economy, stock market and financial service sector;
2. Identify the industry based on importance, relevance and its influence to the United Kingdom as basis for research;
3. Analyse the theory related to the impact of an economic event/economic uncertainty on stock market returns in order to choose an appropriate research method;
4. Conduct an Event study in order to determine the impact of Brexit on stock prices of listed financial service companies in the United Kingdom.

Research method. Scientific literature will be analysed to determine the correct method to base the research on. In order to determine the impact of Brexit on listed financial service companies in the United Kingdom, an Event Study will be carried out using Gretl and MS Excel software with data downloaded from the London Stock Exchange and Yahoo Finance websites.

Practical value. Thesis analysis would be most relevant to investors in the London Stock Exchange, especially those who are investing in financial service companies. The information may also be valuable to various stakeholders of financial service firms who are unsure about the economic future of the finance industry. The research should provide answers as to how Brexit has affected financial industry, the severity of the impact and what can be foreseen for the future.

Situation analysis

According to the official exchange rate (CIA gov, 2017), the United Kingdom (UK) is the fifth largest economy in the world, and the second largest in Europe, accounting to \$2.629 trillion GDP). As one of the leading trading and economic powers in the world, the UK played an important part in Europe and more specifically in the integration of European Union. The UK was a founding member of the alliance called the Western European Union (WEU), which was established in 1954. In 1960 the UK was one of the seven founding members of the European Free Trade Association (EFTA), however left in 1973 to join the European Communities (EC). In 1975, there was a referendum held on whether UK was to remain in the EC (sometimes referred to as the EEC). The Majority, i.e 67% of the voters, voted to remain. When in 1992 the EC became the European Union (EU), the UK was one of the 12 founding members. In 2007 the UK also signed the treaty of Lisbon, which formed the constitutional basis of the EU.

Many European countries historically have looked up to the UK for leadership, however the reality dictated otherwise. UK chose to remain outside the monetary union (Eurozone), actively criticized growing bureaucracy in the parliament and dismissed any suggestions for further integration within in Union, disapproved of the European leaders (specifically the European migrant crisis which began in 2015) for not being able to handle the situation efficiently. As the relations between the EU and the UK deteriorated, in

2013 the prime minister David Cameron even suggested that he supported in-out referendum for the UK people due to disagreements and inability for the EU to change and reorganize. Many attributed these claims to forthcoming elections, where Cameron tried to win over the eurosceptic British citizens, who were unhappy with the way EU operated. In 2015 pre-election conservative manifesto, the pledges of the conservative party were to revise the relationship with the European Union and bring "real" change, as well as hold a in-out referendum until the end of 2017. The primary goal of Cameron and the conservative party was to establish a "special status" for the UK in the European Union and to push the European Union into reforms that would increase efficiency and reduce bureaucracy. To further please the eurosceptic electorate on 22 February 2016 Cameron announced the date of referendum which was to be held on 23 June 2016.

It is important to highlight that Cameron himself urged the UK voters to vote to remain in the EU, however his plan backfired horribly and the gamble to win over more voters resulted in a situation which led to Brexit. Cameron afterwards resigned and the newly elected Conservative party leader Theresa May took over the helm of soon to be Brexit negotiations. One of the biggest economies leaving the European Union is a big hit for trade and overall economic climate in Europe. It has also impacted the UK stock exchange heavily, which will be discussed in later stages of the situation analysis.

Brexit

Brexit political impact

Brexit (British and exit blend) is a popular term referring to the UK withdrawing from the European Union. The decision was made following a referendum held on 23 June 2016 to decide whether the UK should remain in the European Union or leave. 51.9% of the voters expressed their opinion to leave the European Union, while 48.1% voted against (Electoral commission, 2016). Across the United Kingdom, England voted for Brexit, by

53.4% to 46.6%. Wales also voted for Brexit, with Leave getting 52.5% of the vote and Remain 47.5%. Scotland and Northern Ireland both backed the EU membership. Scotland backed Remain by 62% to 38%, while 55.8% in Northern Ireland voted Remain and 44.2% Leave (Electoral commission, 2016). After the referendum, there were waves of outrage among many voters in Scotland and London particularly due to the fact that the decision to leave European Union was forced upon them by other regions. This indicates a split between the voters opinion on the issue: Scotland threatens to leave the UK with similar tendencies observed in Northern Ireland. Division within the UK and uncertainty about the future of the European Union partnership has made Brexit a hot topic in both political and economical world.

Moving forward, it is essential to analyse the most important events that followed the referendum. On 17 January 2017 Theresa May set out 12 priorities that the UK will use in order to negotiate Brexit. Main point of these priorities is to outline the core strategic course that the UK could follow and has been following even before Brexit: control of immigration policy and laws, ability to negotiate trade agreements separately but still have free trade with the European markets, i.e remain in the Single market. However a large amount of European leaders are unhappy about the way Theresa May and the UK approach their decision to leave European Union, indicating that a "soft" exit is the preferable option, whereas Theresa May stance lands on "hard" exit, meaning complete seclusion of the UK from European Union, however still wanting to retain free trade and free movement.

On 24 January 2017 the Supreme Court rejected the previous ruling and announced that the UK parliament will get a chance to vote on invoking the Article 50 (Trading opportunities, 2017).

On 13 March 2017, the Parliament voted to invoke the Article 50 and begin Brexit negotiations (Trading opportunities, 2017).

On 29 March 2017, Theresa May wrote to the European Council leader Donald Tusk notifying of UK's intention to leave European Union which marked the official invoking of Article 50. This also confirmed the official exit of UK from the European Union and that the official negotiations of UK's withdrawal could proceed.

In more current affairs (June 2017-present), the most important factor is the way Brexit talks are to unfold. European Union suggests a three-phase approach, consisting of the withdrawal, the future relationship and the transition. The evaluation, made by the EU's chief negotiator, estimates 18 months (From June 2017 to October 2018) for negotiations once ratification and preparatory works are completed (FT, 2017). However Britain's lead negotiator, David Davis already believes that the suggested schedule is simply "not practical" and may lead to disagreements. Here is the outline of Phase 1 as suggested by the European Commission chief negotiator Michel Barnier:

Phase one: the withdrawal (June to December 2017). The main focus is on the Exit bill, under which Jean-Claude Juncker estimates that the UK owes €60bn from past financial commitments. Many British ministers consider this to be completely false. French and German leaders expect Britain to at least agree to the methodology on exit liabilities before trade talks can begin. Many officials predict that negotiations could be prolonged to December 2017 (Barker Alex, Brundsen Jim, 2017). Another focus point is on citizen rights, where both sides want to guarantee rights for as much as four million migrants. However this is deemed to be extremely complex issue by many senior European Union officials due to uncertainty of immigrant status, i.e whether to keep European Union citizen rights or employ new "special" rights.

Phase two: The future relationship (January to June 2018). The most complex part of the negotiations and potentially divisive for the European Union due to different views taken by both sides. Mr Barnier (representing the European Union) hopes to lay out a broad

agreement on future relations between the parties, implementing at least the main objectives of a post-Brexit free trade deal, while Mr Davis (representing Great Britain) wishes that Free Trade Agreement would be laid out fully by the end of the negotiations. Unlike traditional trade deals, the EU-UK deal must deal with regulatory separation and divergence, not convergence (Barker & Brundsen, 2017). The main goal is to lay out a regulatory framework for the UK to follow after Brexit, however the European Union officials do not approve of any joint committees that would give additional veto power to the UK.

Another important point in the negotiations is market access. The European Union is to enter negotiations as a bigger player and should dictate the rules on how the framework will be laid out. The UK is going to become a single market and this has certain benefits, however European Union insists that there will be a massive economic decline due to restricted access to European Markets. Furthermore, regulatory changes to the financial services are a key topic in both European and British markets. Many of financial service firms have expressed concerns on how the changes will be implemented and whether UK will continue to follow regulations that the EU proposed. Financial Conduct Authority (FCA) insisted that regulations will continue to stay consistent within the outlined framework. Their reasoning for implementing MiFID II and other changes is the fact that majority of the proposed regulatory changes come not only from the European Union, but also as common propositions in support of G20 and World Trade Organisation (FCA , 2017). Thus, future conditions and supervision of UK financial services will be a hot topic in the negotiations.

Phase three: The transition (July to October 2018). Main talks in the transition will be on Britain escaping the jurisdiction of the European Court of Justice (ECJ). The European Union insists that in order to participate in the EU single market u need to follow

the EU rules, the EU supervision and the EU enforcement. Sole authority of the European courts is essential to safeguarding the EU regulation. One of the compromises that both parties could reach is to involve the UK courts to independently enforce the EU rules.

Another important topic in the transition is free movement and money. Many UK citizens voted to leave the EU due to the lack of immigration control. Post-Brexit Britain will regain such power, however all financial contributions benefiting UK and vice versa should be dropped, including free of movement of labor.

Brexit negotiations will determine the future of the United Kingdom and European Union relationship. While there are many disagreements between the parties, it is beneficial for both sides to reach consensus and make sure the transition happens smoothly. Prolonged negotiations would only increase tension and frustration in both the UK and the EU. The political impact of Brexit is potentially enormous and may set the tone for future negotiations. Even though Brexit is a political move at its core, it also had tremendous impact on the economy of UK, which will be discussed in the next part of situation analysis.

Brexit economic impact

The initial focus of the economic analysis will be on how the pound exchange rate fluctuated compared to the dollar. Currency fluctuations are especially important to foreign investors and international companies, but can also have an impact at customer level. Strong currency is not necessarily beneficial, as it makes exporting more expensive, whereas weaker currency may benefit exporters. For consumers, weaker currency may make buying imports more expensive and vice versa. Here are the key points of pound's slump during Brexit aftermath timeline, outlined in Figure 1:

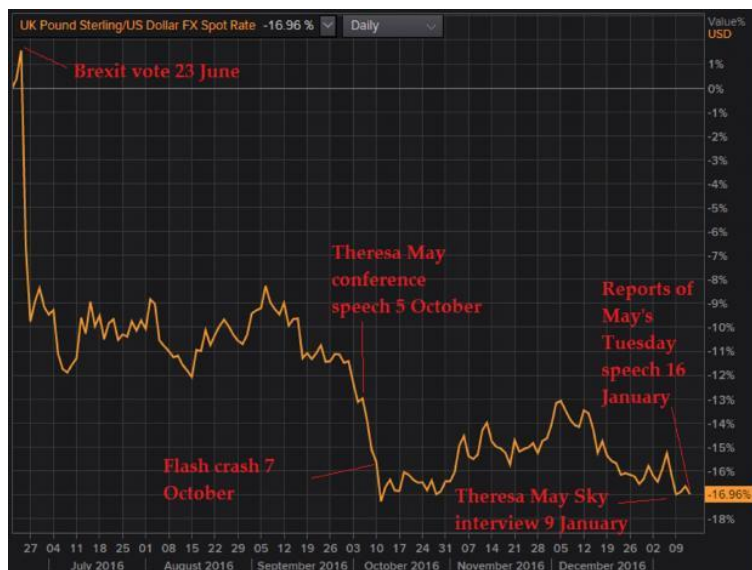


Figure 1. Slump of pound sterling in key moments. From Independent, "Pound sterling slump: The key moments in six charts" by Rodionova Z., 2017.

After Brexit results, the pound plunged heavily, to \$1.33, indicating investors uncertainty about the future. the pound sensitivity to Brexit was not unexpected and continued to remain volatile after the big post-Brexit plunge up until October 2016, when Theresa May gave her speech to the conservative party, setting the date for Brexit and reassuring that UK will try to negotiate the best deal possible (Independent, 2016).

Mysterious flash crash on 7 October 2016 contributed to continuous downfall of the pound. After the crash, the pound somewhat rebounded and remained volatile up until January 2017, when it took a slight dip due to one of the lowest rate at \$1.2 per pound. This was due to Theresa May outlined priorities on how the UK is going to approach exit and that "hard" Brexit will be the plan which UK will choose to follow in order to exit the European Union. In 2017, the pound remained volatile but somewhat rebounded and already reached above \$1.3 per pound in July (XE, 2017). As it can be seen from the analysis, the pound remained both volatile and on the downturn after Brexit.

Other key points to analyse is how a weak pound affects the market, more specifically the consumers and firms. The biggest winners from a weak pound are exporting firms due to the fact that foreign buyers need less currency to buy the same quantity of goods. A weaker pound may also improve current account deficit due to increase in exports. Foreign investors and foreign tourists also benefit from a weaker pound due to cheaper exchange rate. The biggest losers of a weak pound would have to be consumers who buy imported goods, British tourists, foreign workers and firms importing goods.

Crucial issue to analyze with respect to the volatility of the pound is whether the decline is only temporary or sustained. Temporary decline would most likely indicate short-term fluctuations in prices, while sustained decrease would lead to fall in purchasing power of goods abroad (Pettinger Tejvan, 2017). Impact on exports can also be insignificant if productivity is low and can not sustain increase in exports. In order to better asses the Brexit impact on the economy of the United Kingdom, other parameters need to also be analysed.

One of the key parameters to determine how economy is managing is Gross Domestic Product (GDP). GDP measures monetary value of final goods and services that are bought by final user and produced in a country at a given period of time (Callen Tim, 2017). Growth of GDP is usually an indicator of an expanding economy. Gross Domestic Product is usually driven by consumption, investment, government spending and net exports. Below you can see Figure 2, outlining the UK and Eurozone GDP growth comparison during 2016 January-2017 July timeline:

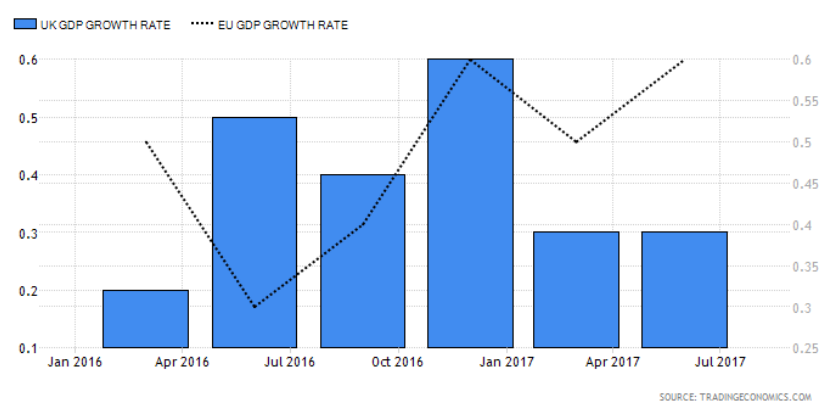


Figure 2. United Kingdom GDP growth rate compared to Eurozone.

From Trading Economics, "United Kingdom GDP Growth Rate"

by Trading Economics.

The UK showed a considerably lower growth rate than eurozone at the start of 2016, amounting to 0.2% in first quarter, while the eurozone climbed at 0.45%. However in the 2nd quarter, UK economy expanded by 0.5% while eurozone retained only a 0.2% growth. 3rd quarter showed a growth of 0.4%, while eurozone went up by slightly less, amounting to 0.3%. 4th quarter showed similar growth from both sides, amounting to 0.6%. Even after Brexit, UK economy showed better growth than eurozone. Experts claim it was due to boom in consumer spending and service sector performance (The Guardian, 2017).

Pharmaceutical exports were a major factor, growing by about 0.7% between October and December 2017. Strong performance in forementioned sectors offsetted poor end of the year for manufacturing and construction. The Brexit effect seemed to not be relevant, as the UK economy showed resilience in year 2016, however 2017 brought different results. In the first and the second quarter UK economy grew by only 0.3%, while the Eurozone by 4.5% and 6% respectively (Mehreen, 2017). As worst six months since 2012 enveloped the United Kingdom, the only shining light was the service sector which expanded by 0.5% with net exports growing by 0.4% (The Guardian, 2017). The Pound's decrease over the year may have had an impact on the growth of exports, hence the marginal gain of net exports is unsurprising. Conversely, the Eurozone showed great results

due to major wins in European elections where pro-european candidates and parties edged out against the eurosceptics. Notable slowdowns in UK's economy forced IMF to cut down GDP growth forecast for year 2017 from 2% to 1.7%, by highlighting household budgets as being under pressure as well Brexit related risks of the economy (Mehreen, 2017).

As the Brexit negotiations are ongoing, the economy of the United Kingdom continuously suffers from uncertainty about the future which influences both consumer and producer markets. With services being the only performing sector, Brexit may lead Great Britain into another mini-recession. Brexit is clearly going to be one of the defining factors in current and future economy of the United Kingdom.

Brexit impact on stock market

As the biggest part of analysis in the previous part was based on the Brexit influence on macroeconomic variables, this part will focus more on stock market and how the major companies were affected by UK's decision to leave the European Union. A share market usually refers to a collection of markets and exchanges where trading and issuing of various securities takes place, either through formal exchanges or over the counter markets. The stock markets are usually found to be sensitive to any major economic events that occur in the country. It is also apparent that markets are highly volatile when there is exposure to major economic events (Rajith, & Dayarathne Lakshman, 2012).

In order to determine the impact on the United Kingdom market, the major point of focus should be on the London Stock Exchange, the biggest stock exchange in Europe and third biggest in the world. The London Stock Exchange or LSE was established in 1801 when it replaced The Royal Exchange. Currently it holds 6.06 trillion GBP as market cap and is home to about 2317 companies as of September 2017 (London Stock Exchange, 2017). In order to better analyse impact on stock market it is wise to refer to the indices rather than looking at different companies, which would require considerable amount of

time and would not be as efficient and valuable. The Indices are normally computed from the prices of selected stocks (weighted average). It means that many listed companies from different sectors are included in the index, which in turn reflects the whole market better than a singular or several selected companies. One of the main stock indexes in the London Stock Exchange is FTSE 100, which refers to 100 listed companies with the highest capitalization. It consists of about 1.7 trillion GBP market capitalization and most companies included in the index are international corporations, however FTSE 100 can still be viewed as at least a partial reflection of the UK economy. Here is the outline of FTSE 100 index for January 2016 – March 2017, with key dates being highlighted:

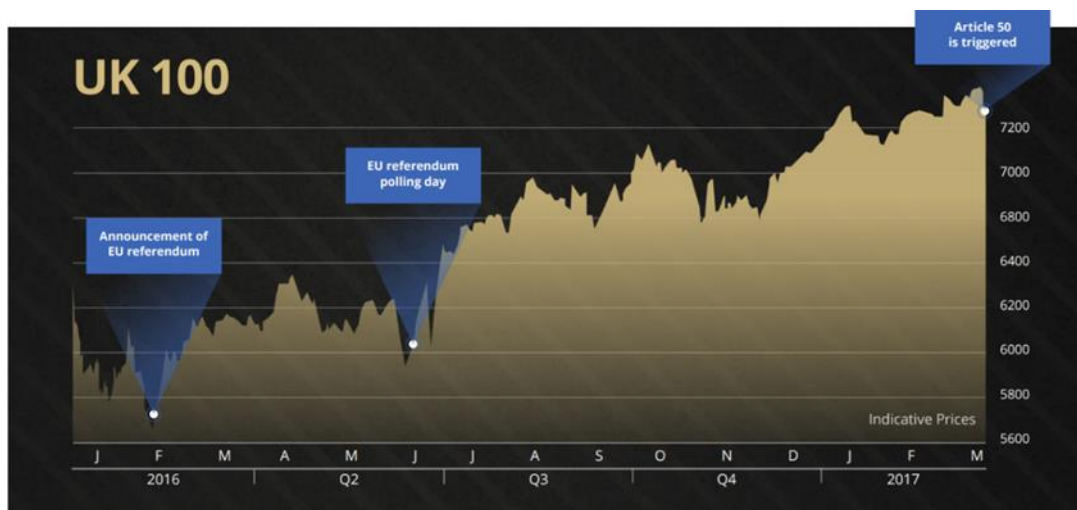


Figure 3. FTSE 100 index value during the period 2016 January to 2017 March

Including highlighted events. From Financial Trading, "Brexit Trading Opportunities".

Unsurprisingly, the markets were volatile around major Brexit events. Before the announcement of exact date of the referendum, investors were faced with uncertainty and naturally the FTSE 100 index displayed poor performance. However after the announcement, going into end of February and the beginning of March 2017, a significant bounceback can be observed mainly due to the pound's depreciaton, as the majority of FTSE 100 companies are exporting firms. A similar story can be observed around the EU referendum date, however a big influence on the FTSE 100 plunge before the referendum

polling day was surge in pound value, as well as investor confidence in pro-EU vote.

Shortly after the results to leave European Union were announced, FTSE 100 rallied and once again returned to appreciation path due to the depreciation of pound.

Moving forward to 2017, FTSE 100 showed some volatility but remained on an upswing as the pound continued to depreciate up until April 2017, where it bounced back and started to rise, stopping the FTSE rapid growth. It is important to outline that about 75% of FTSE 100 companies earnings are in dollars and this is why the index is so sensitive to the appreciation and depreciation of pound (Wilson, Neil 2017). However, it is worth noting since the start of 2017 the correlation between the pound and the FTSE has increasingly become weaker. The pound has steadied, meaning that the reliability of pound weakening and FTSE rising at the same time is lower.

Full picture of GBP/USD compared to FTSE 100 can be seen below:

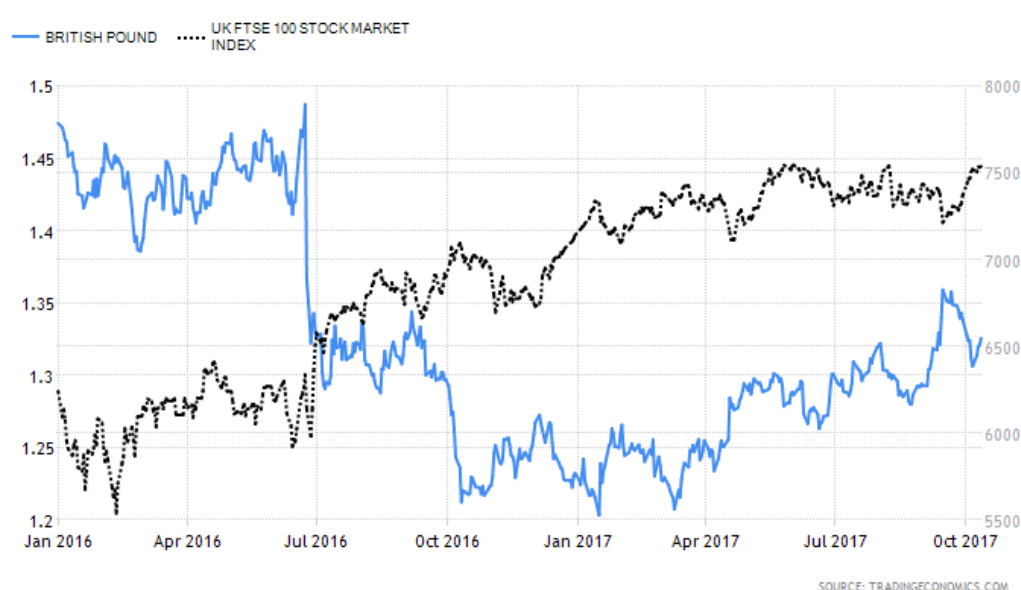


Figure 4. British pound performance comparison to FTSE 100 index during the period 2016-2017. From Trading Economics.

Even though the correlation has become weaker, should there be a drop in sterling exchange rate, there should be a rise in some FTSE 100 equities, mainly the dollar earners. And if that happens, big question would be as to why it happend with main focus being

given to the ongoing negotiations, especially considering the single market trade terms that the United Kingdom and The European Union are yet to agree on.. If the trade terms are worse than expected , then there is an expectation for the value of many different stocks to be affected. The consideration would then shift to which sectors and companies are the most exposed and vulnerable to economic and political uncertainty. According to Neil Wilson, the sectors that are most likely to be affected:

1. Retail, due to pound weakness and consumer spending.
2. Airlines, due to changes in regulatory requirements, position in Single aviation market and the fall of sterling.
3. Financial services, due to changes in regulations, fall of pound and inflation.

It is hard to determine which of these sectors will be exposed the most. Historically, the most impactful and important sector to the UK economy was the financial services and it is only logical to continue with the analysis on the sector that has the largest influence on the UK markets.

Brexit impact on financial service sector

Financial service firms are economic service companies encompassing a broad range of business that manage money, including commercial and investment banks, insurance companies, investment funds and others. Financial service companies are usually present in developed countries and recently have become one of the biggest players in the global economy. These companies and the whole financial sector is especially important to United Kingdom. It houses more than two million jobs in the UK, two thirds of them outside of London; financial sector is the UK's largest tax paying sector, amounting to £66bn taxes paid; it is the biggest exporting industry, contributing to about £67bn to the balance of trade and in 2014, exports of financial services to the EU generated £18.5bn trade surplus (TheCityUK, 2016). In September 2017, financial services held 21.89% of total market

capitalization in the FTSE 100, making it the largest sector represented in the index.

Therefore it is obvious that the financial service sector is an incredibly important and crucial industry to economy of the UK which will face quite a few risks post-Brexit.. According to ACCA Global, there are three major risks concerning Brexit that will have an impact on the UK financial service sector, which are:

1. Devaluation of the pound
2. Unclear and insufficient communication by g theovernment/regulators on proposed approach
3. Increase in the UK inflation

While the devaluation of pound and increase in inflation are valid concerns, the biggest risk should be attributed to the uncertainty surrounding the proposed approach to Brexit. In an industry as highly regulated as financial services, most firms need certainty about future changes. For investment banks, the biggest concern is the regulatory changes with regard to the transition to MiFID II and accessibility to European markets (Flewing & Young, 2016). If British companies were to lose passporting rights (refers to ability to offer services in Euro-zone based on UK licence or vice versa), it would be a big hit to asset managers and companies which are closely related to their European counterparts as well as other companies which offer services to European Union. In result, the related parties would need to buy licensing rights to operate in different countries which would bring higher costs.

These implications mean that at least in the short term, the Brexit negotiations are likely to have a negative impact on financial service industry revenues based on uncertainty UK position in Brexit talks. Uncertainty is the key word here, as it is the main reason behind volatility in the market and the financial service sector, which in turn signals the need to further analyse the impact of Brexit on financial service companies.

Brexit has certainly caused a turmoil in the UK and Europe. As negotiations are ongoing between the leaders, economic and political instability has caused the market to remain volatile. Pound depreciation has rallied the market in 2016 ,but the 2017 stabilization has led to a slow down in the FTSE 100 growth. Stagnating GDP growth is a major concern going forward, as the United Kingdom needs to the growth to compensate for future losses of leaving the single market union. The continued friction and disagreements between European and British representatatives have left industries and especially the financial service sector facing various risks. The implications are major given that the biggest tax paying sector is troubled with uncertainty going forward and thus further analysis of the impact of Brexit on the financial service companies and sector is extremely important and relevant to both British and European related parties. Analysis is especially important to investors which are concerned with volatility and future implications of listed financial service companies.

Literature overview and research methodology

Before analysing the financial service industry , it is important to understand the importance of service sector for the United Kingdom economy. The service sector is a cornerstone of UK's economy. It compromises four fifths of Great Britains' GDP (CIA, 2017). Service Industry always had substantive impact on balance of trade, ever more so in recent years. A report published by EY (2014, June) specifically outlines how current account deficit has grown since 2000 due to increase in deficit in the goods market, but what is often overlooked is record highest ever surplus on trade of services at £81bn (Refer to Appendix A). It is a continuation of a long established pattern of UK struggles in goods market, which are offset by sustained strength in the provision of service exports. The authors also outline that the importance of service sectors are not only evident in trade figures but were also influential in Great Britains' economic activity, particularly over the

past decade. In the period from 2004-07, net services trade contributed 0.6% per year to GDP growth and this meant that a sector accounting for just 11% of the economy was responsible for approximately a fifth of the growth over this period (EY, 2014).

The Service sector has certainly benefited from EU single market, but it is about to change due to Brexit. According to Will Higham (2016) it is especially evident in the financial service industry, as the relative openness of the sector means it has benefitted much more from EU membership than other sectors. As it was mentioned before, the financial service sector is the largest tax payer in the UK and also one of the most international, covering vast amount of countries around the world. Analysis of the impact of Brexit on listed financial service companies could provide valuable information on how severe the effect could be. Currently there is little precise analysis on Brexit impact on stock market and industries affected, however as Brexit could be attributed as an economic event or even as economic uncertainty, literature covering these topics widens. In literature overview section, researchers analysis of economic uncertainty, economic event impact and even preliminary Brexit impact on financial service sector reports will be covered. It is important to consider what many researchers concluded about similar problems to acquire knowledge of possible Brexit influence on financial service sector and companies operating in it.

Literature overview

An important part of overview is to determine whether Brexit will have significant impact on the financial service industry. Oliver Wyman (2016) report analyses the impact of UK's exit from European Union on financial service sector. The severity of impact will largely depend on agreements between the parties on many pieces of legislation. Depending on the possible regulatory outcome, Oliver Wyman (2016) outlines two major ends of the spectrum as circumstantial results of Brexit: High access and Low access for Great Britain.

High access refers to having regulatory equivalence to European legislation, while low access moves United Kingdom into a third country position with the EU (for more information, refer to Appendix B).

To properly evaluate the impact, Oliver Wyman (2016) also separates EU-related UK businesses that would leave the British market after Brexit from other domestic companies and defines it as "The First Order Impact". For example in a low access scenario, these Sales and trading firms would no longer be able to sell products to EU clients directly; Asset management based firms would no longer be allowed to distribute to EU clients directly and insurance companies would no longer be able to service EU clients. Other activities that may have additional impact on the ecosystem of UK economy are defined as "The Ecosystem Impact" and it mostly refers to loss of economies of scale after Brexit either in the business or in the ecosystem as a whole. Both definitions made by Oliver Wyman (2016) are presented in the figure below and will aid in explaining the possible impact of Brexit on the UK economy:



Figure 5. Quantification of first order and ecosystem effects of the UK's exit from the EU in different scenarios. From Oliver Wyman Report, 2016.

Whether UK manages to exit EU and achieve high access according to Oliver Wyman (2016), the impact would be one percent revenues lost in First order and one percent in Ecosystem, which definitely seems negligible. However, the likelihood of such agreement between EU and UK is almost equal to zero percent as both parties showed no interest in keeping the regulatory equivalence after Brexit and leaned more towards the third party arrangement. Thus in Low access scenario, the impact is much stronger as First order could potentially lose 10% of revenues while Ecosystem indicates about 15-20% of revenues at risk. There are also big potential job, tax and gross value added losses associated with low access scenario, which only amplify the fears of "hard" Brexit. Another important aspect to outline is that Oliver Wyman (2016) predicts these outcomes under certain assumptions, such as continuation of international norms, UK equivalence agreement with non-EU nations and continuation of current tax treaties and other agreements with non-EU countries, as well as continued access to skilled talent from both EU and the rest of the world. Most of these assumptions in reality will most likely not hold in practice, as the UK will lose a large amount of trading power after exiting the Single market of the EU block. What is more, access to skilled talent from the EU is not a guarantee in the light of as well as expectation that there will be as much access to skilled talent in EU as there was before Brexit is certainly not a given, considering the deteriorating relationships between EU countries and the UK. If these assumptions do not hold, the impact of Brexit on financial service industry is likely to amplify and turn out to be much larger.

In the end, the analysis that Oliver Wyman (2016) provide is suggesting that the impact of Brexit on UK financial service sector will vary dramatically depending on how much EU access is retained. In the high access scenario, the impact is most likely going to

be negligible, while a low access scenario impact would be much larger with the resulting wider influence to the ecosystem further magnifying the losses.

Another essential point to analyse is the effect off an economic event (similar to Brexit) on the stock market. Dayarathne and Rajith Lakshman (2012) in their paper try to examine sensitivity of stock prices to economic events in an emerging and developed market. The authors argue that there is a positive relationship between volatility and world prominent crises in the world economies, but the link between economic, political events and stock market volatility in comparative form is very limited in literature. The scarcity of literature prompted authors to write this analysis and base their research on a problem faced by investors when the returns deviate from their expected return due to uncertainty in the market or in the economy. As stock markets are highly sensitive to political and economic events, it causes volatility in stock prices, which in turn result in losses for the investors (Dayarathne and Rajith Lakshman, 2012). Dayarathne and Rajith Lakshman use this opportunity to capture the exact point of volatility in the market return series in both emerging and developed markets.

To identify the data and volatility, authors use a test, refined by Inclan and Tiao 1994, for the detection of multiple changes in volatility of a time series. The test, identified as ICSS (Iterated cumulative sum of squares), is applied in the paper due to an advantage of revealing crisis periods without human intervention, making it the objective approach (Dayarathne and Rajith Lakshman, 2012). ICSS is used mainly to detect structural shifts in volatility in weekly market returns series from the CSE and the NYSE. The ICSS mainly asserts that the variable, i.e X , is more sensitive to the changes in volatility than the alternatives available (For more information, refer to Appendix C). As the authors analyse both the developed and the developing markets, focus will be on the developed market, in this case NYSE due to relevance to papers topic, as LSE also represents a developed

market. In the research, the breakpoints in the NYSE are followed by major economic and political events in the US. Volatility breaks in NYSE are more prominent during the economic crisis periods (for more information, refer to Appendix D). Critical point to take from this research is that results of ICSS suggest that stock market volatility is not an isolated event and that it coincides with changes in the economic environment. (Dayarathne and Rajith Lakshman, 2012)

Therefore, NYSE market portfolio in this research was clearly sensitive to major economic events that occurred in the country. Stock market was found to be highly volatile when markets were exposed to major economic events such as a stock market crisis. Such findings indicate that similarly an event like Brexit could have an impact on LSE, but further analysis is required to understand the more complex nature of Brexit and its possible complex influence.

To define Brexit as an economic event would be a major simplification, as it involves much more intricacy. However, the key term for Brexit analysis is uncertainty, and the next reviewed paper focuses on Economic policy uncertainty and Stock market returns rather than only on economic events. Vichet Sum, 2012 in his paper Economic Policy Uncertainty and Stock Market Returns investigates how stock market returns respond to uncertainty shocks. The author points out how consumers and investors are reluctant to make spending and investment decisions when their perception of economic uncertainty is high. Vichet Sum (2012) also highlighted how uncertainty pushes up financing costs leading to reduced investment and economic slowdown. Most importantly, Vichet Sum (2012) links economic uncertainty to stock market performance and conducts the research in order to determine the impact. The index that the author uses in his investigation is based on United States economic policy uncertainty spanning from 1985-2011, an index constructed by Baker, Bloom, and Davis, 2012. Vichet Sum employs a vector autoregressive analysis, a

system of equations to explore the impulse response function of the changes in economic policy uncertainty and stock market excess returns (refer to Appendix E for additional information). In addition, equation two is carried out to test if the increase (decrease) in the changes of economic policy uncertainty corresponds to the increase (decrease) in the stock market excess returns; if this is true, regression coefficient δ in equation three should be statistically significant and different from 0 (Vichet Sum, 2012; refer to Appendix E for additional information).

The vector autoregressive analysis reported results show that stock returns negatively respond to shock returns in the first, fourth, fifth, eighth, ninth, tenth and eleventh months (Refer to Appendix F). Additionally, the results from OLS regression reported that changes in economic policy uncertainty index predict negative stock returns. The regression coefficient is -0.0823 and statistically significant (Refer to Appendix F).

Based on the research conducted by the author, economic uncertainty both predict and correspond to negative stock returns. Taking this outcome into the consideration, Brexit could have a negative impact on UK stock market. It is also useful to use this research information to try to gauge and assess the future stock market performance. However the only possible implication that could be derived from the investigation is that economic uncertainty usually leads to negative stock market returns, but the missing piece is the severity of impact, which will be analysed in the next paper.

Investors traditionally prefer the information to be as informative as possible and determining the severity of impact of economic uncertainty to stock market returns is a crucial piece of information. Next paper to be examined investigates how economic uncertainty affects market returns percent wise. Jonathan Brogaard and Andrew Detzel in their thesis *The Asset Pricing Implications of Government Economic Policy Uncertainty*, 2012 analyse the impact of economic policy uncertainty on asset prices. The authors extend

the Baker, Bloom and Davis (2012) measure to an international setting, creating a news-based index of economic policy uncertainty for a cross-section of countries in order to determine the effects of economic policy uncertainty on asset prices (Brogaard & Detzel, 2012). This kind of measure quantifies the degree of economic policy uncertainty in an asset pricing study, which is instigated to be positively correlated. Brogaard & Detzel employ regression and OLS models in order to determine the effects of economic uncertainty on not only stock returns but United States GDP. The authors research outlined that changes in economic policy uncertainty are in fact associated with discount-rate and cash flow effects. According to the writers, increases in economic policy uncertainty are negatively associated with decreases in U.S. GDP for one quarter in the future (Brogaard & Detzel, 2012), which is driven by decrease in consumption and private investment. Similarly to previously analysed authors, growing uncertainty was found to be influential towards the economy, indicating mostly negative influence. However most important find of Brogaard & Detzel lies within their research on influence on stock returns and volatility, where they found that when economic policy uncertainty increases by 1%, contemporaneous market returns fall by 2.9% and market volatility increases by 18%. As this research was based on 21 countries, a minor increase in policy uncertainty could have colossal impact on market returns in most developed countries, including Great Britain.

Specifically linking this research to Brexit, the event certainly wasn't a minor one percent uncertainty increase but more of a significant jump, which could lead to not only a potential market downturn but a major crash, even a stock market crisis.

Papers analysed above provided sufficient evidence that Brexit could potentially impact both the United Kingdom's economy and the stock market. However there is lack of literature analysing impact on industries that might be heavily affected by economic uncertainty and this provides excellent opportunity to further investigate how an event, such

as Brexit, could influence a more exposed sector i.e financial services. Perfect tool to assess the impact of an event on the stock market is called an Event study. A tool favored by many researchers, Event study is often praised for its versatility as it can be used to elicit the effects of any type of event on the direction and magnitude of stock price changes, such as mergers, acquisitions or even trade agreements and thus is extremely common in finance area studies. Before getting into how the Event study will be conducted, it is essential to outline the assumption of the Efficient Market Hypothesis that the research will be based on.

Efficient market hypothesis

Efficient market hypothesis (EMH) is a theory in finance which states that asset prices fully reflect all available information (Fama, 1991). However there are three different defined forms of EMH(Eatwell, Milgate, & Newman, 1989), which have different kind of implications of how markets work and not all of them can be tested using event studies, thus definitions needs to be clarified:

- The weak form of market efficiency refers to not being able to predict future prices by analyzing past prices (Eatwell, Milgate, & Newman, 1989). Under the assumption that only equity prices reflect the information of historical price movements, event studies testing cannot be performed, as historical pricing is used to predict future(normal) returns.
- Semi-strong form of the Efficient Market Hypothesis implies that all public information is calculated into current share price and that only insider information could be used to achieve superior returns (Eatwell, Milgate, & Newman, 1989). This means that neither technical, nor fundamental analysis can be used to achieve excess returns. Under this assumption, since all public information is accounted for in stock prices and technical, fundamental analysis cannot provide investor with superior returns, testing using historical

prices, such as Event studies, could be considered objective. Fama, 1991, defined semi-strong EMH testing as Event studies.

- Strong form efficiency infers that share prices reflect all information, public and private, and it is impossible to earn excess returns (Eatwell, Milgate, & Newman, 1989). It means that even traders with inside information cannot earn superior returns.

As semi-strong EMH is a basis for Event study methodology according to Fama, 1991, it shall be used in the research. The assumptions of historic and public information influencing the stock price and the event affecting prices only during the Event window provides the ability to assess related returns appropriately.

Research methodology

Event study

As it was mentioned before, Event study methodology is extremely common among researchers analyzing how an event could affect stock prices and it will be used to achieve the goals of assessing the impact of Brexit on LSE listed financial service companies and derive a conclusion on how it affected the sector as a whole. The methodology fame of event studies cannot be denied as according to Henderson, 2002 in 1987 and 1988 fourteen event studies were published in Journal of Finance and another twenty-six in the Journal of Financial Economics. The popularity of event studies started with Fama, Fisher, Jensen & Roll, 1969 where authors tried to investigate how correctly and quickly market reacted to the announcements of stock splits.

After that many economists, financial analysts and researchers started to favor Event study methodology when it comes to analyzing effects of an event on stock prices and similarly the Event study model will also be used in this thesis.

The broader definition of an Event study could be defined as using a statistical method to assess the impact of an event on a firm, however it is more generally used for analyzing

relevant event impact on stock prices (Campbell, Lo, & MacKinlay, 1997). The methodology is extremely versatile and as mentioned before, popular in many research areas such as finance, management, economics, political science and marketing. The basis behind Event studies is to find abnormal returns during the period and compare them with actual returns to determine if there was a significant impact of an event, specifically in this case on stock prices. Campbell, Lo and MacKinlay, 1997 identified seven steps that make up the Event study model:

1. Identification of an event;
2. Selection criteria;
3. Normal and abnormal returns;
4. Estimation procedure;
5. Testing procedure;
6. Empirical results;
7. Interpretation and conclusions.

Identification of an event. Identification of an event refers to determining the event day and the time of the event (event window) that will be analyzed. The time of the event is usually more than one day. In this case of referendum, event window is not only limited to announcement day but also a few days before or after (Campbell, Lo, & MacKinlay, 1997). This comes from assumption of EMH, where it is outlined that markets already reacted to the information before the event day and adjusted prices and would react further after the event. In this figure, event window is referred to as Test period (TP):

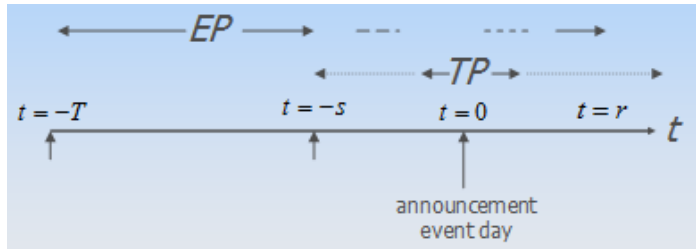


Figure 6. The Estimation Period (EP) and the

Test Period (TP). From Strong, 2006.

Estimation period (EP) is the time period where markets were not influenced by the news of the event and where normal returns were present.

Selection criteria. Selection criteria segment refers to identification of data availability issues, determining restrictions and reporting potential biases (Campbell, Lo and MacKinlay, 1997). Sampling could be restricted due to lack of data, as it might not be available for all companies. Precise criteria is essential to best represent the chosen population. Lastly, inappropriate biases, if present, should be reported to prevent improper selection.

Normal and Abnormal Returns. If data biases were removed or if it had none, normal and abnormal returns can be determined. To calculate normal and abnormal returns, share return data must be retrieved. As daily returns may pose non-normality issue, according to Henderson, 1990, log returns should be used to ensure normality of the data. Taking this into consideration, log returns will be used in this research. Abnormal returns are actual returns during the event minus the normal(estimated) returns. The abnormal returns, according to (Campbell, Lo, & MacKinlay, 1997), are calculated as follows:

$$\varepsilon_{it}^* = R_{it} - E[R_{it}|X_t] \quad (1)$$

where ε^* is the abnormal return, R – actual return and $E(R)$ is the normal return on the firm i , for the time period t . X is the information on which the normal returns model is conditioning (Campbell, Lo, & MacKinlay, 1997). As mentioned before, normal returns are

the ones that would have occurred if event never took place (Campbell, Lo, & MacKinlay, 1997). Normal returns can be estimated in many different ways, but Schweitzer, 1989, suggest three most commonly used:

1. Mean-adjusted returns. Assumes that company's stock returns are constant.

Using the model, calculation of abnormal returns would be:

$$AR_{j\tau} = R_{j\tau} - \bar{R}_j \quad (2)$$

Where $R_{j\tau}$ is the observed return, and $\bar{R}_j$ is the average return on the security of interest (Schweitzer, 1989).

2. Market-adjusted returns. Assumes that normal returns are equal to that of an index. Formula for Abnormal returns in this case is:

$$AR_{j\tau} = R_{j\tau} - R_{m\tau} \quad (3)$$

where $R_{j\tau}$ is the observed (actual) return and $R_{m\tau}$ is the market return, such as the return on FTSE 100, or other indices (Schweitzer, 1989).

3. Market model. Method implications include stock return linear relationship with the market return (index). Calculating returns with this model, normal return parameters need to be determined with the formula below:

$$R_{jt} = \alpha + \beta R_{mt} + \varepsilon_{jt} \quad (4)$$

where R_{mt} is the return on the index, α and β are the parameters of regression and ε_{jt}

$$AR_{j\tau} = R_{j\tau} - (\alpha + \beta \times R_{m\tau}) \quad (5)$$

is the residual (Schweitzer, 1989). After α and β are calculated and inserted into the formula to determine return of the index, abnormal returns can be calculated using this formula:

Schweitzer, 1989 suggested that market model is the most used model among event studies researchers and that it lets researchers estimate abnormal returns more accurately

and without bias or other statistical problems. That is why this thesis will be based on market model and for market returns FTSE 100 index will be used.

For estimating parameters, ordinary least squares (OLS) will be used as it is a common and popular option as well as there is no indication that other procedures improve either the specifications or power of the tests (Brown & Warner, 1985, p. 18). Thus, OLS will be used in determining parameters.

Estimation procedure. After determining the most appropriate model for normal returns, the parameters of normal returns can be estimated (Campbell, Lo, & MacKinlay, 1997). Data importance comes from estimating the Estimation period (EP) and according to Campbell, Lo, & MacKinlay, 1997, market reactions, relative to the event of interest, should not be included in the EP. What matters is that it must be considerably sufficient to avoid bias.

Testing procedure. As parameters for the normal returns were estimated, then next step is determining abnormal returns.

When using the market model for the normal returns estimation, it is advised to standardize the AR's to account for each company's variance during the EP and correct for the bias, that parameters come from estimation period whereas AR's are calculated during the test period (Strong, 2006). Formula is as follows:

$$v_{j\tau} = \frac{AR_{j\tau}}{se(AR_{j\tau}) \times \sqrt{C}} \quad (6)$$

where $v_{j\tau}$ is the standardized abnormal return, $AR_{j\tau}$ and $se(AR_{j\tau})$ are the abnormal return and the standard error of the abnormal return of company j on event day τ , respectively and C is the correction term (Strong, 2006). Correction term is vital in this formula due to the fact that parameters are determined during estimation period, while

abnormal returns are calculated during the event period. Formula for correction term was defined by Patel, 1976 and is as follows:

$$C_{j\tau} = 1 + \frac{1}{T} + \frac{(R_{m\tau} - \bar{R}_m)^2}{\sum_{\tau=1}^T (R_{m\tau} - \bar{R}_m)^2} \quad (7)$$

Where T is the number of observations in estimation period, $R_{m\tau}$ is the market return on the event day, R_{mt} is the return of the market on the day from estimation period, $\bar{R}_m$ is the average market return over the estimation period.

The standardized returns should then be aggregated and nulled, as well as the alternative hypotheses tested for statistical significance (Campbell, Lo, & MacKinlay, 1997). There are various aggregating return methods, but since in this research, event dates for all securities will be identical, portfolio approach will be used. According to Campbell, Lo & MacKinlay 1997, this model could be used to address this problem, as to form portfolio return, average of all securities are analyzed and calculated on each day in the event window using standardized abnormal returns. Formula is as follows:

$$AR_{pt} = \frac{1}{N_t} \sum_i AR_{jt} \quad (8)$$

Where AR_{pt} is the portfolio return and N_t is the number of firms related to the same event (Strong, 2006). As the portfolio returns are constructed, the analysis should be identical to that of a single security, where abnormal return represents a return of a single security and formulas for aggregation would be valid, since independence was achieved (Campbell, Lo & MacKinlay 1997). Portfolio return formula will be used in this thesis, as it is deemed appropriate.

After returns are aggregated, outcomes are tested through calculating test statistics and performing hypotheses testing. According to Strong, 2006, these are the typical hypotheses used for Event studies:

$$H_0: E(R_{j,t=-s:r}|y_i) - E(R_{j,t=-s:r}) \equiv E(u_{j,t=-s:r}) = 0 \quad (9)$$

$$H_1: E(R_{j,t=-s:r}|y_i) - E(R_{j,t=-s:r}) \equiv E(u_{j,t=-s:r}) \neq 0 \quad (10)$$

Key point behind these hypotheses is that under null hypothesis (H_0) differences between returns of stocks, considering the event of interest and the return if event never took place is 0, while alternative hypothesis (H_1) suggests that the return is not equal to 0 (Strong, 2006). To put it simply, null hypothesis claims that the event had no impact on the stock returns while alternative suggests otherwise. If test statistic is significant, null hypothesis is rejected. Test statistic is aggregated return divided by standard error from the estimation period (Campbell, Lo & MacKinlay 1997). Standard error formula is as follows (Strong, 2006):

$$se(AAR_t) = \sqrt{\frac{1}{t_2 - t_1} \left(\sum_{-t_2}^{-t_1} \left[AAR_t - \sum_{-t_2}^{-t_1} AAR_t / (t_2 - t_1 + 1) \right]^2 \right)} \quad (11)$$

Where AAR_t is the portfolio return at time t (from EP) and $t_2 - t_1$ is the number of observations in the EP minus one. On the condition that test statistic is lower than -1.96 or higher than 1.96, the null hypothesis of zero abnormal returns is rejected.

Empirical results. Event study results can be evaluated after the completion of hypothesis testing. Campbell, Lo, & MacKinlay, 1997 suggest that presenting diagnostics could be useful to the research in addition to presenting the outcomes. In addition,

evaluation of outliers which could have influenced the results is crucial to determine if assessment was valid.

Interpretation and conclusions. After the research has concluded, results assessment may be presented together with interpretations. The researcher can now determine whether the event had any effect on stock market returns and provide insights, comments and observations.

Drawbacks of Event Study methodology

Event study was chosen as the most applicable method to determine the impact of an event on stock market, however there are still many drawbacks that should be considered.

Here are some potential problems that Event study methodology faces:

1. Choosing the Event date is a problem for majority of Event Studies as determining the exact date when information becomes available is crucial part of the research. Identifying a wrong date could lead to studying returns with little to no relevance to the actual event and results would be deemed not valuable (McWilliams, Siegel & Teoh, 1999).

2. Similarly choosing the length of an Event Window could be a problem as generally it includes not only the event day but a few days after or before the event to include market reactions. If length of the event window were too short, i.e one day, markets would not be able to effectively acknowledge the information in such a short time. Event window cannot also be too long as markets should incorporate the information quickly (McWilliams, Siegel & Teoh, 1999).

3. Choosing an appropriate sample size is a common problem in Event Studies, as the econometric tests will be based on assumption of normality, sample size must be sufficient to evade non-normality of data (McWilliams, Siegel & Teoh, 1999).

4. Company-related events, such as mergers & acquisitions, during the event window could have a substantial impact on the share price, which in turn could skew the results of the research. It is imperative that influence of company-related events is controlled when performing an Event Study (McWilliams, Siegel & Teoh, 1999).

5. Similarly, to company-related events, industry effects can also have a significant influence during the event window (McWilliams, Siegel, & Teoh, 1999). To avoid this, choosing a relatively short interval of one to three days is key, as it is unlikely that sample would be affected in that time by specific industry events.

6. Calculating normal returns can often be a problem due to choosing the correct approach and which measure to use (Henderson, 2002). If regression approach is used, a particular model and the period of estimation must be chosen, which in turn could lead to various econometric/statistical problems.

7. Similarly abnormal returns calculation can be tricky, as there are many models that could be used and picking the appropriate one can often lead to difficulties (Henderson, 2002). Abnormal return between securities correlation and Event Date difference are of many problems that must be addressed to avoid violating the independence assumption.

All of the issues listed above must be addressed by the researcher and taken into consideration. Furthermore, if at some point any of the assumptions are violated, researcher must determine a different approach or chose other measures to use to achieve needed results. As determined by Fama and other researchers, Event Study is deemed the most appropriate and rational methodology to use when considering Event influence on stock market returns and thus will be used in this thesis, with the intent to avoid potential biases listed above to achieve set goals.

Empirical research

In the last part of the thesis, empirical research will be conducted in order to determine the impact of Brexit on listed financial service companies. Firstly, industry assessment will be carried out, to split up the financial service companies into smaller brackets for further analysis on how Brexit might have affected different sectors of financial services. Then data will be chosen and specified, as well as assessed to avoid potential statistical problems. Afterwards, normal returns will be calculated using OLS model. Furthermore, abnormal returns will be determined, aggregated and tested for significance. Lastly, conclusions of the research will be presented.

Industry analysis

To conduct research on how Brexit affected financial service market, companies for analysis must be chosen. As it was resolved in previous part of thesis, financial service sector was chosen for analysis as it was determined to be not only the most important sector for United Kingdom, but also majority of financials sector firms provide services internationally and have close ties to many European Union countries. Companies chosen for research were based on ICB (Industry Classification Benchmark), where various firms were separated according to their industries and sectors (ICB, 2017). For the purpose of this research, focus will be on Financials industry and the three sectors residing in it:

- a) Banks
- b) Insurance
- c) Financial Services.

To estimate the impact of Brexit on Financials industry, a sample of 15 companies were chosen. Five companies of each sector with the highest market capitalization were chosen for the sample to be as representative of population as possible. Picked companies stock price daily data was obtained from Yahoo Finance covering the 2015.01.02 –

2017.11.31 period. Log returns were calculated to avoid potential bias when performing OLS estimation. Additionally for the research to be indicative and representative, specific criteria was developed for the selection of companies:

1. Company must be Listed on London Stock Exchange and incorporated in UK
2. Company must belong to Financials industry (ICB).
3. Company must be part of FTSE 100

Following the determined criteria, companies chosen are presented in Table 1.

Table 1

Analysis of companies selected for research

Industry	Sector	Company	Company Mcap, (£m)
Financials	Banks	HSBC Holdings PLC	145.921
		Lloyds Banking Group PLC	46.599
		Royal Bank of Scotland Group (The) PLC	32.310
		Barclays PLC	32.262
		Standard Chartered PLC	23.827
Financials	Insurance	Prudential PLC	46.946
		Aviva PLC	20.317
		Legal & General Group PLC	15.671
		Old Mutual PLC	9.613
		St. James's Place PLC	6.185
Financials	Financial services	London Stock Exchange Group PLC	13.069
		Standard Life Aberdeen PLC	12.574
		Schroders PLC	9.074
		3i Group Plc	8.513
		Hargreaves Lansdown PLC	7.684

Note: Date for November 31st, 2017

Source: table prepared by the author, source of data is London Stock Exchange, 2017.

To evaluate the impact on UK market appropriately, companies chosen must be incorporated in the UK to be representative of local market. In addition, firms need to be listed on London Stock Exchange, as it should correspond with thesis objective to analyze listed companies. Thus, all companies chosen for research are listed on LSE and incorporated in the UK. Furthermore, designated companies should belong to Financials industry according to ICB classification to coincide with thesis goals to analyze impact on

Financial Service industry. Moreover, firms were divided into three sectors, five companies each appropriately based on ICB classification to analyze impact on each sector separately and provide results.

Ultimately, appointed companies must be part of FTSE 100 index, as constituents of the index represent the majority of United Kingdom market as well as perform large amount of operations abroad and should provide indicative results about the industry. Additionally, as market model is being used to estimate normal return parameters and the market return was chosen to be FTSE 100 index, measuring returns of a company that is not a constituent of the index could produce additional problems with model bias and appropriateness.

Lastly, companies were chosen based on market capitalization and their market share in the economy to make the model as representative as possible. As determined companies are the largest constituents of FTSE 100 index and represent at least 50% of total market capitalization of the corresponding Financials sector (LSE, 2017), hence research outcomes will be treated as fairly representative of the whole industry.

Empirical research

Normal returns estimation

After selecting the companies for investigation and calculating their daily log returns, normal returns can be estimated. Chosen Estimation period will be from 2015 January 5th to 2016 February 22nd, as there were no significant events that could have caused disruption in the market and the British referendum date was yet to be announced. As it was outlined in research methodology, market model was chosen for calculations (refer to equation 4) and OLS to acquire parameter estimates. FTSE 100 log returns will be used as market return. However, it is important to confirm that the data chosen satisfies the OLS assumptions. For verification, refer to Appendix 1 for linearity, Appendix 2 for heteroscedasticity and serial correlation, Appendix 3 for normality, Appendix 4 for

stationarity of variables and Appendix 5 for normality of dependent variable. After adjustments, assumptions are satisfied and OLS should present unbiased results. Results are presented in Table 2.

Table 2

Fitted models' estimates and statistics

Company	α	β	R^2	Standard error of the estimate	Significance of the independent variable	N
HSBC Holdings PLC	-0,0004	1,02208	0,500823	0,007862	1,10E-38	246
Lloyds Banking Group PLC	-0,0004	0,74740	0,494511	0,007641	3,83E-41	267
Royal Bank of Scotland Group	-0,0008	0,95402	0,468337	0,010944	4,70E-39	273
Barclays PLC	0	1,16305	0,522359	0,009412	7,78E-42	251
Standard Chartered PLC	-0,0011	0,48234	0,055700	0,016521	0,0002	243
Prudential PLC	0	1,10486	0,591164	0,009028	2,15E-53	267
Aviva PLC	-0,0001	0,95748	0,553161	0,008500	2,90E-48	267
Legal & General Group PLC	0,0003	0,85544	0,604248	0,006968	2,86E-55	267
Old Mutual PLC	0,0007	1,26100	0,683261	0,008550	7,33E-68	266
St. James's Place PLC	0	1,07754	0,549355	0,009772	8,95E-48	267
LSE PLC	0,0005	0,83678	0,438206	0,009777	3,63E-35	268
Standard Life PLC	0	1,02642	0,643529	0,008582	1,33E-49	215
Schroders PLC	0	1,03662	0,614815	0,007954	5,86E-55	258
3i Group PLC	0,0004	0,88557	0,501708	0,007965	1,26E-38	245
Hargreaves Lansdown PLC	0,001	0,96407	0,395531	0,012307	1,78E-30	264

Source: table prepared by the author, data for calculations retrieved from Yahoo

Finance, models fitted using GRETL statistics software.

To begin analyzing, it is important to provide insights on parameters estimated by the OLS model. According to Wooldrige, investigating intercept (α) is usually not purposeful, as it represents an insignificant amount, however it should not be equal to zero to prevent from breaking zero conditional mean assumption of OLS. In this case, intercept values are extremely low and do not represent a significant relevance to the model. Analyzing parameters of the independent variable β , all the values are above zero, indicating that all tested companies' returns move in the same direction as market does, i.e if market returns go down, firms returns decrease simultaneously and vice versa. Furthermore, most beta values hover around one, which indicate that firms return movement do not differ

drastically compared to the market, e.g if FTSE 100 returns grow by 10%, Schroders PLC returns would increase by 10,3% or Aviva PLC returns would rise by 9,57%.

Analyzing other main statistics of the model, R^2 or coefficient of determination could be regarded as an indicator of goodness of fit in regression analysis. In this case, the higher the R^2 is, the better independent variable, i.e FTSE 100 index, is at explaining the variance in dependent variable, i.e selected companys' returns. Usually models with a coefficient of determination above 0,25 are considered to be appropriate and well fit to explain the variance of dependent variable (Wooldridge, 2013). All of the models R^2 in Table 2 are above 0,25 with the exception of Standard Chartered PLC which despite its incorporation in the UK, it does not conduct retail banking in the UK and most of its profits come outside of Europe. Goodness of fit can be improved by adding more variables or changing current independent variable with another one, however following the aim of this thesis to analyze only the performance of the market and focus on United Kingdom industry, thus no other variables were added or changed. The Low coefficient of determination of Standard Chartered PLC will be treated as a sign of model not being fully representative, however it will be included in further calculations for research purposes. Other models will be considered as relatively representative and good fit.

Moving further, another important statistic is standard error of the estimate, which presents how estimate of standard deviation of unexamined effects influences dependent variable (Wooldridge, 2013) and these values will be used in abnormal returns calculation. Moreover, independent variable values of all models are statistically significant at one percent level, indicated by the p-values in Table 2. Thus, FTSE 100 index values do matter to returns of stocks chosen, even for Standard Chartered PLC, which had a very low coefficient of determination. Lastly, to reduce model bias and improve data normality, extreme values of each stock returns were removed (Refer to Appendix 5). Each stock

return data had a different amount of outliers outside of normal 90% range, thus N amount differs in each security.

Testing procedure

Abnormal returns

After parameters have been estimated, abnormal returns can be calculated. Essential part of analysis is choosing which events to evaluate. To determine the impact of Brexit, three major occurrences related to the outcome of Brexit will be analyzed: Brexit referendum, UK prime ministers speech on January 17, 2017 and March 13, 2017 where British parliament voted to trigger Article 50 and officially begin the process of exiting the European Union. All of these events were important to stock market as they relayed information related to Brexit outcomes that were important to the investors (More information about related events can be found in situation analysis).

Furthermore, since Brexit referendum took place on the 23rd of June, results only came in on the evening of 23rd of June, thus 24th stock price information will be treated as Day 0 in research. Moreover, 27th will be treated as day +1, since 24th was Friday, 25th and 26th are not counted as trading days for stock market, thus 27th is taken as day +1. More importantly, two-day event window for Brexit referendum was chosen due to unexpected outcome and the time it takes for market to normalize. Additionally, since results of referendum were announced in the evening of 23rd after the markets had already closed, opening price information of 23rd and 24th will be researched to analyze the impact of unexpected Brexit outcome in extended-hours trading.

Other two events will have one-day event windows since the news came in early in the day and markets were more efficient in reflecting the information. Abnormal returns were determined using the market model formula (refer to equation (5)) and calculations are presented in Appendix 6. Abnormal returns were present in all securities during the events

analyzed. As it was mentioned in second part of thesis, to analyze impact of events, abnormal returns must be standardized and aggregated before any meaningful conclusions can be made (Campbell, Lo, & Mckinlay, 1997). Standardization calculations are shown in Appendix 7 (refer to equation (6) for formula) and standardized residuals are presented in Table 3.

Table 3

Standardized abnormal returns

Company	Referendum (Day 0) open	Referendum (Day 0) close	Referendum (Day +1)	2017.01.17	2017.03.13
HSBC Holdings PLC	-5,42	2,29	0,53	-0,56	0,64
Lloyds Banking Group PLC	-44,82	-27,42	-11,53	3,02	-0,68
Royal Bank of Scotland Group	-38,59	-15,12	-12,54	3,58	-1,61
Barclays PLC	-39,39	-16,55	-16,96	2,05	-1,17
Standard Chartered PLC	-4,44	-0,56	-2,99	2,11	0,10
Prudential PLC	-18,28	-6,54	-9,06	1,19	1,01
Aviva PLC	-51,68	-16,16	-6,34	0,88	0,19
Legal & General Group PLC	-47,60	-28,13	-15,80	1,11	-0,10
Old Mutual PLC	-13,94	-1,04	-1,77	2,84	0,79
St. James's Place PLC	-32,09	-14,28	-5,13	0,75	0,58
London Stock Exchange PLC	-15,62	-6,42	-6,80	1,20	-0,46
Standard Life PLC	-18,62	-17,98	-4,53	1,75	-0,39
Schroders PLC	-26,90	-11,88	-15,37	1,82	-0,06
3i Group Plc	-5,74	-7,95	-8,07	1,31	0,36
Hargreaves Lansdown PLC	-14,64	-10,97	-6,65	4,16	-0,21

Source: table prepared by the author, data for calculations retrieved from Yahoo

Finance.

Standardized residuals provide relevant information on how each companies abnormal returns differ from their normal patterns, as they account for variance during the estimation period. All companies indicate significant negative abnormal returns during the referendum, while results from January 17 and March 13 differ across firms, ranging from significant to insignificant abnormal returns. However to determine the impact on Financial Service sectors and industry, returns need to be aggregated to provide a clear and objective view, thus aggregated results will be provided in the next part of the thesis.

Aggregation of standardized residuals

After calculating abnormal returns, portfolio returns will be calculated for each sector using the Equation (8). As it was outlined in previous part of this thesis, portfolio returns were calculated as it was deemed most appropriate due to event dates being identical for each security (Refer to Research Methodology for more information). Portfolio returns are displayed in Table 4.

Table 4

Portfolio abnormal returns

Sector	Referendum (Day 0) open	Referendum (Day 0) close	Referendum (Day +1)	2017.01.17	2017.03.13
Banks	-26,53	-11,47	-8,70	2,04	-0,54
Insurance	-32,72	-13,23	-7,62	1,35	0,49
Financial services	-16,30	-11,04	-8,28	2,05	-0,15

Source: calculated and prepared by the author, data for calculations retrieved from Yahoo Finance.

Analyzing the data in the table displayed, abnormal returns were present in all events studied (Considered presence of abnormal returns if portfolio AR is not equal to 0). Highest abnormal returns identified in Referendum opening price comparison and lowest in March 13 for all sectors outlined. However to make meaningful inferences about data presented, outcomes should be tested for statistical significance. All three events portfolio abnormal returns were accumulated and cumulative abnormal returns for each sector were calculated and are presented in Table 5.

Table 5.

Cumulative abnormal returns and test statistics

Sector	Cumulative abnormal return	Standard error	Test statistic
Banks	-45,2059	0,8984	-50,32
Insurance	-51,7193	0,7936	-65,17
Financial services	-33,7341	0,7705	-43,78

Source: calculated and prepared by the author, data for

Calculations retrieved from Yahoo Finance.

Standard errors of estimation period were measured using the formula (11). Test statistic was calculated by dividing Cumulative abnormal returns with Standard error of portfolio returns (Campbell, Lo, & Mckinlay, 1997). According to the model, if value of test statistic is larger than 1,96 or lower than -1,96, the null hypothesis (H_0) is rejected (Refer to Equation 10). All three sectors test statistics turned out to be statistically significant and Null hypothesis of no abnormal returns ($H_0 \neq 0$) was rejected.

Banking sector displayed a substantial negative test statistic, indicating major negative returns that occurred during the relevant event dates. It is not surprising considering how losing the access to single EU market and passporting rights could potentially affect the biggest United Kingdom banks. Barclays operates in over 40 countries, of which 12 are members of European Union, making it the biggest market outside of UK. Losing access to these markets could potentially lead to decline in revenues and customers for the bank. Similarly, Royal Bank of Scotland and Lloyds Banking Group operate in many European countries and a substantial amount of revenues could potentially be at risk considering the Brexit outcome. Additionally, since all major banks have expanded to other industries and have substantial investments there such as Lloyds operating in insurance industry, Barclays and Royal Bank of Scotland in financial service sectors, Brexit effect amplifies as outlined industries were impacted by the event

simultaneously. Biggest difference can be observed in Standard Chartered and HSBC group abnormal returns, as they were considerably less significant due to the nature of these banks (See Table 3). Standard Chartered does not conduct retail banking in the UK and 90% of its profits come from Asia, Africa and Middle East, thus the less significant abnormal returns can be explained by diversified Revenue streams, which are less related to Brexit events. Similarly, majority of HSBC revenues come from outside of Europe, mainly from North America and China, explaining the lower abnormal returns shown as there is no anticipation of a major influence of Brexit on these markets. Omitting Standard Chartered abnormal returns from research analysis was considered, as the estimation model was found to not be fully representative and the company does not conduct retail banking in the UK, however changing one variable would not present different results and the outcome of research would remain the same, thus further analysis and modifications were not performed.

Moving forward to insurance sector, similarly to banking sector, loss of passporting rights and access to single European market could result in potential losses to companies. Revenue streams and prime location of firm operations in the company can explain differences in abnormal returns among insurance companies. Old Mutual PLC reported lowest abnormal returns, albeit still significant, due to only operating in the UK and emerging markets such as South Africa, India and Nigeria, leading to investors believing that the effects of Brexit will not reach other markets. Prudential has significant investment in European markets, however diversification of operations to United States, India and China could make up for potential customer and revenue losses, thus the abnormal returns were not as high as other insurance companies. Aviva's main revenue inflows are from the UK and Europe, thus the abnormal returns were highest among all insurance companies as there could be large potential losses in both markets. Legal & General operates mostly in the UK and US, however its subsidiary Legal & General Investment Management (LGIM)

is the second largest institutional investment management firm in Europe, thus indicating a large investment portion in European Union market which will be the main victim of Brexit. St. James's company mostly operates in the UK and thus lacking proper diversification to avoid potential losses related to Brexit. Insurance sector could be treated as potentially the one with most potential losses after Brexit as their customers and revenues are mostly concentrated in United Kingdom and European markets.

Ultimately, the financial service sector was affected by Brexit mainly due to potential regulatory and passporting right changes. All of the companies and the sector returned significant abnormal returns, however 3i Group had a slightly lower abnormal return rate. 3i is a venture capital and private equity company, which invests in financial services, consumer, industrial and energy, and healthcare sectors. Based on diversified portfolio of investments, not all industries may be affected negatively by Brexit, thus 3i might not be as sensitive to potential Brexit impact as other companies. Schroders returned highest abnormal returns among financial service companies due to the nature of operating in many European countries and having European subsidiaries. Other companies have significant investments in European Union, such as LSE group major venture in Italy, Standard life Aberdeen operating in over 80 countries of which majority are in Europe and Hargreaves Lansdown having significant investment stake in European funds. Financial service sector is still vulnerable to potential Brexit developments, however it is deemed to be less sensitive sector as opposed to banks and insurance due to natural diversification among portfolios.

Aggregated results presented significant returns for all three sectors, however it is important to analyze each event independently to gain knowledge on separate event significance. Test statistics for each event were calculated and are presented in Table 6.

Table 6

Test statistic for each event evaluated

Sector	Referendum	2017.01.17	2017.03.13
Banks	-51,99	2,27	-0,61
Insurance	-67,50	1,71	0,62
Financial services	-46,24	2,66	-0,20

Source: Prepared by the author, data for calculations

Retrieved from Yahoo finance.

Since Brexit referendum event includes two event day window and opening price comparison, portfolio cumulative returns were calculated and tested for significance, while other events had one day event window and portfolio abnormal returns (refer to Table 4) test statistics were estimated. As expected, Brexit referendum returned the highest abnormal test statistic for all sectors since entire portfolio abnormal returns were estimated to have significant test statistics. Brexit referendum outcome was the most unanticipated, as the market expected British citizens to refrain from rather radical decision and vote to remain in European Union for mutual benefit of the bloc, however decision was made to leave and that caused a stir in the market. Uncertainty of political/economic future is usually an immense reason for market volatility and thus referendum outcome resulted in vast decline in returns for many companies. Test statistics of referendum were heavily different from other events and were extremely large, indicating that market was taken aback by the results compared to other two events.

Moving forward to January 17 Theresa May speech, two out of three sectors reported statistical significance, however insurance sector did not. As opposed to referendum test statistic, all three sectors presented positive test statistics, indicating that the market reacted positively to Theresa May speech. One of the reasons behind it could be market expectations, as Theresa May represented a more conservative and pro-Brexit bloc

in Tory party in the UK and her decision to support "hard" Brexit was predictable. Another reason could have been the influence of other factors surrounding the event, such as the drop of pound and rising confidence in United Kingdom consumer market, which could have affected the returns of the market. Even if banks and financial services reported statistically significant test statistics, there is a chance that Type 1 error could have been made, i.e. true null hypothesis could have been rejected (Brown and Warner, 1980).

Similarly, insurance sector did not report statistical significance but there is a prospect of Type 2 error, i.e. accepting the null hypothesis when it is not true (Brown and Warner, 1980). Ultimately, test statistics of banks and financial services were not significantly higher than 1,96 and insurance test statistic was not greatly lower than 1,96 threshold to draw proper conclusions about significant abnormal returns, as it is very likely that other factors such as depreciation of pound could have inflated returns during the event.

Lastly, analyzing March 13 British parliament triggering of Article 50 and beginning the Brexit negotiations officially, none of the three sectors reported significant abnormal returns during the event. It was extremely unlikely that conservative party controlled parliament would go against the decision of British voters and reject the proposition to begin the process of leaving the European Union, thus the market did not experience substantial volatility. Moreover, banks, insurance and financial service sector test statistics were not as close to significance threshold (1,96) as in January 17 event analysis, thus the probability of an Type 2 error, accepting the false null hypothesis, is not that high. Conclusively, as none of the abnormal returns during the event were statistically significant (see Table 3), results do not reflect abnormal performance, as well as aggregated results do not mirror statistically significant performance (see Table 6), thus it can be assumed that March 13 event did not generate considerable abnormal returns that are substantially different than 0.

Research results

The research outcome suggests that Brexit events had an effect on London Stock Exchange listed Financials industry companies. All three sectors aggregated returns displayed statistically significant outcomes (abnormal performance was present and notably different than 0). It represents a rather expected outcome due to the nature of Financials industry and the internationality of the companies analyzed. Banks that were included in the research operate in vast amount of European Union countries, thus any unexpected regulatory, political or economic changes guarantee a strong reaction from the market. Similarly insurance sector expands to European markets which compromise a large portion of covered in the research firms revenues. Financial service sector dependence on European market is clear as many subsidiaries and various investments are affected by European Union single market advantages and regulatory laws.

Additionally, all sectors analyzed returned significant negative abnormal returns, indicating an adverse reaction from the market to the events considered. Such reaction was not unpredictable as multi-national listed companies could lose customers and revenues in the European Union if Brexit consequences, such as exiting single market union and various regulatory changes, come to life. Considering the outcomes, the assumption could be made that Brexit would reduce the income and returns for investors into the Financials industry companies listed on London Stock Exchange.

Furthermore, out of the three different events investigated, Brexit referendum had the most significant impact on the listed Financials industry companies. Across the fifteen companies, referendum stock returns were the most statistically significant, as were portfolio and cumulative abnormal returns. Admittedly, Brexit outcome was the most unpredictable and hence market volatility was immense following the event, causing a sharp drop in returns. January 13 speech had two sectors, banks and financial services, present

significant test statistics and insurance displayed notably insignificant returns, however as the test statistics were not considerably larger than the threshold, it is possible that other events such as drop in pound value or rise in consumers confidence could have inflated results. March 13 parliament triggering of Article 50 was found to be statistically insignificant across all companies and sectors, indicating that market expected such decision to occur.

Ultimately, it is apparent from the research results that event outcomes that were unpredictable and unexpected, such as Brexit, cause major volatility in the market and significant abnormal returns could be observed. On the other hand, events, such as January 17 speech and March 13 parliament voting, did not produce significant abnormal results due to being more predictable and meeting expectations of the market. Investors should expect similar reactions to relevant events to anticipated or unanticipated outcomes by the market. Before considering these results as conclusive and appropriate, some research limitations should be examined.

Research limitations

Estimating normal returns. Firstly, Estimation period data could be biased, as there might have been other relevant events included which had caused market volatility and resulted in parameters being estimated incorrectly. Secondly, market model was chosen for estimating abnormal returns, which included FTSE 100 as market returns, and it is possible that other indices could have returned better and improved results as opposed to FTSE 100.

Industry limitations. Sector portfolios analyzed had only five companies included and the results could be considered as not fully representative of the whole sector. As the five researched companies comprised of about 50% of the sector analyzed, further analysis of other small to middle-sized could provide additional results to obtain supplementary findings about Brexit effect on the market.

Other events. Abnormal returns obtained might have been influenced by other events not considered in the research, hence the outcomes might be biased. It is very likely that the continuous drop of pound and rise in consumers confidence in the UK could have heavily influenced the returns of companies analyzed, thus potential bias should be considered when making relevant conclusions.

Additional Brexit events. As there were only three events related to Brexit considered, analyzing additional events could have complimented the research and provided with different results. As only Brexit referendum was found to be conclusively statistically significant, it is possible that including other events such as appointing Theresa May as Prime Minister of United Kingdom or the beginning of Brexit negotiations as analysis points could have provided with different results as compared to only evaluating January 17 speech and March 13 parliament triggering the Article 50.

Conclusions

1. Brexit had a tremendous impact on the political landscape of the United Kingdom.

Following the referendum, the political climate became chaotic due to unknown developments that will further shape the future of Great Britain outside of the European Union. Future negotiations with the European Union will determine the regulatory changes and high or low access to single market scenarios, which are critical to many industries, including financial services.

2. Brexit heavily influenced the economy of the United Kingdom, especially the pound and Gross Domestic Product. The pound in comparison to the dollar continuously depreciated following the Brexit referendum, while GDP outperformed the Eurozone in 2016, albeit with a dip and grew slowdown in 2017. The main culprit of the decline of the pound was the growing uncertainty in the market, while stable GDP growth was achieved due to rising exports and service sector performance.

3. Brexit also had an effect on the stock market of the United Kingdom. Analysis of the biggest London Stock Exchange index FTSE 100 showed that markets were substantially volatile during Brexit related events, especially the referendum. However, the index showed continuous growth during 2017 mainly due to the declining pound and growing exports.
4. Brexit had an immense impact on the financial service industry. Many listed financial service companies were affected by the devaluation of the pound and an increase in inflation with uncertainty around regulatory and passporting changes causing the biggest headaches.
5. Analysis of the industries showed that the financial service sector is the most influential and most important sector to the United Kingdom. Furthermore, it is currently the most exporting industry, having close ties to the business in the European Union. Therefore, the thesis research was based on the financial service industry and listed financial sector companies.
6. By analysing scientific literature, which detailed similar studies as conducted in this thesis, the focus was drawn on the economic events and the impact of political uncertainty on stock prices and returns. This helped to determine that the most appropriate and expedient method for this research was the Event study. Thus an Event study was implemented to estimate the effects of Brexit events on listed financial service companies. Naturally, for the analysis to function, semi-strong efficient market hypothesis was assumed due to the use of historical prices and publicly available information.
7. The conducted Event study provided insights to conclude that banking, insurance and financial service sectors reported significant cumulative abnormal returns, indicating a strong influence of Brexit events on stock returns of the analysed companies, therefore the null hypothesis of zero abnormal returns was rejected. Furthermore, all three sectors reported significant negative abnormal returns, implying substantial sensitivity to Brexit

events. Such adverse reaction from the market could have been predicted, as regulatory, passporting and single market access changes may cause multi-national financial service companies to lose customers, leading to a decrease in revenues. In light of such outcome, investors can expect Brexit events to reduce the returns on stocks of listed financial service companies.

8. Additionally, the research results determined that the Brexit referendum had the largest influence on listed financial service companies out of all three events analysed.

Comparably, Theresa May speech on January 17th reported banking and financial services sectors returns to be marginally statistically significant while insurance sector returns were deemed to be insignificant. However, as the abnormal returns of the banking and financial service sectors were not substantially larger than the statistical threshold, it was apparent that other events, such as the devaluation of the pound, could have inflated the results.

Furthermore, the Article 50 as invoked by the British parliament reported statistically insignificant returns across all sectors. Ultimately, the relevant Brexit events, such as the parliament invoking Article 50, that met the expectations of the market did not cause significant volatility in the market, while other events with an unexpected outcome, like the Brexit referendum, caused a major increase in volatility. In light of the research results, investors should expect similar reactions from the stocks to events that respectively meet and do not meet the expectations of the market.

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Appendices

Appendix A. UK: Current account by component

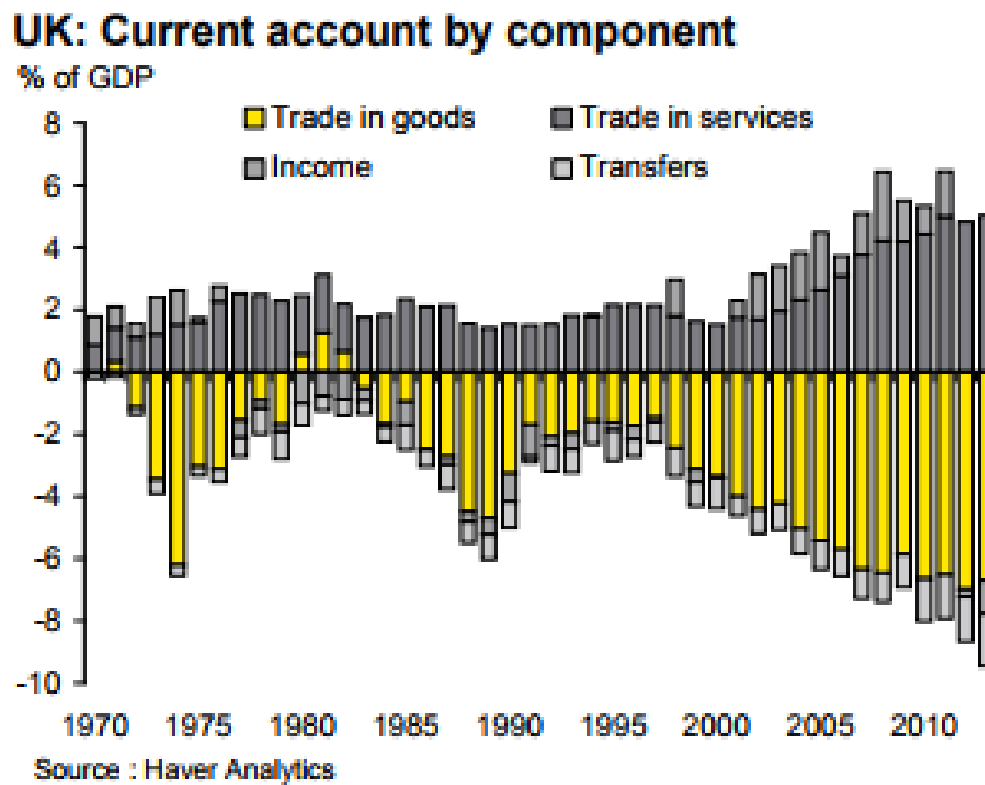


Figure A1. UK current account by component.

"Special report on services exports" by EY, 2014 June.

Appendix B. A Spectrum of regulatory outcomes.

Figure 6: A spectrum of regulatory outcomes



Figure A2. A spectrum of regulatory high or low access outcomes.

"The impact of the UK's exit from the eu on the uk-based financial services sector"

By Oliver Wyman, 2016.

Appendix C. ICSS Algorithm additional explanation.

Iterated Cumulative sum of squares (ICSS) Algorithm

The ICSS algorithm according to Inclan and Tiao (1994) compares well against alternative approaches available in the literature to detect changes in volatility. Inclan and Tiao (1994) make this comparison using monte carlo simulation methods which revealed that ICSS algorithm was the best for analyzing long time series with potentially multiple change points of variance in a series. Inclan and Tiao (1994) define a long time series as on with 200 or more observations. These conditions are satisfied for the weekly return processes that are studied here. In other words, they are long time series with potentially multiple volatility breaks.

Present study, for above reasons, uses the ICSS to detect structural shifts in volatility in weekly market returns series from the CSE and the NYSE. The ICSS mainly asserts that the variable D_k is more sensitive to the changes in volatility than the alternatives available. Here D_k is defined as

$$D_k = \frac{C_k}{C_T} - \frac{k}{T}, \quad k = 1, \dots, T,$$

with $D_0 = D_T = 0$ where $C_k = \sum_{m,t} R_{m,t}^2$ and $R_{m,t}^2$ is the market return series at week t . Thus the ICSS tracks the changes in D_k to detect changes in volatility. The algorithm involves several iterative steps which are followed in this paper. These steps given below closely follow the explanation by Inclan and Tiao (1994: 916). Here the notation $R[t_1 : t_2]$ represents $R_{m,t_1}, R_{m,t_1+1}, R_{m,t_1+2}, \dots, R_{m,t_2}$, $t_1 > t_2$ and notation $D_k(R[t_1 : t_2])$ represents the range over which cumulative sum of squares are sought.

Step 1. Let $t_1 = 1$,

Step 2. Calculate $D_k(R[t_1 : T])$. Let $k^*(R[t_1 : T])$ be the point at which $\max_k |D_k(R[t_1 : T])|$ is obtained and let $M(t_1 : T) = \max_{t_1 \leq k \leq T} \sqrt{(T - t_1 + 1/2)} |D_k(R[t_1 : T])|$. If $M(t_1 : T) > D^*$, where D^* is the critical value, consider that there is a change point at $k^*(R[t_1 : T])$ and proceed to Step 2a.

Step 2a. Let $t_2 = k^*(R[t_1 : T])$. Evaluate $D_k(R[t_1 : t_2])$; that is the centered cumulative sum of squares applied only to the beginning of the series up to t_2 . If $M(t_1 : t_2) > D^*$, then there will be a new point of change and repeat Step 2a until $M(t_1 : t_2) > D^*$. When this occurs it can be concluded that there is no evidence of change in $t = t_1, \dots, t_2$ and therefore the first point of change is $k_{first} = t_2$.

Step 2b. Now do a similar search starting from the first change point found in step 1, towards the end of the series. Define a new value for t_1 : let $t_1 = k^*(R[t_1 : T]) + 1$. Evaluate $D_k(R[t_1 : T])$, and repeat Step 2b until $M(t_1 : T) > D^*$. Let $K_{last} = t_1 - 1$.

Step 2c. If $K_{first} = K_{last}$, then there is just one change point. The algorithm stops there. If $K_{first} \neq K_{last}$, keep both values as possible change points and repeat steps 1 and 2 on the middle part of the series; that is $t_1 = K_{first} + 1$ and $T = K_{last}$. Each time that steps 1 and 2 are repeated then result can be one or two more points. Call N_t the number of change points found so far.

Step 3. If there are two or more possible change points, make sure they are in increasing order. Let $\mathbf{p}$ be the vector of all the possible change points, found so far. Define the two extreme values $\mathbf{p}_0 = 0$ and $\mathbf{p}_{N_t+1} = T$. Check each possible change point by calculating $D_k(R[\mathbf{p}_{j-1} + 1 : \mathbf{p}_{j+1}])$, $j = 1, \dots, N_t$. If $m(\mathbf{p}_{j-1} + 1 : \mathbf{p}_{j+1}) > D^*$ then keep the point; otherwise eliminate it. The retained points constitute the multiple volatility change points in the $R_{m,t}$ series.

Figure A3. Iterated Cumulative sum of squares (ICSS) Algorithm. "Sensitivity of Stock Prices to Economic Events: Econometric Evidence from Sri Lankan Stock Market and US Stock Market" By Dayarathne & Lakshman, R. ,2012, December), Volume 11 Number 1, pp 21-32: Sabaragamuwa University Journal.

Appendix D. Volatility breaks of NYSE returns

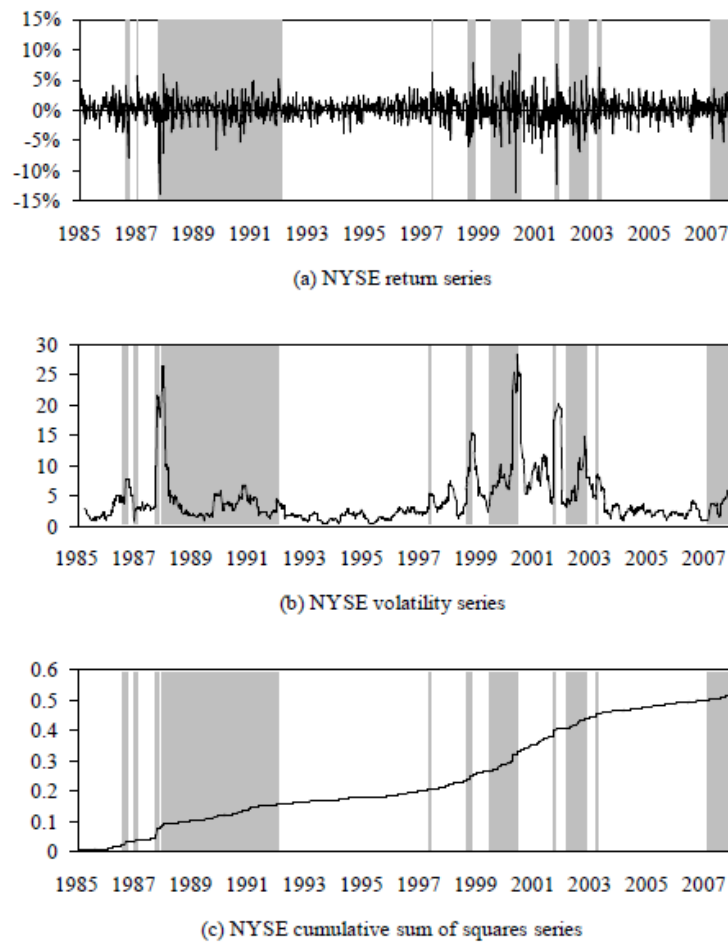


Figure 3: The application of ICSS to the NYSE returns series. The periods of high volatility are shaded in the panels capturing different manifestations of the NYSE return series: (a) the NYSE return series, (b) the quarterly moving variance of the return series, and (c) the cumulative sum of squared return series.

Figure A4. The application of ICSS to the NYSE returns series. "Sensitivity of Stock Prices to Economic Events: Econometric Evidence from Sri Lankan Stock Market and US Stock Market" By Dayarathne & Lakshman, R. ,2012, December), Volume 11 Number 1, pp 21-32: Sabaragamuwa University Journal.

Appendix E. Vector autoregressive analysis.

$$\begin{pmatrix} R_t = \lambda_0 + \sum_{i=1}^n \lambda_i \Delta EPU_{t-i} + \sum_{i=1}^n \varphi_i R_{t-i} + \varepsilon_t \\ \Delta EPU_t = \lambda_0 + \sum_{i=1}^n \lambda_i \Delta EPU_{t-i} + \sum_{i=1}^n \varphi_i R_{t-i} + \varepsilon_t \end{pmatrix} \quad (1)$$

$$R_t = \lambda + \delta \Delta EPU_t + \varepsilon_t \quad (2)$$

Where:

R_t = return on the CRSP value-weighted index in month t

R_{t-i} = return on the CRSP value-weighted index in month $t-i$

ΔEPU_t = change in economic policy uncertainty index by taking the first difference; that is he
value of economic policy uncertainty index in month t less month $t-1$

ΔEPU_{t-i} = The change in economic policy uncertainty index in $t-i$

Figure A5. Vector autoregressive analysis formulas. "Economic Policy Uncertainty and Stock Market Returns" by Sum, V., 2012, International Review of Applied Financial Issues and Economics, Forthcoming.

Appendix F. Economic Policy Uncertainty Shocks and OLS Regression results

Table 1: Impulse Response Functions of Stock Returns to Economic Policy Uncertainty Shocks

Step	Impulse Response Functions
0	0
1	-0.02795
2	0.04197
3	0.04006
4	-0.00338
5	-0.00113
6	0.01356
7	0.04815
8	-0.00334
9	-0.02592
10	-0.01961
11	-0.00365
12	0.00312

Table 3: Time-Varying OLS Regression Results

$$R_t = \lambda + \delta \Delta EPU_t + \varepsilon_t$$

	Coefficient	Std. Err.	<i>t</i>	Sig.
Constant	0.93997	0.24408	3.85	0.000
δ	-0.08234	0.01498	-5.50	0.000
R-Square	0.0846			
Adj. R-Square	0.0818			
F(1, 327)	30.20			0.000

Number of Observation = 329

Figure A5. Impulse Response Functions and OLS Regression results. "Economic Policy Uncertainty and Stock Market Returns" by Sum, V., 2012, International Review of Applied Financial Issues and Economics, Forthcoming.

Appendix 1. Test for linearity in parameters

Table 1A

Non-linearity tests

Company	Non-linearity test
HSBC Holdings PLC	0,503189
Lloyds Banking Group PLC	0,58191
Royal Bank of Scotland Group	0,183161
Barclays PLC	0,415202
Standard Chartered PLC	0,189428
Prudential PLC	0,558078
Aviva PLC	0,979144
Legal & General Group PLC	0,912749
Old Mutual PLC	0,500302
St. James's Place PLC	0,380231
LSE PLC	0,294162
Standard Life PLC	0,0630474
Schroders PLC	0,481431
3i Group Plc	0,166322
Hargreaves Lansdown PLC	0,768847

Note: If the value of non-linearity test is below 0,05, the null hypothesis of parameter linearity is rejected. If the value of non-linearity test is above 0,05 the null hypothesis of parameter linearity is accepted.

Source: table prepared by the author, tests performed using GRETL software. Data retrieved from Yahoo Finance and London Stock Exchange website, 2017.

Appendix 2. Tests for heteroscedasticity and serial correlation

Table 2A.

Breusch-Pagan, Koenker and Durbin Watson tests

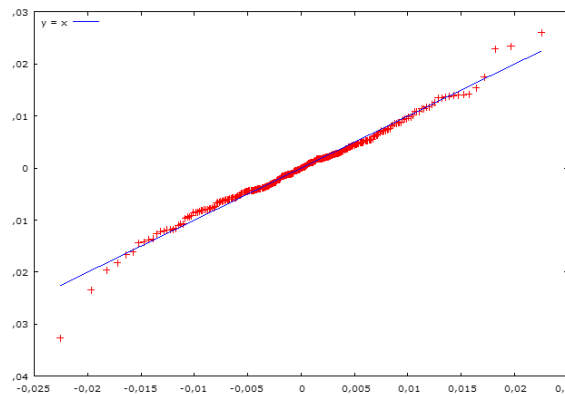
Company	Breusch-Pagan	Koenker	Durbin Watson
HSBC Holdings PLC	0,0543025	0,0608169	1,96746
Lloyds Banking Group PLC	0,444703	0,531401	1,99211
Royal Bank of Scotland Group	0,312625	0,376628	2,11403
Barclays PLC	0,954892	0,960005	2,17372
Standard Chartered PLC	0,117252	0,124047	1,66645
Prudential PLC	0,352575	0,35635	2,23478
Aviva PLC	0,802091	0,831688	2,20812
Legal & General Group PLC	0,738157	0,761207	1,75762
Old Mutual PLC	0,688738	0,757648	2,0278
St. James's Place PLC	0,347813	0,32682	1,96482
LSE PLC	0,551919	0,529976	1,97588
Standard Life PLC	0,205474	0,332709	1,85351
Schroders PLC	0,558992	0,599061	2,19278
3i Group Plc	0,277226	0,265326	1,98823
Hargreaves Lansdown PLC	0,310821	0,391866	2,10512

Note: If at least one of the values of Breusch-Pagan or Koenker tests are above 0,05 – Null hypothesis of homoscedasticity is accepted. If the Durbin Watson values obtained Are not significantly different from 2 – the serial correlation is not present.

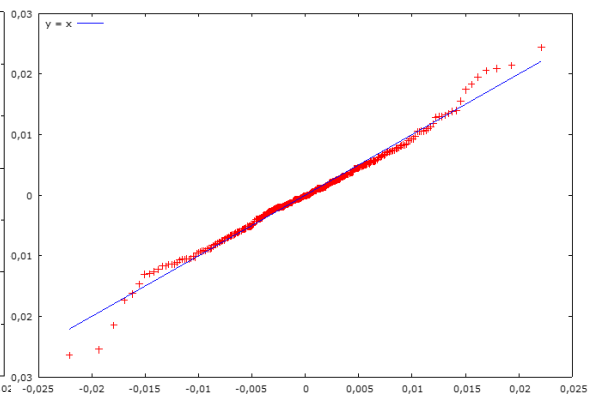
Source: table prepared by the author, tests performed using GRETl software. Data retrieved from Yahoo Finance and London Stock Exchange website, 2017.

Appendix 3. Normality of the residuals

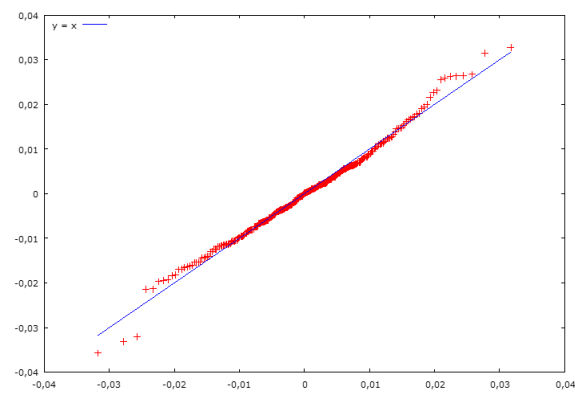
HSBC OLS model residuals



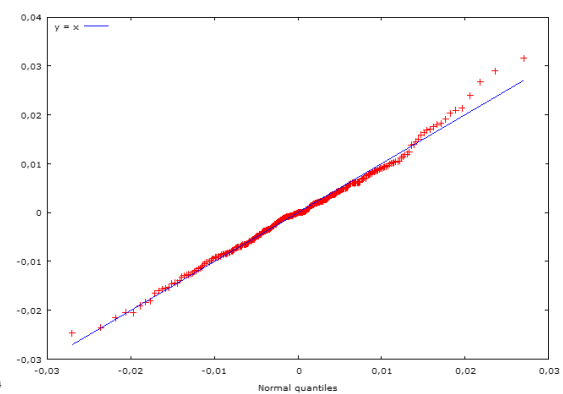
Lloyds



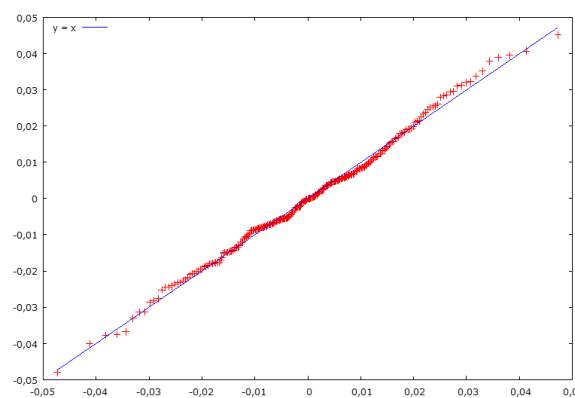
Royal bank of scotland



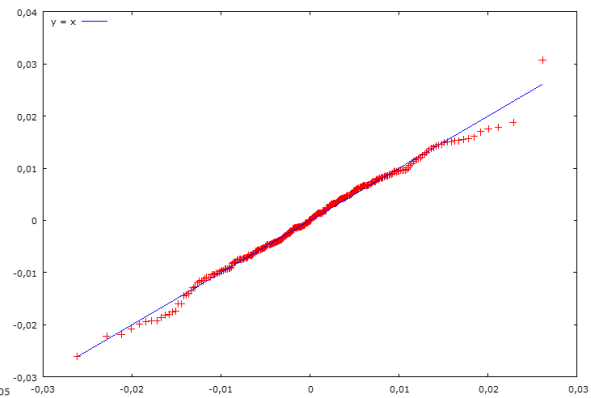
Barclays OLS model residuals



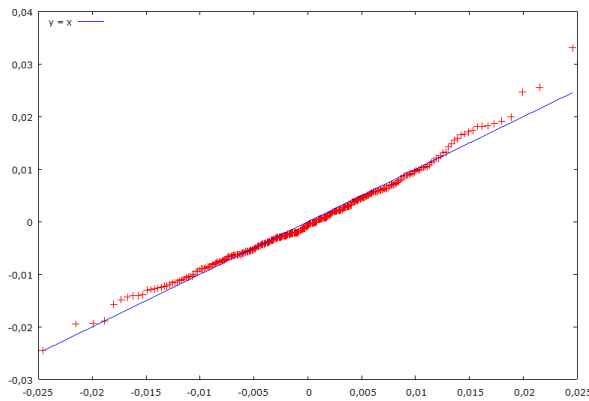
Standard chartered



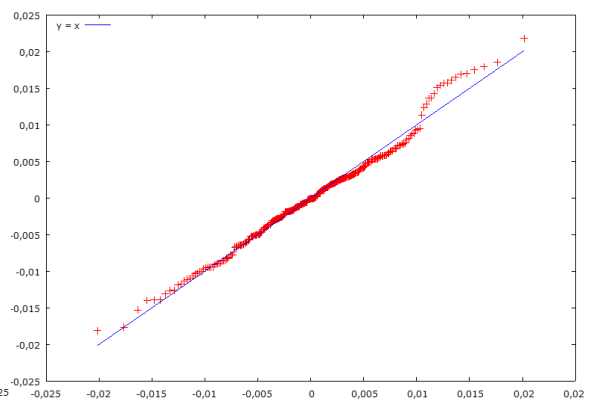
Prudential



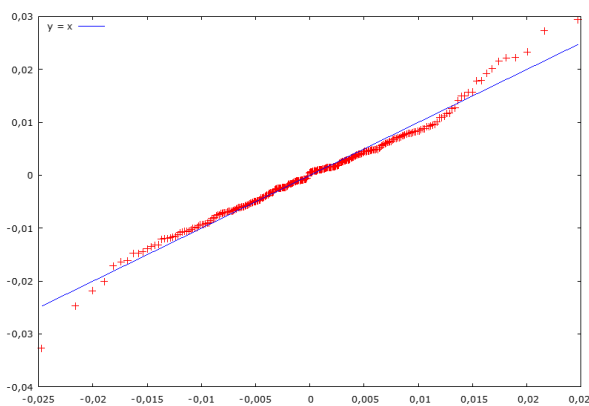
Aviva



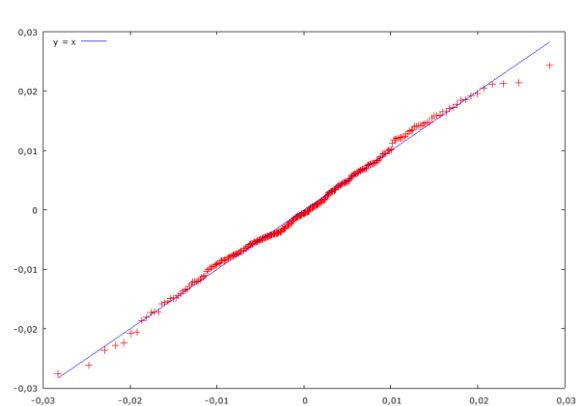
L&G



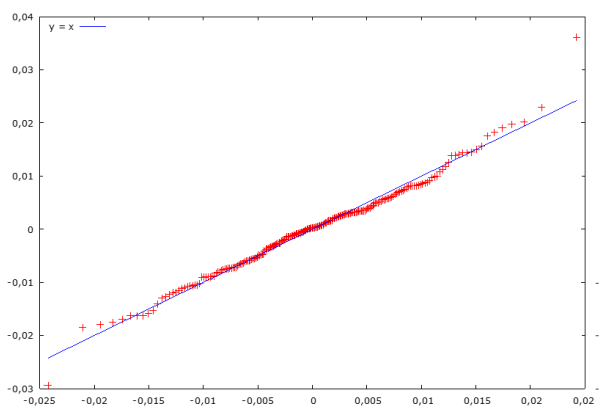
Old Mutual



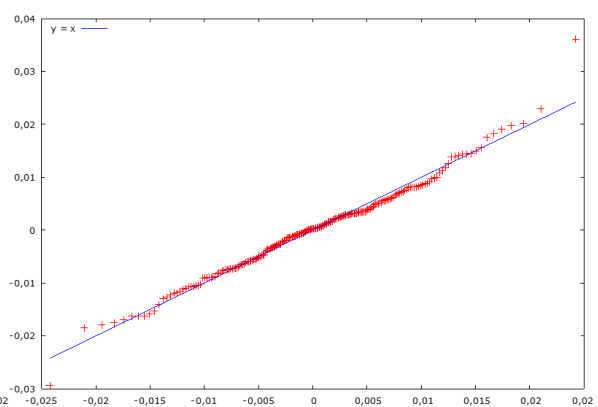
St James



LSE



Standard life Aberdeen



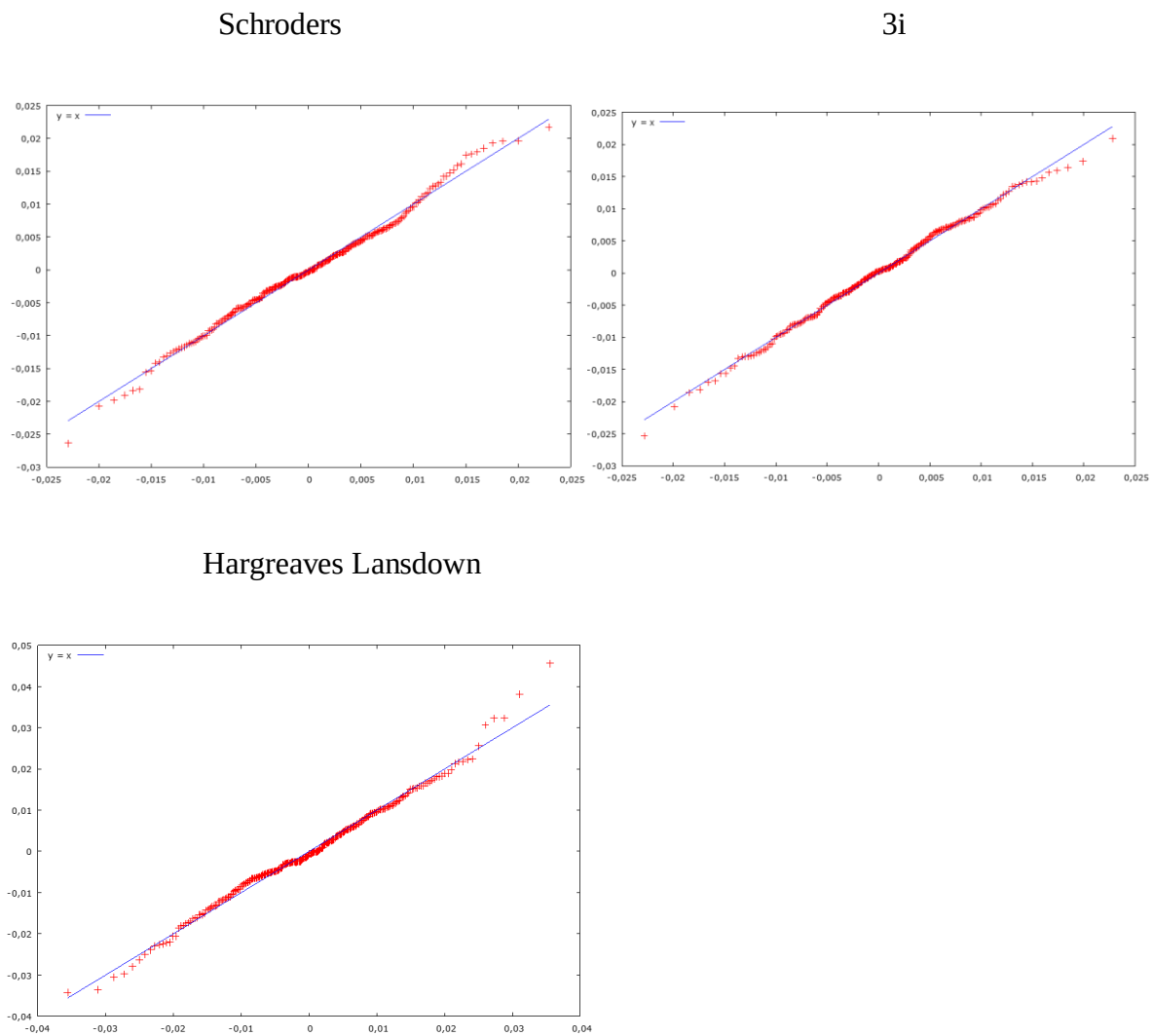


Figure 1A. P-P plots of residuals received with OLS

Note: The closer the residuals are to the normal distribution, the better they fit the 45° line.

Source: output received using GRETl software. Data received from Yahoo Finance and London Stock Exchange website, 2017.

Appendix 4. Augmented Dickey Fuller test

Table 4A

Augmented Dickey Fuller test p-values for models' variables

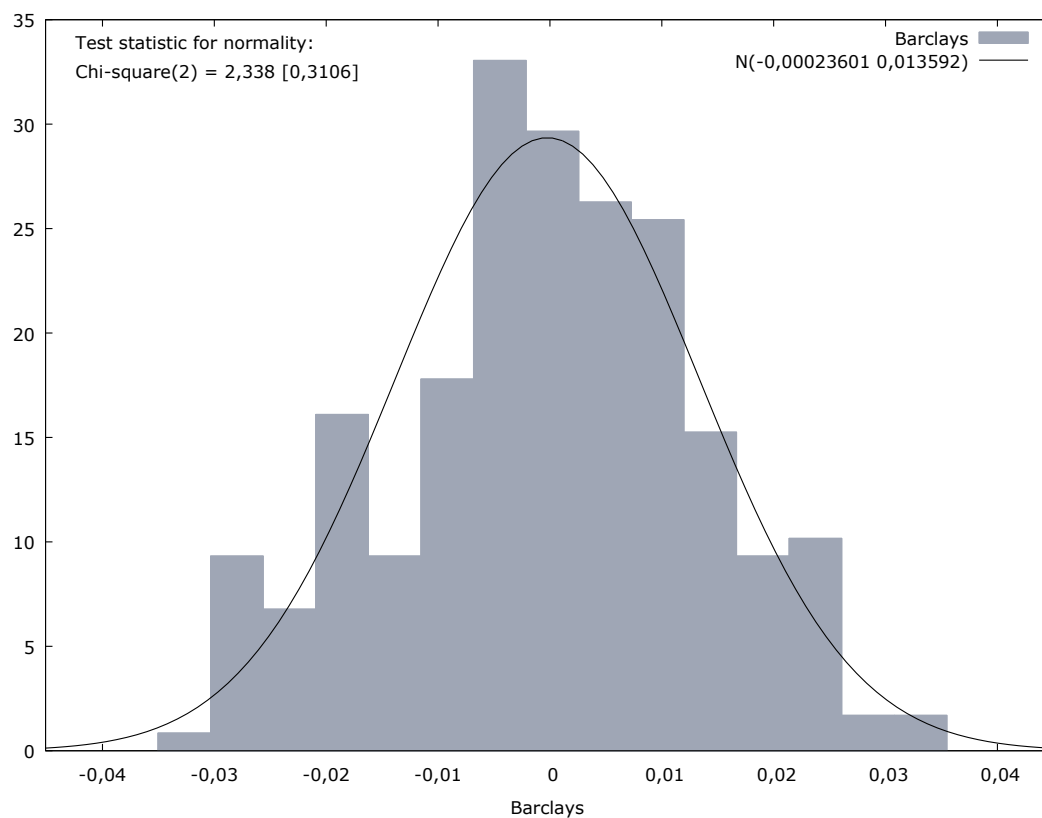
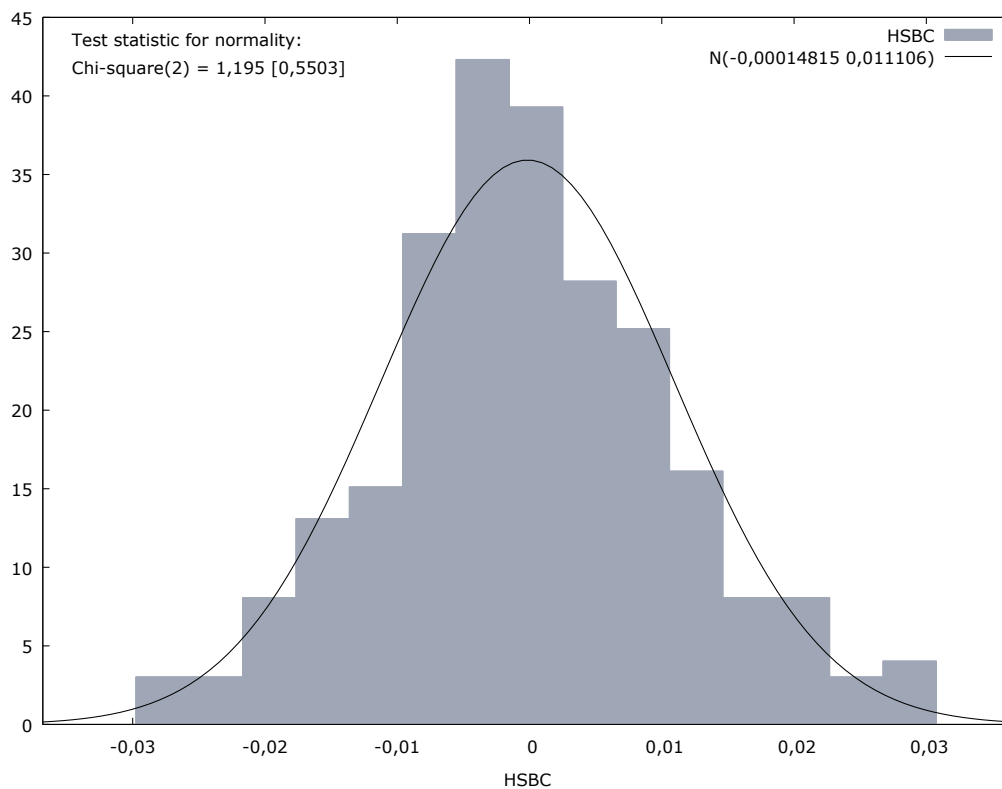
Company	p-value of the dependent variable	FTSE 100 p-value
HSBC Holdings PLC	2,635E-30	1,09E-29
Lloyds Banking Group PLC	1,72E-31	7,34E-32
Royal Bank of Scotland Group	1,551E-29	6,124E-28
Barclays PLC	9,787E-26	2,632E-22
Standard Chartered PLC	7,613E-21	1,791E-24
Prudential PLC	2,15E-35	6,81E-21
Aviva PLC	4,55E-31	2,135E-28
Legal & General Group PLC	5,32E-28	1,578E-35
Old Mutual PLC	7,769E-27	1,551E-11
St. James's Place PLC	2,103E-28	4,807E-10
LSE PLC	1,801E-29	3,448E-12
Standard Life PLC	2,145E-08	9,687E-23
Schroders PLC	3,412E-32	2,853E-11
3i Group Plc	1,016E-12	7,521E-10
Hargreaves Lansdown PLC	1,016E-28	7,006E-30

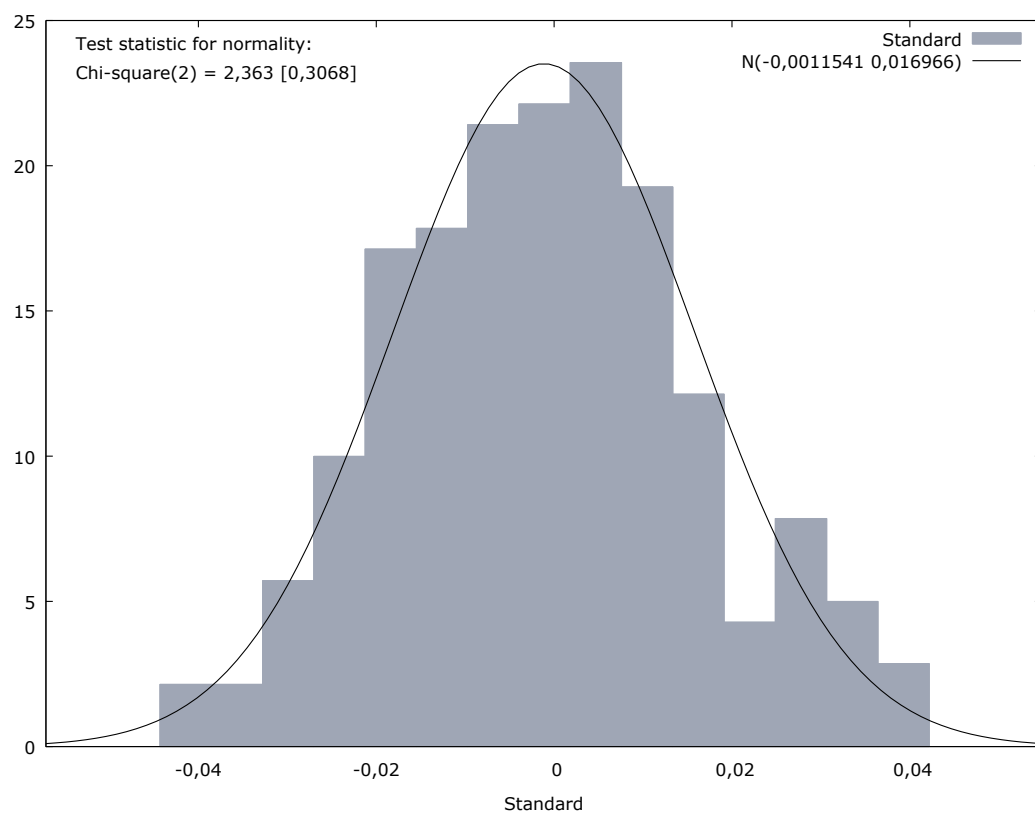
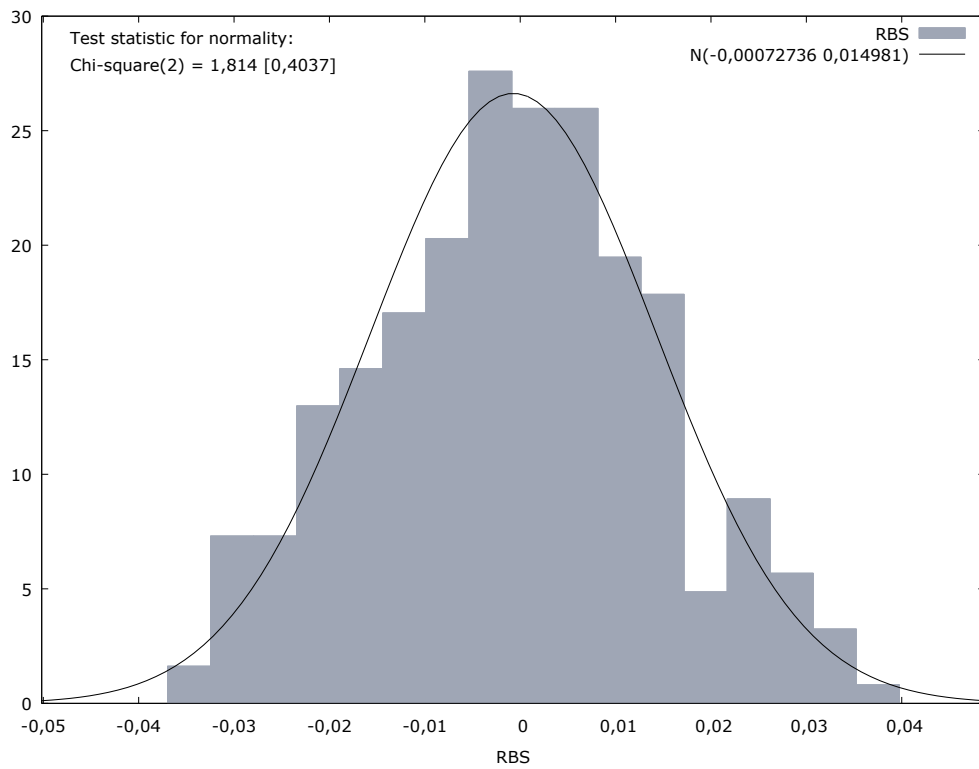
Note: Stationarity present if p-value is significant.

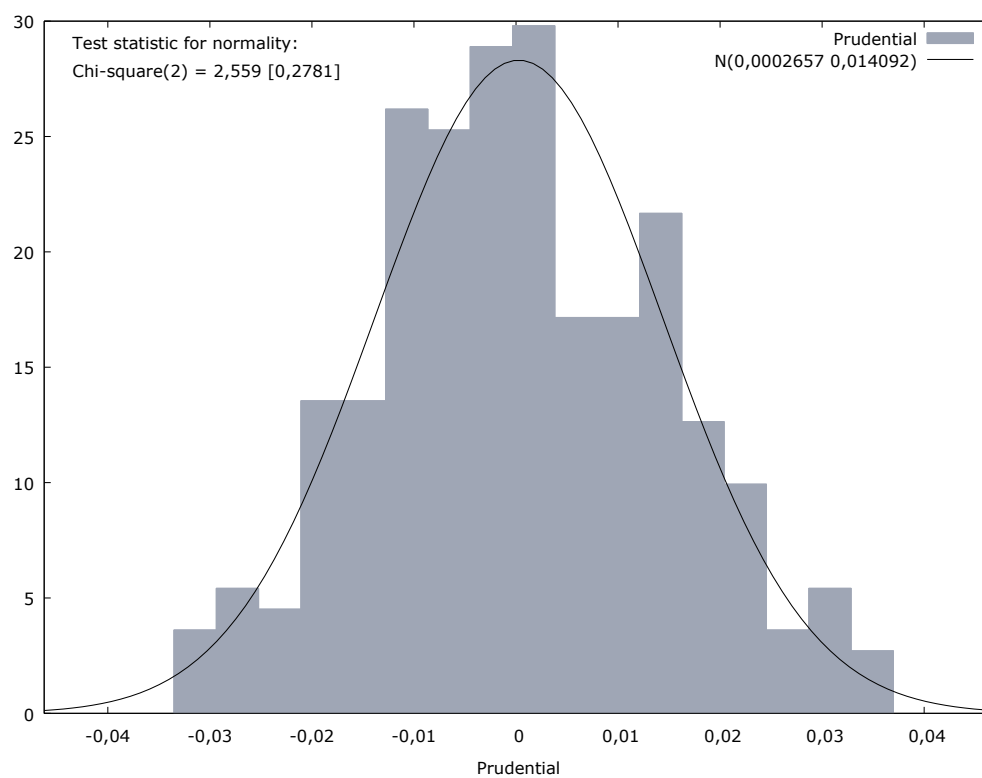
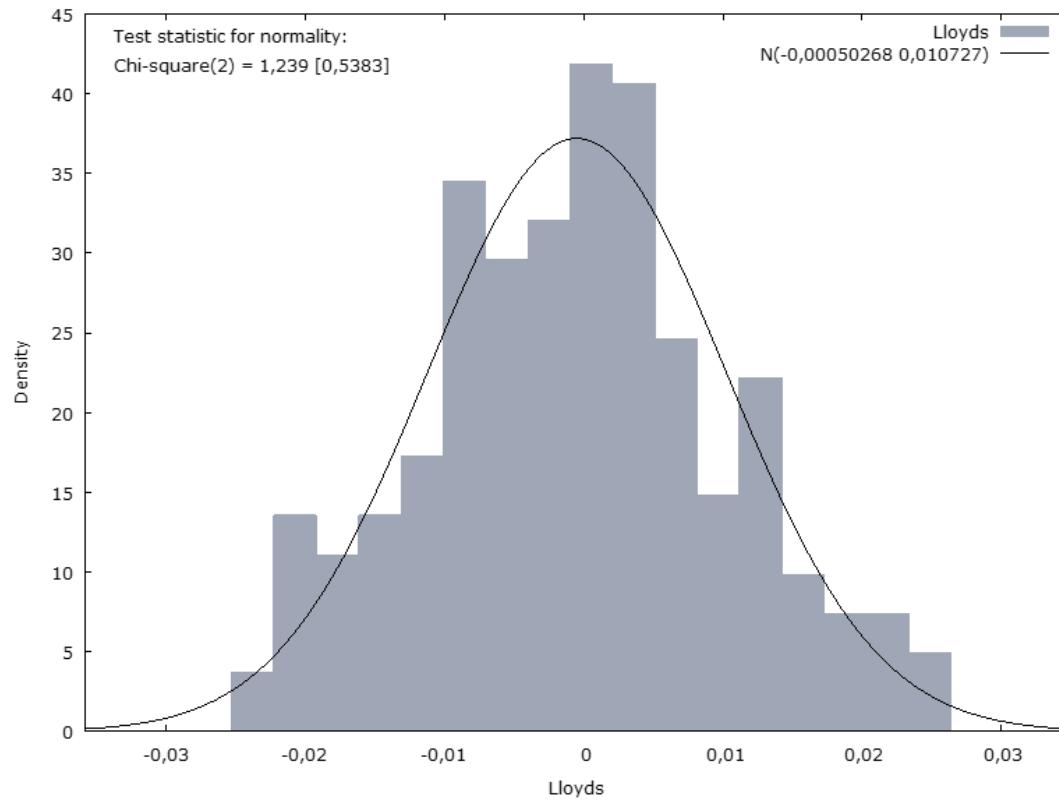
Source: Output received using GRETTL software. Data retrieved from Yahoo Finance

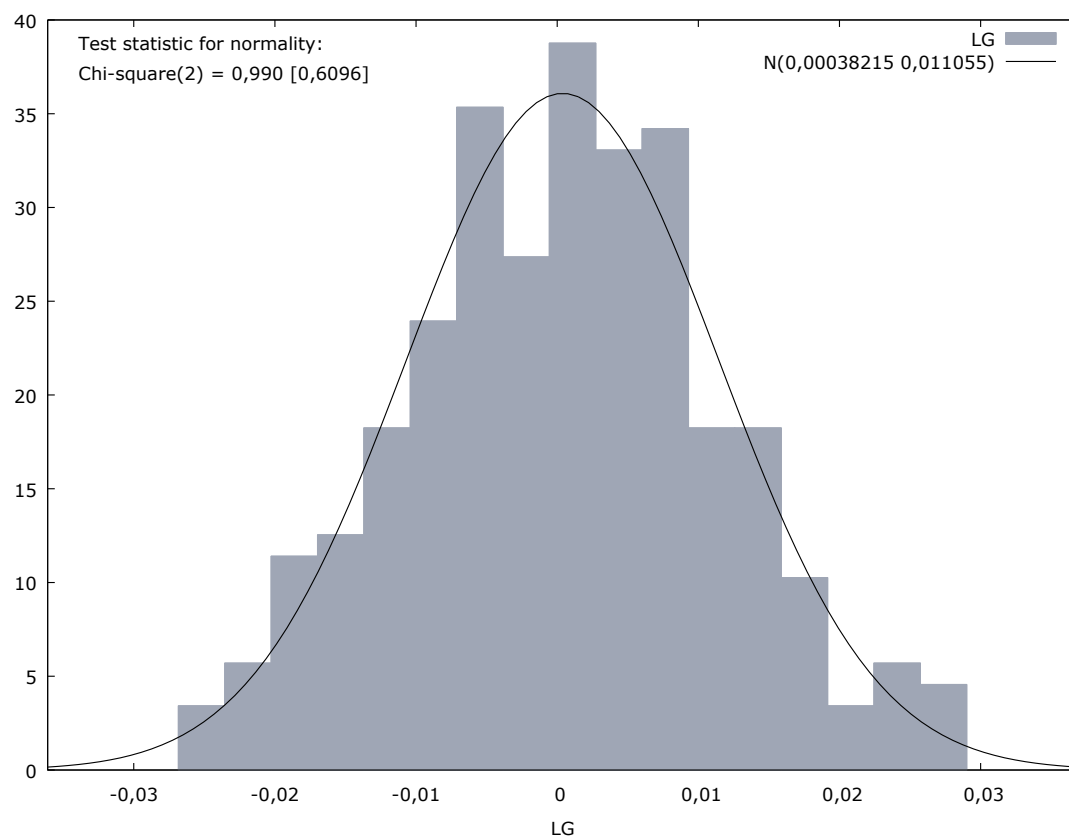
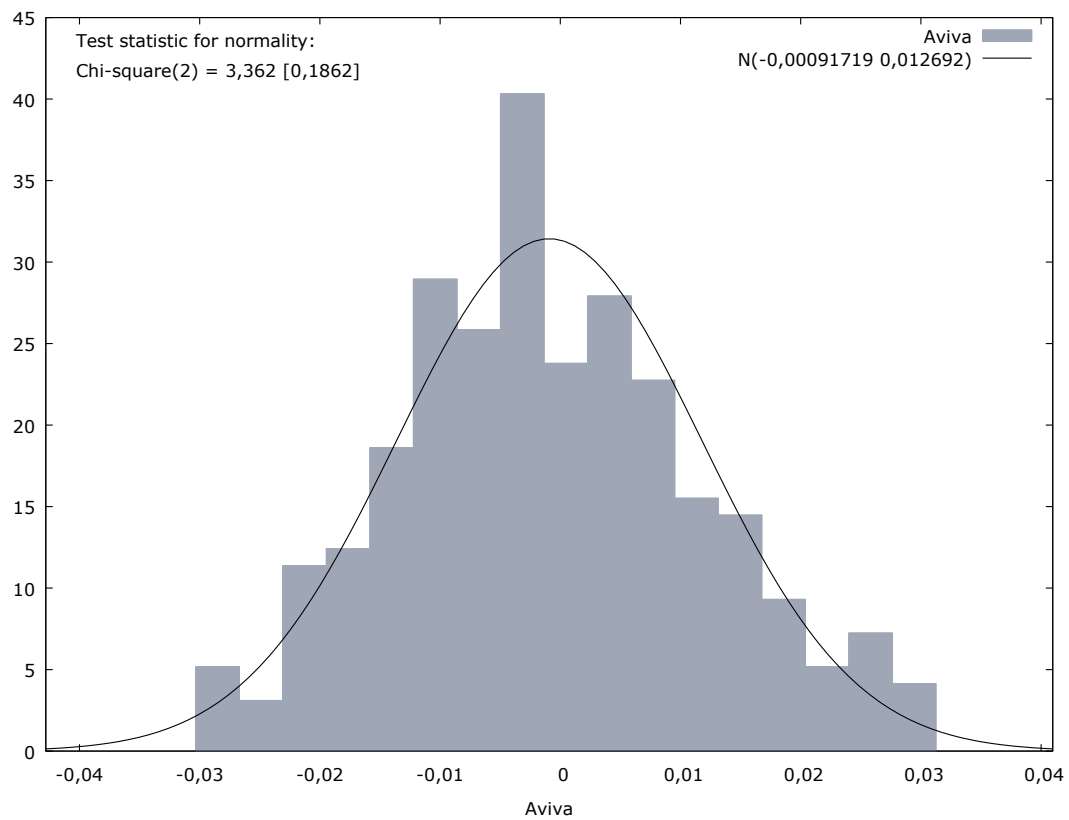
And London Stock Exchange website, 2017.

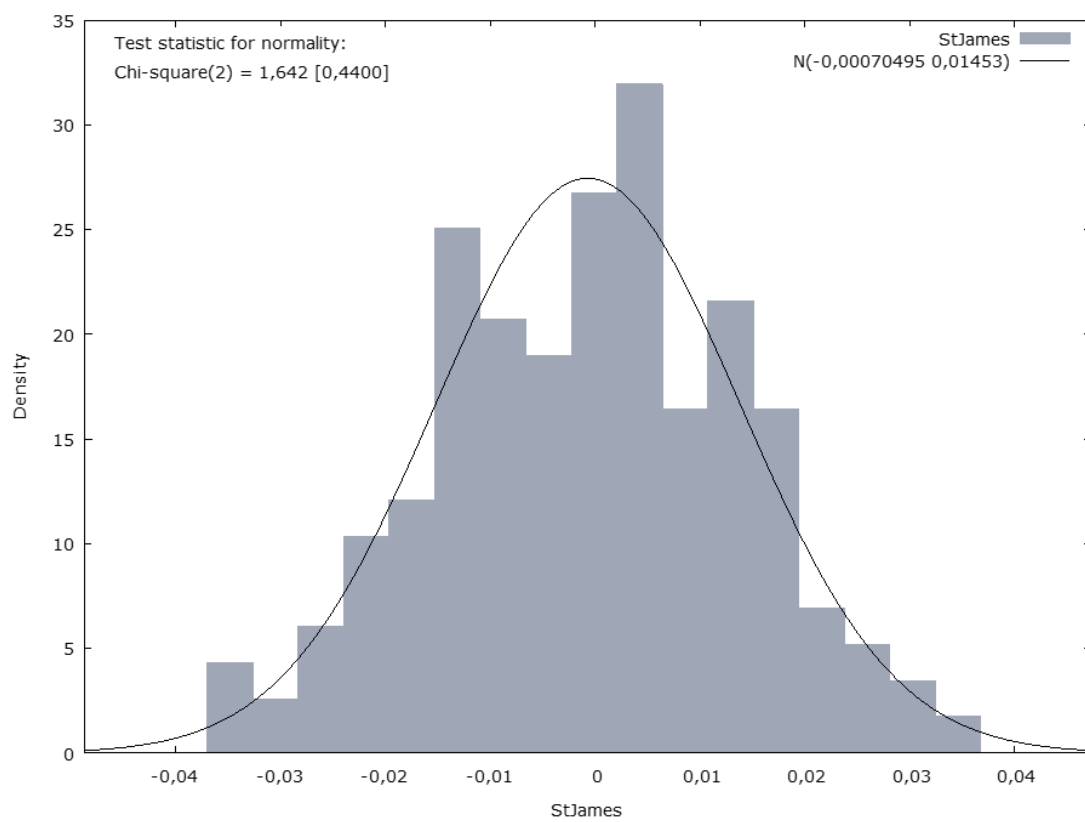
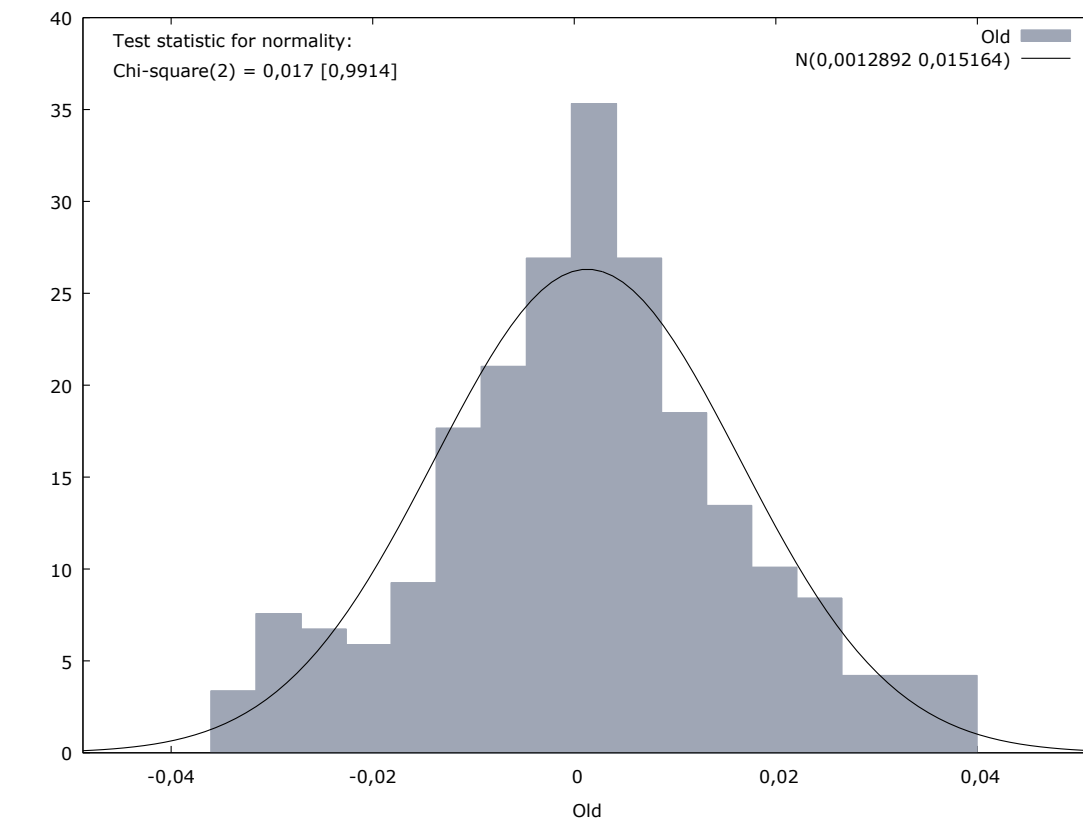
Appendix 5 Histograms of independent variables

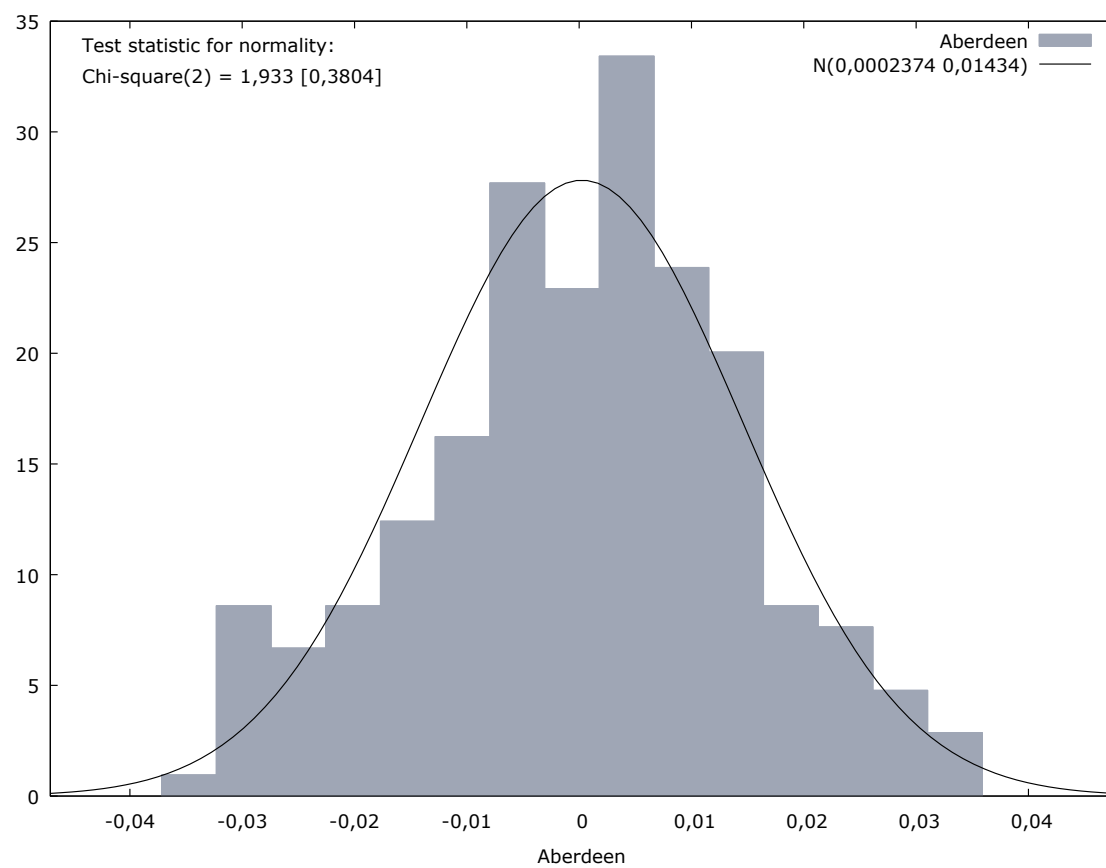
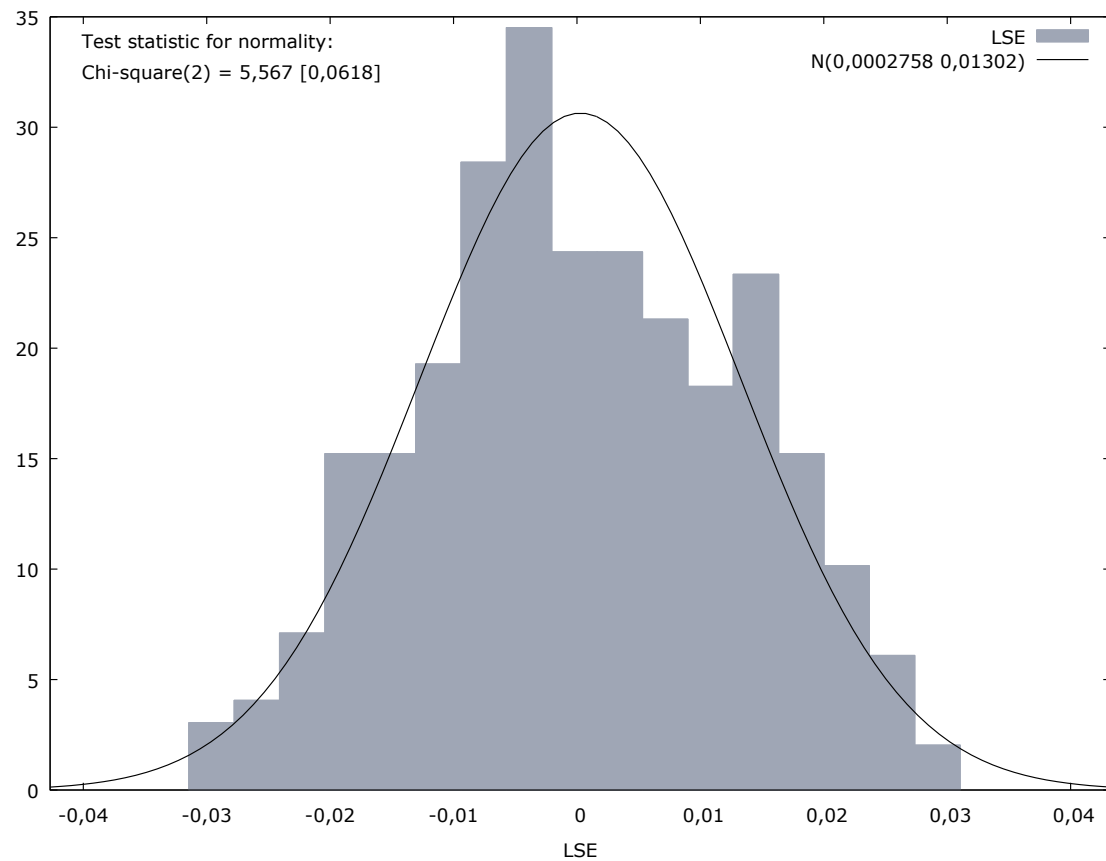


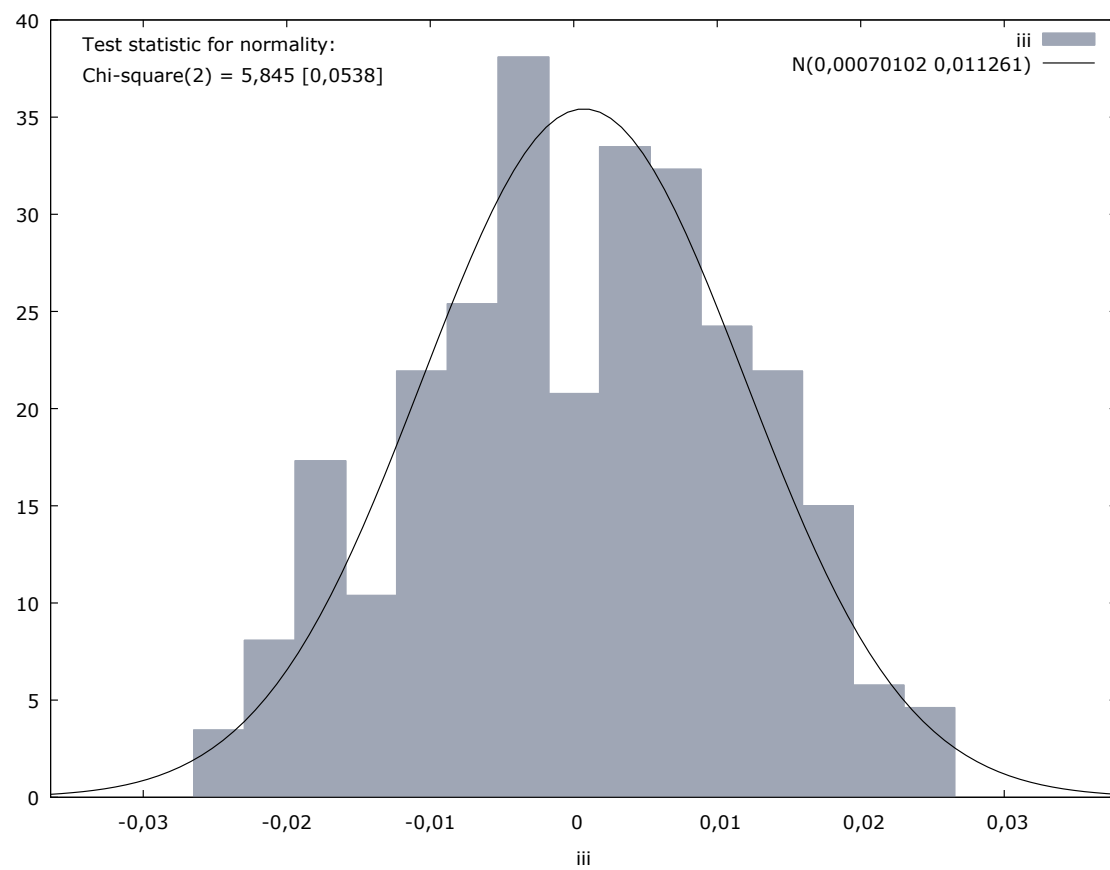
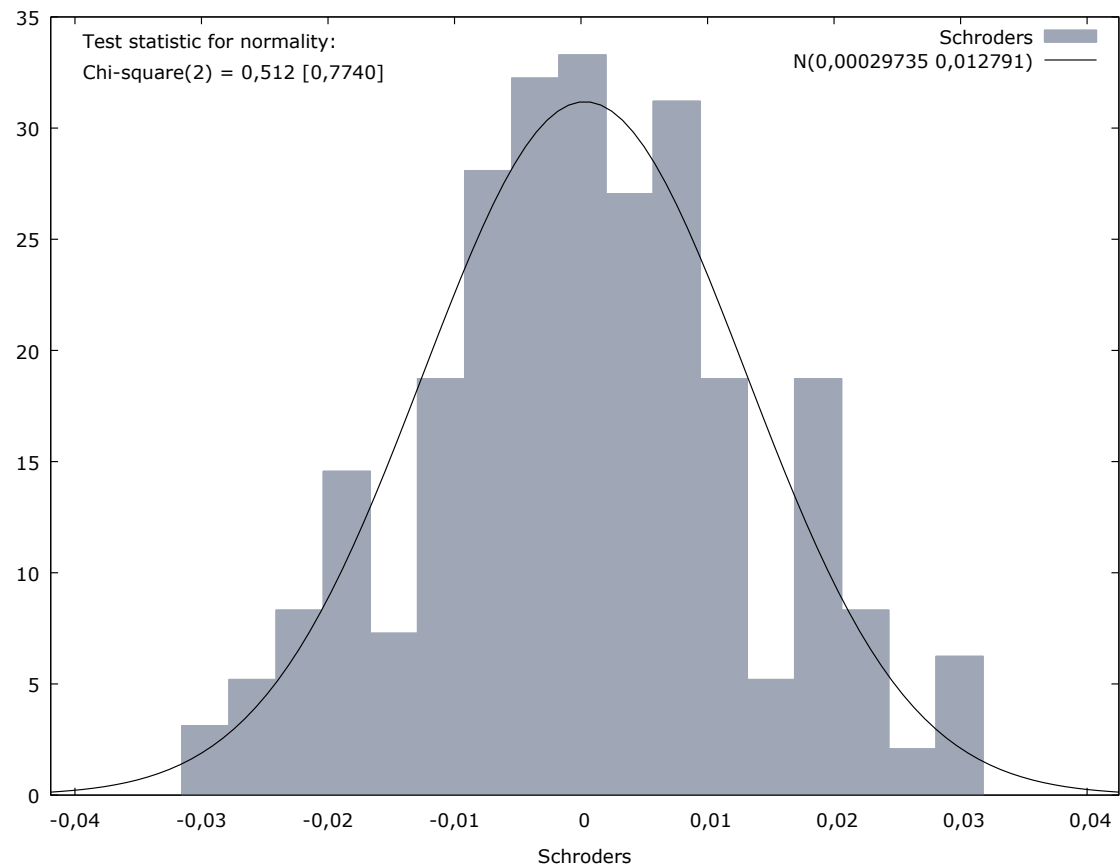












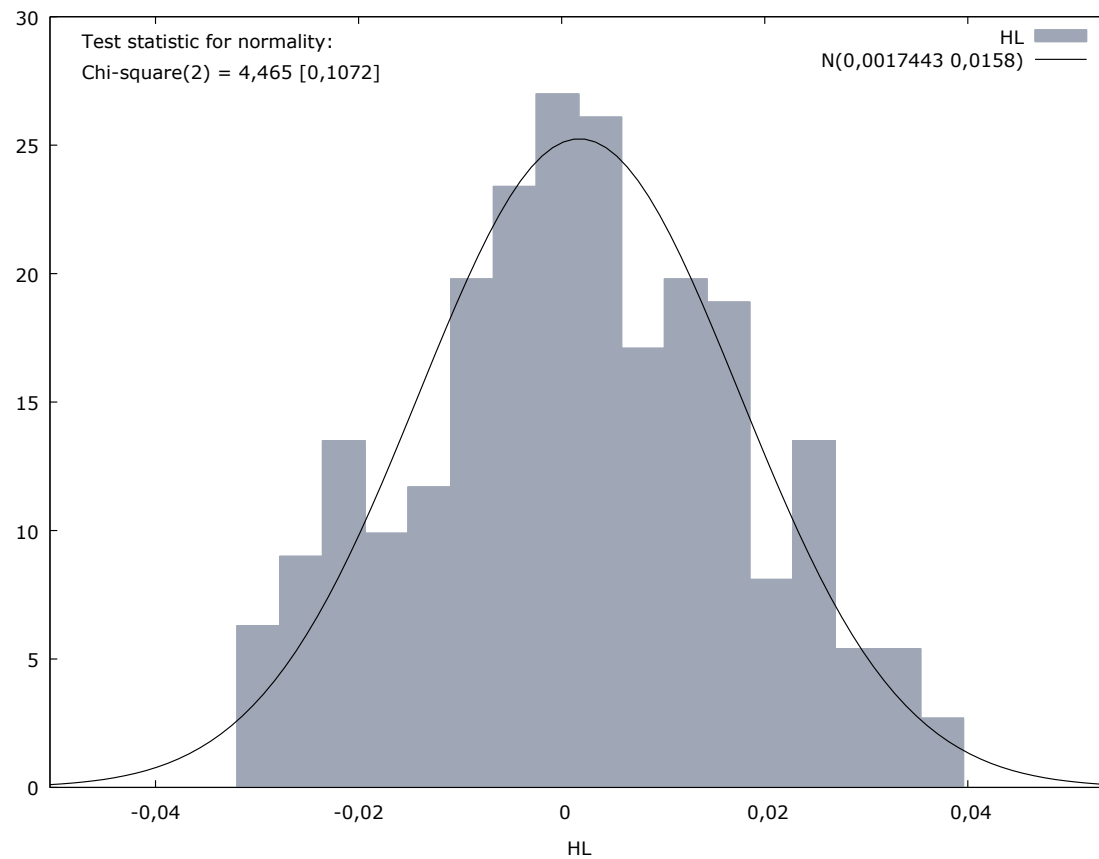


Figure 2A. Histograms of dependent variables. Observations were removed if placed beyond normal curve tails (Removing outlier bias).

Source: output received using GRET software. Data retrieved from Yahoo Finance and London Stock Exchange websites.

Appendix 6. Calculations of abnormal returns during event days.

Table 5A

Interim calculations of abnormal returns during event days

Calculation of abnormal returns referendum open formula			
Company	Rj	Rm	Abnormal
HSBC Holdings PLC	-0,03156	0,0122088	-0,04364
Lloyds Banking Group PLC	-0,33325	0,0122088	-0,34194
Royal Bank of Scotland Group	-0,41151	0,0122088	-0,42235
Barclays	-0,35564	0,0122088	-0,36984
Standard Chartered	-0,0707	0,0122088	-0,07549
Prudential PLC	-0,15216	0,0122088	-0,16565
Aviva PLC	-0,42954	0,0122088	-0,44113
Legal & General Group PLC	-0,32227	0,0122088	-0,33301
Old Mutual PLC	-0,10354	0,0122088	-0,11964
St. James's Place PLC	-0,30174	0,0122088	-0,31489
LSE PLC	-0,14247	0,0122088	-0,15319
Standard Life PLC	-0,14795	0,0122088	-0,16049
Schroders PLC	-0,20222	0,0122088	-0,21487
3i Group Plc	-0,03471	0,0122088	-0,04592
Hargreaves Lansdown PLC	-0,1681	0,0122088	-0,18087

Appendix 6. Calculations of abnormal returns during event days.

Table 5B

Interim calculations of abnormal returns during event days

Calculation of abnormal returns referendum close formula			
Company	Rj	Rm	Abnormal
HSBC Holdings PLC	-0,014406	-0,0319677	0,0186673
Lloyds Banking Group PLC	-0,235696	-0,0319677	-0,211373
Royal Bank of Scotland Group	-0,198987	-0,0319677	-0,167689
Barclays	-0,194538	-0,0319677	-0,157358
Standard Chartered	-0,026107	-0,0319677	-0,009588
Prudential PLC	-0,09531	-0,0319677	-0,05999
Aviva PLC	-0,170558	-0,0319677	-0,139849
Legal & General Group PLC	-0,226427	-0,0319677	-0,199381
Old Mutual PLC	-0,048612	-0,0319677	-0,009
St. James's Place Pl	-0,176494	-0,0319677	-0,142048
LSE PLC	-0,089841	-0,0319677	-0,063591
Standard Life PLC	-0,189983	-0,0319677	-0,15717
Schroders PLC	-0,129377	-0,0319677	-0,096239
3i Group Plc	-0,092201	-0,0319677	-0,064292
Hargreaves Lansdown PLC	-0,167316	-0,0319677	-0,137497

Appendix 6. Calculations of abnormal returns during event days.

Table 5C

Interim calculations of abnormal returns during event days

Calculation of abnormal returns referendum +1 formula			
Company	Rj	Rm	Abnormal
HSBC Holdings PLC	-0,02246	-0,02582	0,00433
Lloyds Banking Group PLC	-0,10829	-0,02582	-0,08856
Royal Bank of Scotland Group	-0,16369	-0,02582	-0,13826
Barclays	-0,19054	-0,02582	-0,16051
Standard Chartered	-0,06472	-0,02582	-0,05116
Prudential PLC	-0,11123	-0,02582	-0,08269
Aviva PLC	-0,07938	-0,02582	-0,05455
Legal & General Group PLC	-0,13315	-0,02582	-0,11136
Old Mutual PLC	-0,04716	-0,02582	-0,0153
St. James's Place PLC	-0,07854	-0,02582	-0,05071
LSE PLC	-0,08818	-0,02582	-0,06707
Standard Life PLC	-0,06588	-0,02582	-0,03937
Schroders PLC	-0,15059	-0,02582	-0,12382
3i Group Plc	-0,08742	-0,02582	-0,06495
Hargreaves Lansdown PLC	-0,10678	-0,02582	-0,08288

Appendix 6. Calculations of abnormal returns during event days.

Table 5D

Interim calculations of abnormal returns during event days

Calculation of abnormal returns referendum January 17 formula			
Company	Rj	Rm	Abnormal
HSBC Holdings PLC	-0,01989	-0,01468	-0,00449
Lloyds Banking Group PLC	0,01168	-0,01468	0,023079
Royal Bank of Scotland Group	0,024363	-0,01468	0,039165
Barclays	0,00216	-0,01468	0,019231
Standard Chartered	0,027776	-0,01468	0,035955
Prudential PLC	-0,0054	-0,01468	0,010814
Aviva PLC	-0,00666	-0,01468	0,007491
Legal & General Group PLC	-0,00448	-0,01468	0,007773
Old Mutual PLC	0,006632	-0,01468	0,024439
St. James's Place PLC	-0,00847	-0,01468	0,007344
LSE PLC	0	-0,01468	0,011781
Standard Life PLC	0	-0,01468	0,015064
Schroders PLC	-0,00066	-0,01468	0,014555
3i Group Plc	-0,00208	-0,01468	0,01052
Hargreaves Lansdown PLC	0,038348	-0,01468	0,051497

Appendix 6. Calculations of abnormal returns during event days.

Table 5E

Interim calculations of abnormal returns during event days

Calculation of abnormal returns referendum March 13 formula			
Company	R _j	R _m	Abnormal
HSBC Holdings PLC	0,008067	0,003263	0,005132
Lloyds Banking Group PLC	-0,0032	0,003263	-0,00521
Royal Bank of Scotland Group	-0,01522	0,003263	-0,01753
Barclays	-0,00714	0,003263	-0,01094
Standard Chartered	0,002156	0,003263	0,001682
Prudential PLC	0,012697	0,003263	0,009091
Aviva PLC	0,00461	0,003263	0,001586
Legal & General Group PLC	0,002409	0,003263	-0,00068
Old Mutual PLC	0,011551	0,003263	0,006736
St. James's Place PLC	0,009191	0,003263	0,005675
LSE PLC	-0,00131	0,003263	-0,00454
Standard Life PLC	0	0,003263	-0,00335
Schroders PLC	0,002873	0,003263	-0,00051
3i Group Plc	0,006188	0,003263	0,002898
Hargreaves Lansdown PLC	0,001515	0,003263	-0,00263

Note: Interim calculations of abnormal returns during event days.

Source: table prepared by the author, data received from Yahoo Finance and London Stock Exchange websites.

Appendix 7. Abnormal returns standardization

Table 6A

Standardization of abnormal returns

Company	AR	S.E	Market return	Estimation on avg market return	(Sum of EP FTSE returns - EP FTSE 100 avg returns)^2	Estimation time	Correction term	Standardized AR
HSBC Holdings PLC(open)	-0,04364	0,007862	0,012209	0,00011	0,0334	291	1,0078191	-5,528586
HSBC Holdings PLC(close)	0,018667	0,007862	-0,03197	0,00011	0,0334	291	1,0342442	2,3347264
HSBC Holdings PLC(+1)	0,00433	0,007862	-0,02582	0,00011	0,0334	291	1,0235717	0,5444264
HSBC Holdings PLC								
2017.01.17	-0,00449	0,007862	-0,01468	0,00011	0,0334	291	1,0099824	-0,568703
HSBC Holdings PLC								
2017.03.13	0,005132	0,007862	0,003263	0,00011	0,0334	291	1,0037341	0,651528
Lloyds Banking Group								
PLC(open)	-0,34194	0,007641	0,012209	0,00092	0,0451	289	1,0062859	-44,61078
Lloyds Banking Group								
PLC(close)	-0,21137	0,007641	-0,03197	0,00092	0,0451	289	1,0274425	-27,29111
Lloyds Banking Group								
PLC(+1)	-0,08856	0,007641	-0,02582	0,00092	0,0451	289	1,019318	-11,47958
Lloyds Banking Group PLC								
2017.01.17	0,023079	0,007641	-0,01468	0,00092	0,0451	289	1,0088537	3,0071275
Lloyds Banking Group PLC								
2017.03.13	-0,00521	0,007641	0,003263	0,00092	0,0451	289	1,0035819	-0,681084
Royal Bank of Scotland								
Group(open)	-0,42235	0,0109	0,012209	-0,0001	0,0324	291	1,0081125	-38,59192
Royal Bank of Scotland								
Group(close)	-0,16769	0,0109	-0,03197	-0,0001	0,0324	291	1,0347806	-15,12355
Royal Bank of Scotland								
Group(+1)	-0,13826	0,0109	-0,02582	-0,0001	0,0324	291	1,0238584	-12,53564
Royal Bank of Scotland Group								
2017.01.17	0,039165	0,0109	-0,01468	-0,0001	0,0324	291	1,0099941	3,5752836
Royal Bank of Scotland Group								
2017.03.13	-0,01753	0,0109	0,003263	-0,0001	0,0324	291	1,0037855	-1,605243
Barclays PLC(open)	-0,36984	0,00941	0,01221	0,00010	0,0335	289	1,007837	-39,14179
Barclays PLC(close)	-0,15736	0,00941	-0,03197	0,00010	0,0335	289	1,0341568	-16,44046
Barclays PLC(+1)	-0,16051	0,00941	-0,02582	0,00010	0,0335	289	1,0235199	-16,85657
Barclays 2017.01.17	0,019231	0,00941	-0,01468	0,00010	0,0335	289	1,0099778	2,0330736
Barclays 2017.03.13	-0,01094	0,00941	0,003263	0,00010	0,0335	289	1,0037589	-1,159872
Standard Chartered								
PLC(open)	-0,07549	0,016521	0,01221	0,00013	0,0412	290	1,0069895	-4,553312
Standard Chartered								
PLC(close)	-0,00959	0,016521	-0,03197	0,00013	0,0412	290	1,0284546	-0,572275
Standard Chartered PLC(+1)	-0,05116	0,016521	-0,02582	0,00013	0,0412	290	1,0197967	-3,066494
Standard Chartered PLC								
2017.01.17	0,035955	0,016521	-0,01468	0,00013	0,0412	290	1,0087693	2,1668279
Standard Chartered PLC								
2017.03.13	0,001682	0,016521	0,003263	0,00013	0,0412	290	1,0036865	0,1016309
Prudential PLC(open)	-0,16565	0,009028	0,01221	0,00010	0,0346	289	1,0076979	-18,27827
Prudential PLC(close)	-0,05999	0,009028	-0,03197	0,00010	0,0346	289	1,0331809	-6,53735
Prudential PLC(+1)	-0,08269	0,009028	-0,02582	0,00010	0,0346	289	1,0228822	-9,056788
Prudential PLC 2017.01.17	0,010814	0,009028	-0,01468	0,00010	0,0346	289	1,0097706	1,192036
Prudential PLC 2017.03.13	0,009091	0,009028	0,003263	0,00010	0,0346	289	1,0037494	1,0051452
Aviva PLC(open)	-0,44113	0,0085	0,012209	-0,00010	0,0311	289	1,0083318	-51,68284
Aviva PLC(close)	-0,13985	0,0085	-0,03197	-0,00010	0,0311	289	1,0361145	-16,16355
Aviva PLC(+1)	-0,05455	0,0085	-0,02582	-0,00010	0,0311	289	1,0247358	-6,339822
Aviva PLC 2017.01.17	0,007491	0,0085	-0,01468	-0,00010	0,0311	289	1,010292	0,8768115
Aviva PLC 2017.03.13	0,001586	0,0085	0,003263	-0,00010	0,0311	289	1,0038239	0,1862461

Legal & General Group									
PLC(open)	-0,33301	0,006968	0,012209	-0,00005	0,0328	289	1,0080419	-47,60084	
Legal & General Group									
PLC(close)	-0,19938	0,006968	-0,03197	-0,00005	0,0328	289	1,0345193	-28,13233	
Legal & General Group									
PLC(+1)	-0,11136	0,006968	-0,02582	-0,00005	0,0328	289	1,0237116	-15,7958	
Legal & General Group PLC									
2017.01.17	0,007773	0,006968	-0,01468	-0,00005	0,0328	289	1,0099824	1,1100292	
Legal & General Group PLC									
2017.03.13	-0,00068	0,006968	0,003263	-0,00005	0,0328	289	1,0037949	-0,097789	
Old Mutual PLC(open)	-0,11964	0,00855	0,012209	0,00012	0,0357	289	1,0075537	-13,93996	
Old Mutual PLC(close)	-0,009	0,00855	-0,03197	0,00012	0,0357	289	1,0323011	-1,036072	
Old Mutual PLC(+1)	-0,0153	0,00855	-0,02582	0,00012	0,0357	289	1,0223128	-1,76927	
Old Mutual PLC 2017.01.17	0,024439	0,00855	-0,01468	0,00012	0,0357	289	1,0095927	2,8447256	
Old Mutual PLC 2017.03.13	0,006736	0,00855	0,003263	0,00012	0,0357	289	1,0037369	0,7863496	
St. James's Place PLC(open)	-0,31489	0,009772	0,012209	-0,00010	0,0308	289	1,0083792	-32,08981	
St. James's Place PLC(close)	-0,14205	0,009772	-0,03197	-0,00010	0,0308	289	1,0364326	-14,27845	
St. James's Place PLC(+1)	-0,05071	0,009772	-0,02582	-0,00010	0,0308	289	1,024943	-5,126007	
St. James's Place PLC									
2017.01.17	0,007344	0,009772	-0,01468	-0,00010	0,0308	289	1,0103585	0,7476397	
St. James's Place PLC									
2017.03.13	0,005675	0,009772	0,003263	-0,00010	0,0308	289	1,0038274	0,5796501	
LSE PLC(open)	-0,15319	0,009777	0,012209	0,00017	0,0467	290	1,0065518	-15,6169	
LSE PLC(close)	-0,06359	0,009777	-0,03197	0,00017	0,0467	290	1,0255646	-6,422559	
LSE PLC(+1)	-0,06707	0,009777	-0,02582	0,00017	0,0467	290	1,0179158	-6,799104	
LSE PLC 2017.01.17	0,011781	0,009777	-0,01468	0,00017	0,0467	290	1,008168	1,2000566	
LSE PLC 2017.03.13	-0,00454	0,009777	0,003263	0,00017	0,0467	290	1,0036531	-0,463355	
Standard Life PLC(open)	-0,16049	0,008582	0,012209	0,00010	0,0301	290	1,0083195	-18,62292	
Standard Life PLC(close)	-0,15717	0,008582	-0,03197	0,00010	0,0301	290	1,0376123	-17,97896	
Standard Life PLC(+1)	-0,03937	0,008582	-0,02582	0,00010	0,0301	290	1,0257739	-4,529822	
Standard Life PLC 2017.01.17	0,015064	0,008582	-0,01468	0,00010	0,0301	290	1,0107021	1,7459911	
Standard Life PLC 2017.03.13	-0,00335	0,008582	0,003263	0,00010	0,0301	290	1,0037807	-0,38953	
Schroders PLC(open)	-0,21487	0,007954	0,012209	-0,00010	0,0302	291	1,0084532	-26,90104	
Schroders PLC(close)	-0,09624	0,007954	-0,03197	-0,00010	0,0302	291	1,0370639	-11,88124	
Schroders PLC(+1)	-0,12382	0,007954	-0,02582	-0,00010	0,0302	291	1,0253461	-15,3734	
Schroders PLC 2017.01.17	0,014555	0,007954	-0,01468	-0,00010	0,0302	291	1,0104718	1,820336	
Schroders PLC 2017.03.13	-0,00051	0,007954	0,003263	-0,00010	0,0302	291	1,0038109	-0,063927	
3i Group PLC(open)	-0,04592	0,007965	0,012209	0,00014	0,0383	291	1,0072394	-5,744263	
3i Group PLC(close)	-0,06429	0,007965	-0,03197	0,00014	0,0383	291	1,030353	-7,951988	
3i Group PLC(+1)	-0,06495	0,007965	-0,02582	0,00014	0,0383	291	1,0210363	-8,070172	
3i Group PLC 2017.01.17	0,01052	0,007965	-0,01468	0,00014	0,0383	291	1,0091681	1,3147654	
3i Group PLC 2017.03.13	0,002898	0,007965	0,003263	0,00014	0,0383	291	1,0036911	0,3631802	
Hargreaves Lansdown(open)									
	-0,18087	0,012307	0,012209	0,00013	0,0303	291	1,0082515	-14,63598	
Hargreaves Lansdown(close)									
	-0,1375	0,012307	-0,03197	0,00013	0,0303	291	1,0374385	-10,96881	
Hargreaves Lansdown(+1)									
	-0,08288	0,012307	-0,02582	0,00013	0,0303	291	1,025666	-6,649975	
Hargreaves Lansdown									
2017.01.17	0,051497	0,012307	-0,01468	0,00013	0,0303	291	1,0106716	4,1622347	
Hargreaves Lansdown									
2017.03.13	-0,00263	0,012307	0,003263	0,00013	0,0303	291	1,0037604	-0,213352	

Note: Interim calculations needed for abnormal return standardization

Source: calculated and prepared by the author. Data retrieved from Yahoo Finance and London Stock Exchange, 2017.