THE IMPACT OF THE BREXIT REFERENDUM ON VARIOUS WORLD STOCK MARKETS

by

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ABSTRACT

JASLEEN ARORA. The Impact Of the Brexit Referendum On Various World Stock Markets. (Under the direction of DR. CRAIG A. DEPKEN, II)

The event study methodology is employed to analyze the impact of the British decision to leave the European Union on various stock market indexes, namely Australia - ALL ORDINARIES; Canada - S&P TSX Composite Index; India - BSE Sensex; New Zealand - S&P NZX 50; Singapore - Straits Times Index; Sri Lanka - CSE ALL; UK - FTSE 100 and USA - Dow Jones Industrial Average, for the period of 03/24/2016 to 09/23/2016. The aim is to analyze the effects of the Brexit referendum by considering symmetric and asymmetric models. The results from the symmetric model suggest that Australia, Canada and USA showed a significant impact of the referendum for the 1 day and 3 day event windows. On the contrary, India, New Zealand and Singapore showed a significant impact only on the day of the referendum. The evidence from the asymmetric model suggests that Australia, Singapore and Sri Lanka did not show any significant signs of an impact of the referendum. Moreover, Canada, India, New Zealand and UK realized a significant impact of the referendum during a 3 day window. The Brexit had a significant impact on USA for both the 3 day and the 7 day event windows.

Keywords: Asymmetric model, Brexit, Event study methodology, Event window, Symmetric model.

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CHAPTER 1: INTRODUCTION

For decades, the world economy has been largely following the path of globalization. There exists a spillover effect of a shock in one part of the world to others. Brexit was one such event in 2016 which came as a surprise to many. The generally optimistic tone struck by markets one day before the referendum suggested investors had largely discounted the chance of a win for the "Leave" campaign. That confidence quickly unraveled on 24th June, 2016 when UK voted to leave the European Union. The decision shook the world's economies as Britain redefined itself after 43 years of EU membership.

The main aim of this study is to use the event methodology to investigate the pricing behavior of various world stock markets, namely Australia, Canada, India, New Zealand, Singapore, Sri Lanka, UK, and USA, with reference to the Brexit referendum. The reason for selecting these countries is to analyze the short term impact on primarily the commonwealth nations with USA considered a neutral comparable. Impact of the referendum was quite direct and evident on the European markets but I wish to analyse the impact on these 7 commonwealth nations due to their strong historical, cultural and economic ties. Since the goal is to measure the immediate impact of the Brexit result, we choose relatively short windows of 1 day, 3 days, 7 days, 9 days and 15 days. The event windows are kept relatively short to avoid the impact of other factors following the Brexit shock that may affect stock market returns. The purpose of selecting different windows is to measure how returns behave closer to the referendum day and far from the referendum day.

In the aftermath of the referendum, global stock markets lost approximately $2 trillion in value on 24th June, 2016 and the shocking result of the referendum corresponded with many stock markets plummeting. The Australian benchmark index, All Ordinaries, finished 3.1 percent (165 points) lower at 5193 at the end of the referendum day, its lowest point since April. Canada's S&P TSX composite index was also down by 1.39 percent (195.76 points) at 13,935.62 just before midday as gains in the gold sector helped limit losses. FTSE (London's bench mark index) 100 fell 8.7 percent and the Dow Jones industrial average dropped by 3.39 percent (610 points) and suffered its worst drop in 10 months. The Indian market's benchmark Sensex plunged by 2.23 percent (604.51 points) to 26,397.71, its biggest single-day fall in nearly four months.

There is a perception that the stock market perceived the referendum result as negative news for the U.K in the near term at least, so the money withdrawn from the stock market was moved into traditional safe assets like gold, Japanese Yen, and government bonds. Informational efficiency has a vital part to explain the stock market's briskness to incorporate state-of-the-art information into prices.

When an unusual event occurs, it disrupts stock market stability, so there should be positive or negative abnormal returns attributable to the event. James Dolley (1933) documented the first event study in the financial literature. Thereafter, scholars have utilized this methodology to investigate the impact of macro and micro economic variables on the stock markets.

The remainder of this paper is as follows. The second section provides a review of the literature and some of the pertinent studies in the area of event methodology. The third section explains the research methodology adopted in the research. The fourth section analyzes the empirical results. The last section concludes the study.

CHAPTER 2: LITERATURE REVIEW

Eugene Fama (1970) proposed the efficient market hypothesis in which all available macro and micro economic information is reflected in security prices. Hence, future prices cannot be forecast on the basis of historical prices. Since asset prices move randomly, their prices cannot be predicted by market participants, restricting abnormal returns. The random walk theory assumes that stock price movements are independent so that there is no visible trend.

The event study methodology was pioneered by Ball and Brown (1968) and Fama et al. (1969) to examine the behavior of corporate stock and bond prices around specific events. The concept was then expanded to study various instances. Robin and Jessica (2014) define an event as an informational announcement of any kind whose occurrence is unexpected by the market. Empirical studies investigate the impact of certain events on trading volume, abnormal returns (stock returns), and the volatility of returns. If the reaction of stock prices to the new information is quick and unbiased then the market is said to be efficient as per the efficient market hypothesis. In other words, abnormal returns signal the reaction of the market to an unforeseen event.

Niederhoffer (1971) studies the short-window reaction of movements in the S&P 500 to world events. The study uses world events on the basis of the magnitude of headline size from the New York Times. He finds that the returns on normal days were less in absolute terms compared to the returns following world events. He concludes that the S&P 500 is noticeably influenced by world events.

Chan (1996) investigates the impact of political news on stock market volatility in Hong Kong. Two indices are used: Blue-Chip shares are proxied by the Hang

Seng Index, and China-related stocks are proxied by the Red-Chip Index. The results indicate that political news increases stock price volatility of both Blue-Chip and Red-Chip shares. Also, he finds that favorable (unfavorable) political news is correlated with positive (negative) returns for the Hang Seng Index. In contrast, political news, good or bad, does not affect the returns of the Red-Chip shares. A substitution effect explains the findings and Chan concludes that Red-Chip stocks can be considered a safe haven from political shocks for investors in Hong Kong.

Zach (2003) shows that the volatility of returns in the Israeli stock market's main index is greater following political events than the other days. Israel was investigated over the period 1993-1997 to test for effects of political events on stock returns. Additionally, the evidence suggests that the stock returns variability was due to the political events. Cross-listed stocks (Israeli and US listed) also exhibit similar behavior; however, stocks that are listed on American exchanges and which are considered Israeli exhibit a different behavior. An in depth investigation into the sources of the differences in behavior reveals that they are not explained by cross-sectional variation of assets or in location of sales.

Nimkhunthod (2007) investigates the Thai Stock Market in the context of thirty national political events. The results indicate that an election has a positive impact to the market in the long term. A coup exerts a temporary negative shock but boosts the market in the longer term. In the event of a riot, the market reacts more strongly to the latest one, May 1992, than the one in 1976, at the beginning of SET (Stock exchange of Thailand) trading. On comparing the magnitude of impact of these events, the result is consistent with the uncertain information hypothesis (UIH), confirming the likelihood of an overreaction to bad news and underreaction to goods news.

Bialkowski et al. (2008) investigate the impact of national elections on the stock markets of 27 OECD countries. A detailed explanation of the second moment of the index return distribution is investigated around the election dates. They find that for specific countries, investors are surprised by the outcome of an election; which is supported by a twofold increase in the index return variance during the week around an election. Moreover, the study also finds stronger reaction in markets with a shorter trading history.

Suleman (2012) splits political news into two broad categories: good news and bad news. He investigates the impact political news has on the stock market returns. An univariate asymmetric GARCH model is used to estimate the impact of political news on returns and volatility. Results show that good news has a positive impact on the returns of the Karachi Stock Exchange - KSE100 index and also decreases volatility. Bad political news leads to a decrease in returns and an increase in volatility. Moreover, he finds that bad news has double the effect on volatility than good news. He also finds that other sectors are affected by good and bad news in the same way as the KSE100 index. The results of sectors like oil and gas, financial, health care do not respond to good and bad political news in a statistically significant way, consistent with Suleman (2012).

Zainabu (2014) tries to establish the effect of the general elections on the returns of the stock market in Kenya in the period between 1997 and 2013. During this period, presidential, parliamentary, and civic elections were held and the outcomes are compared to previous general elections in which there were fewer political parties. The findings show that investors tend to include forward-looking expectations, implying that voters incorporate speculative expectations into their assessment of macroeconomic indicators. From the analysis, the stock market returns tend to be affected by the presence of election trends. The study recommends that investors carefully plan and carry out investments during and after general elections as the returns can be affected either positively or negatively during that period.

The current study has been undertaken to analyze the impact of the Brexit referendum in 24th June, 2016 on various stock markets: Australia- ALL ORDINARIES; Canada- S&P TSX Composite Index; India- BSE Sensex; New Zealand- S&P NZX 50; Singapore Straits times Index; Sri Lanka- CSE ALL; UK- FTSE 100; and USA- Dow Jones Industrial Average.

CHAPTER 3: RESEARCH METHODOLOGY

I am interested in investigating whether the Brexit has an impact on several stock markets and this study uses an exploratory approach due to limited theoretical and empirical contribution. The event study methodology has been conducted according to the procedure of Mackinlay (1997). The approach captures any abnormal (a significant deviation from average) value changes in an index prices and follows the notion that prices will immediately be reflected by an event (Fama, 1969). Moreover, the study has been undertaken to analyze the change in returns between pre and post period from event day (Bhagat et al., 1985).

There are six basic steps to complete an event study analysis:

1) Define the event date, estimation window and event window

2) Select the research sample

3) Estimate the returns

4) Choose a model

5) Hypothesis Testing

6) Expected Results

3.1 Event Definition

The most important target of an event study analysis is determining the research event. Moreover, the period of changes, which may occur because of the event, should be decided. Using a macroeconomic event as an example, the suitable economic event should be selected, such as promulgating laws. Then, the research period of the event study before and after the event should be fixed. After the research period selection, the training data and testing data should be decided based on the estimation window and the event window. In this paper, t=0 represents the day of the event (i.e. Brexit referendum outcome on June 24th, 2016), t=1, 2, 3. . . represent days after the event while t=. . . -3,-2,-1 represent days prior to the event. Five event windows have been considered in this paper viz. one day event window (t=0), three day event window (t = -1,0,1), seven day event window (t = -3,-2,-1,0,1,2,3), nine day event window(t = -4,-3,-2,-1,0,1,2,3,4) and fifteen day event window (t = -7,-6,-5,-4-,3,-2,-1,0,1,2,3,4,5,6,7).

3.2 Sample Selection

The daily closing prices of the stock indices of eight countries namely: Australia, Canada, India, New Zealand, Singapore, Sri Lanka, UK and USA from March 24th, 2016 to September 24th, 2016 were obtained from Yahoo Finance. The 3-month US treasury rate was used as a proxy for the risk-free rate of return. The normal rate of return, expected rate of return and abnormal rate of return were calculated for these countries. The number of calendar days within each sample period was the same for all eight countries; but, the total number of observations varied slightly, depending on the number of non-trading days within the period. I calculated the event period based on the index availability, but then omitted without replacement the dates where I found no matching control variable or when an index return is missing. If the event falls on a non-trading day in a country, the event window shifts to the available trading days.

3.3 Normal Rate of Return Calculation

The normal rate of return is the rate return of the testing period if the event did not occur. And the return comes from the training period data. There are four popular models used to calculate the normal rate of return:

Mean-adjusted return model

Market-adjusted return model

Market model

Constant return model

Practice indicates that the results from these four models differ when the sample size is quite small. However, the difference will become smaller and smaller with the improvement of the sample size, i.e. the results of these four models are almost the same when the sample size is large enough. Therefore, the larger the sample size the less accurately the results reflect the real effect of the event. Before calculating the normal rate of return, some preparation is required. First, the daily closing price of the stock market index is collected. Then the rate of market return is calculated as:

$$NR_{it} = \frac{P_{1it} - P_{0it}}{P_{0it}} * 100,$$

where NR_{it} = Rate of return on day t for stock index i which is within the estimation window;

P_{1it} = Adjusted closing stock price on day t for stock index i which is within the estimation window;

P_{0it} = Adjusted closing stock price on day t-1 for stock index i which is within the estimation window.

3.4 Estimate Expected Rate of Return

In this study, the 3 - month US treasury rate is assumed as the ER.

3.5 Estimate Abnormal Rate of Return

The abnormal rate of return equals the actual rate of return minus the expected rate of return and is calculated as follows:

$$AR = NR - ER$$

where AR = Abnormal Rate of Return;

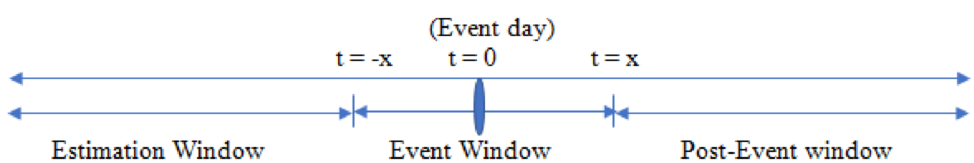
NR = Normal Rate of Return;

ER = Expected Rate of Return.

3.6 Choosing a model

The aim is to analyze the effects of the Brexit referendum by considering symmetric and asymmetric models. For the symmetric model, the effect during the event window is assumed to be same before and after the event. In the asymmetric model, impact of the event can differ before and after the event. The event window varies by length across the different models. All other days before the selected event window are considered a part of the estimation window. The aim of the event window is to measure the event's significance influence on the stock price, which would be indicated by an abnormal return rate during the event window. The estimation window is used to calculate the normal rate of return before the event. If the event didn't take place, the result of the estimation window should be treated as the expected rate of return.

a) Symmetric Model.



To check if there exists the abnormal rate of return due to the event, the following OLS regression is run:

$$AR_{it} = \beta_{0it} + \beta_{1it} D_1 + \epsilon_{it}$$

where AR_{it} = Abnormal rate of return for stock index i for a t day event window;

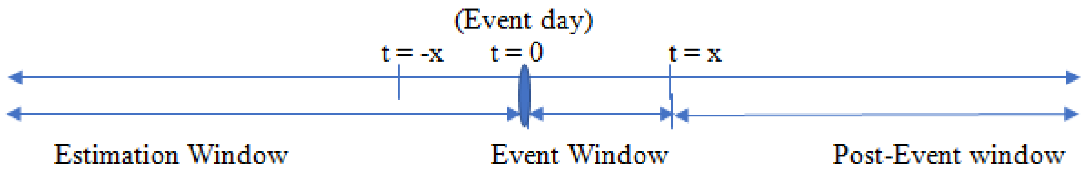
β_{0it} = Intercept term for stock index i for a t day event window;

β_{1it} = Parameter estimate for stock index i for a t day event window;

D_1 = Dummy variable equal to 1 for all days when $-x \leq t \leq x$ and, 0 otherwise;

ϵ_{it} = Stochastic error for stock index i for a t day event window.

b) Asymmetric Model.



To check if there is an effect on the abnormal rate of return due to the event, the following regression is run:

$$AR_{it} = \beta_{0it} + \beta_{1it}D_1 + \beta_{2it}D_2 + \epsilon_{it}$$

where AR_{it} = Abnormal rate of return for stock index i for a t day event window;

β_{0it} = Intercept term for stock index i for a t day event window;

β_{1it}, β_{2it} = Parameter estimates for stock index i for a t day event window;

D_1 = Dummy variable equal to 1 for all days when $-x \leq t < 0$ and, 0 otherwise;

D_2 = Dummy variable equal to 1 for all days when $0 \leq t \leq x$ and, 0 otherwise;

ϵ_{it} = Stochastic error for i stock index for a t day event window.

3.7 Hypotheses of the Study

A paired simple t-test is conducted on confidence interval 95% (alpha 5%). The hypotheses tested are as follows:

1) H0: $\beta_1 = 0$

H1: $\beta_1 \neq 0$

2) H0: There is no actual difference between the abnormal returns before the event and the after the event ($\beta_1 = \beta_2$).

H1: There is an actual difference between the abnormal returns before the event and the after the event ($\beta_1 \neq \beta_2$).

3.8 Expected Results

Australia shares historical and cultural ties with Britain. Over the past few decades, Australia has made stronger trade relation with Asia pacific region, having; China, Japan, South Korea and Singapore as its top trading partners. Thus, it is evident that Australia's economic and financial dependence on UK has diminished over the time. Therefore, a very little impact of the Brexit referendum is expected on Australian stock markets. Similarly, Canadian trade is just 2.5 percent of the total UK's trade. Hence, the impact of the Brexit referendum should be minimal. UK is amongst India's top 25 trading partners and the third largest investing destination. In short term, the brexit referendum is expected to negatively impact Indian markets, but due to the strong economic fundamentals and favorable domestic conditions, the negative impact is not long lasting.

In the short term, the Brexit referendum is not expected to have much impact on the New Zealand's economy due to the strong economic growth of 2.4 percent in March, 2016 and a well capitalized banking sector. But in the medium and long term, the effects can be more visible because of increasing dependence of UK on New Zealand's sheep meat and wine export. In the short term, Singapore's trade with UK can be disrupted which would hamper it's growth. Therefore, the brexit referendum is expected to have a negative impact on Singapore's market. Britain accounts for around 10 percent of exports of Sri Lanka and is the second largest export destination. Currently Sri Lankan trade position is not stable and the short term impact of the Brexit referendum is expected to be negative.

Briatin has been undergoing a significant amount of economic, political, and financial uncertainty due to Brexit. The impact of the referendum is expected to be adverse in the short run. The medium term and long term effects are uncertain and would depend upon it's negotiation with EU. The trade relation between US and UK is not very significant. Also, US economy is getting stronger and gaining momentum to support it's economic growth. Therefore, the impact of the Brexit referendum on US markets is expected to be minimal.

CHAPTER 4: RESULTS

4.1 Australia

The AR decreased greatly on the day of the event to -3.364% before increasing to 0.180% on the next day of the event. However, the change in actual rate of return for 3 day, 7 day, 9 day and 15 day window is -2.492%, -2.471%, -0.472% and 1.575% respectively. Moreover, the 6-month average AR is -0.221% and there is an increase in the before event mean and after event mean from -0.188% to -0.251% (Figure 4.1).

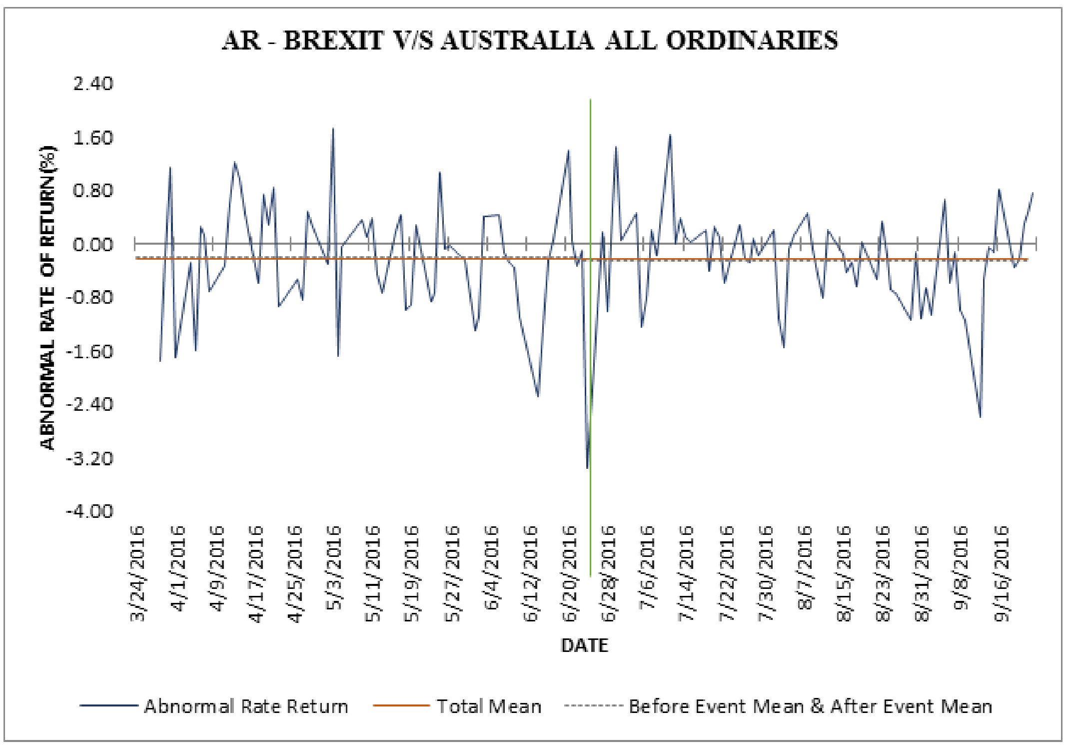


Figure 4.1: Plot of AR, total mean and before event mean & after event mean for the period of 03/24/2016 to 09/23/2016.

Table 4.1 reports a symmetric model for Australia-ALL ORDINARIES. It is evident from this table that AR is significant at that the day of the event and during the 3 day window. Hence we reject that null hypothesis of $\beta = 0$ at these two instances. Estimated regression equation for a 1 day window is as follows:

$$AR_t = -0.19655 - 3.16755D_1 + \epsilon_{it}$$

Estimated regression equation for a 3 day window is as follows:

$$AR_t = -0.20029 - 0.8975D_1 + \epsilon_{it}$$

This shows that when $D_1 = 1$ at the day of an event then the average abnormal returns are -0.19655 and when we increase the event window to 3 days (-1,0,+1) then the average AR becomes -1.097.

Table 4.1: Symmetric Model for Australia - ALL ORDINARIES.

Event window	**Variable**	**Parameter estimate**	**Standard error**	**t -value**	**p-value**
1 day	Intercept	-0.19655	0.06711	-2.93	0.004
	dummy	-3.16755	0.75627	-4.19	<.0001***
3 days	Intercept	-0.20029	0.07118	-2.81	0.0057
	dummy	-0.8975	0.46311	-1.94	0.0549*
7 days	Intercept	-0.20061	0.073	-2.75	0.0069
	dummy	-0.37867	0.31094	-1.22	0.2256
9 days	Intercept	-0.22813	0.07402	-3.08	0.0025
	dummy	0.09377	0.27805	0.34	0.7365
15 days	Intercept	-0.22097	0.07601	-2.91	0.0043
	dummy	-0.00439	0.22117	-0.02	0.9842

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance levels respectively.

Table 4.2 reports the asymmetric model for Australia-ALL ORDINARIES. The model represents the results for four event windows i.e. 3 day, 7day, 9 day and 15 day. For hypothesis testing results are postulated in the Appendix A. Since for all event windows, p - values are not significant, hence we fail to reject the null hypothesis of $\beta_1 = \beta_2$.

Table 4.2: Asymmetric Model for Australia - ALL ORDINARIES.

Event window	Variable	Parameter estimate	Standard error	t -value	p-value
3 days	Intercept	-0.20029	0.07079	-2.83	0.0054
	DV1	0.0904	0.7915	0.11	0.9093
	DV2	-1.39145	0.56191	-2.48	0.0146
7 days	Intercept	-0.20061	0.07281	-2.76	0.0067
	DV1	0.0709	0.46619	0.15	0.8794
	DV2	-0.71585	0.40537	-1.77	0.0799
9 days	Intercept	-0.22813	0.07382	-3.09	0.0025
	DV1	0.4817	0.40766	1.18	0.2396
	DV2	-0.21658	0.36612	-0.59	0.5552
15 days	Intercept	-0.22097	0.07615	-2.9	0.0044
	DV1	0.15956	0.31397	0.51	0.6122
	DV2	-0.14785	0.29492	-0.5	0.617

4.2 Canada

The AR is 0.601% one day before the event and then falls to -2.004% on the next day. However, the change in actual rate of return for 3 day, 7 day, 9 day and 15 day window is -2.242%, 0.174%, 0.352% and 2.209% respectively. Moreover, the 6-month average AR is -0.201% and there is a slight decrease in the before event mean and after event mean from -0.165% to -0.237% (Figure 4.2).

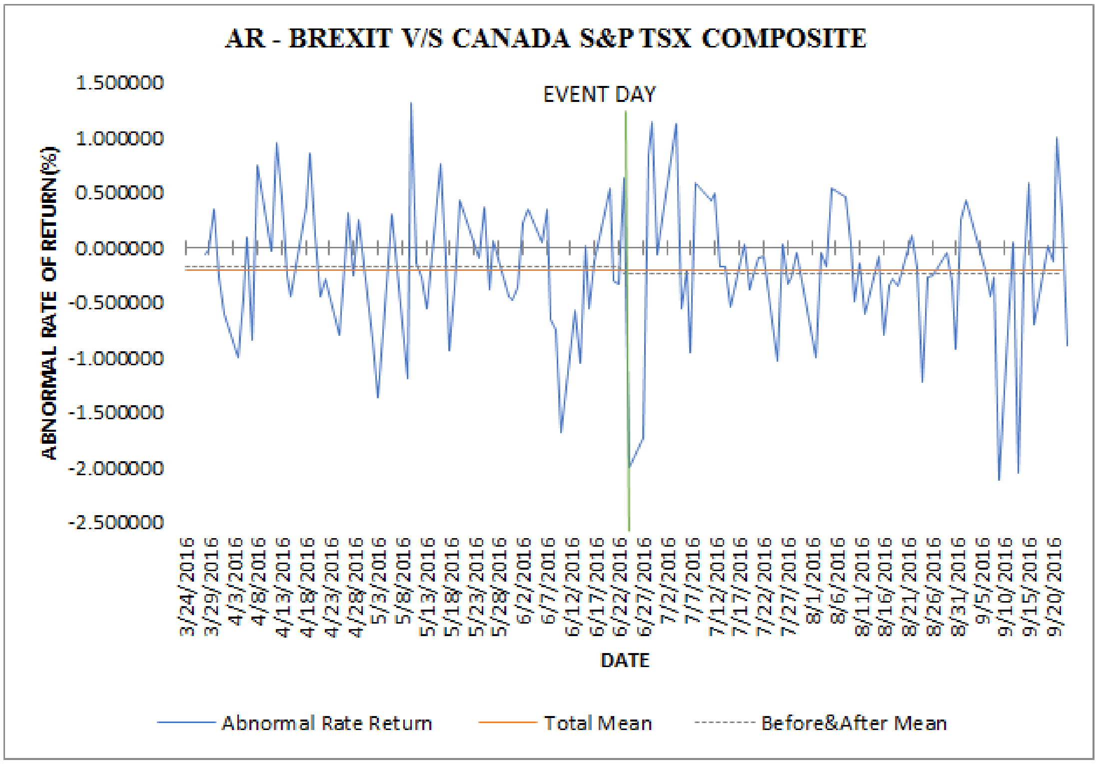


Figure 4.2: Plot of AR, total mean and before event mean & after event mean for the period of 03/24/2016 to 09/23/2016.

Table 4.4 reports the symmetric model for Canada - S&P TSX Composite Index. From this table it is evident that AR is significantly present for on the day of event and 3 day window due to the Brexit impact. Hence we reject the null hypothesis for these two windows. Estimated regression equation for a 1 day event window is as follows:

$$AR_t = -0.18731 - 1.81755D_1 + \epsilon_{it}$$

Estimated regression equation for a 3 day event window is as follows:

$$AR_t = -0.1815 - 0.84798D_1 + \epsilon_{it}$$

This shows that when $D_1 = 1$ at the day of an event then the average abnormal returns are -2.004 and when we increase the event window to 3 days then the average AR becomes -1.029.

Table 4.3: Symmetric Model for Canada - S&P TSX Composite Index.

Event window	**Variable**	**Parameter estimate**	**Standard error**	**t -value**	**p-value**
1 day	Intercept	-0.18731	0.05509	-3.4	0.0009
	dummy	-1.8175	0.61592	-2.95	0.0038**
3 days	Intercept	-0.1815	0.05624	-3.23	0.0016
	dummy	-0.84798	0.36301	-2.34	0.0211**
7 days	Intercept	-0.19915	0.05843	-3.41	0.0009
	dummy	-0.04809	0.2469	-0.19	0.8459
9 days	Intercept	-0.20675	0.05892	-3.51	0.0006
	dummy	0.06812	0.21957	0.31	0.7569
15 days	Intercept	-0.21526	0.06042	-3.56	0.0005
	dummy	0.11175	0.17443	0.64	0.5229

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance levels respectively.

Table 4.4 reports the asymmetric model for Canada - S&P TSX Composite Index. The model represents the results for four event windows i.e. 3 day, 7day, 9 day and 15 day. For a 3 day event window, there is significant actual difference between the abnormal returns before the event and the after the event. Hence we reject the null hypothesis for this window (See Appendix A).

Estimated regression equation for a 3 day event window is as follows:

$$AR_t = -0.1815 + 0.82268 D_1 - 1.68331 D_2 + \epsilon_{it}$$

This shows that when D1 = 1 then the average abnormal returns are 0.641. and when D2 = 1 the AAR decreases to -1.865. Since, β_2 - β_1 = -2.50598, therefore there is a net negative impact of the referendum.

Table 4.4: Asymmetric Model for Canada - S&P TSX Composite Index.

Event window	Variable	Parameter estimate	Standard error	t -value	p-value
1 day	Intercept	-0.1815	0.05392	-3.37	0.001
	DV1	0.82268	0.59799	1.38	0.1714
	DV2	-1.68331	0.42456	-3.96	0.0001
3 days					
	Intercept	-0.19915	0.05847	-3.41	0.0009
	DV1	0.20267	0.37134	0.55	0.5862
7 days	DV2	-0.23616	0.32292	-0.73	0.466
	Intercept	-0.20675	0.05882	-3.51	0.0006
9 days	DV1	0.34564	0.3222	1.07	0.2855
	DV2	-0.15389	0.28938	-0.53	0.5958
15 days	Intercept	-0.21526	0.06061	-3.55	0.0005
	DV1	0.19857	0.24779	0.8	0.4245
	DV2	0.03579	0.23278	0.15	0.8781

4.3 India

The AR is 0.573% one day before the event which then falls sharply to -2.509 on the day of the event. The change in actual rate of return for 3 day, 7 day, 9 day and 15 day window is -1.355%,-0.270%, 0.494% and 1.648% respectively. Moreover, the 6-month average AR is -0.203% and there is a slight decrease in the before event mean and after event mean from -0.125% to -0.203% (Figure 4.3).

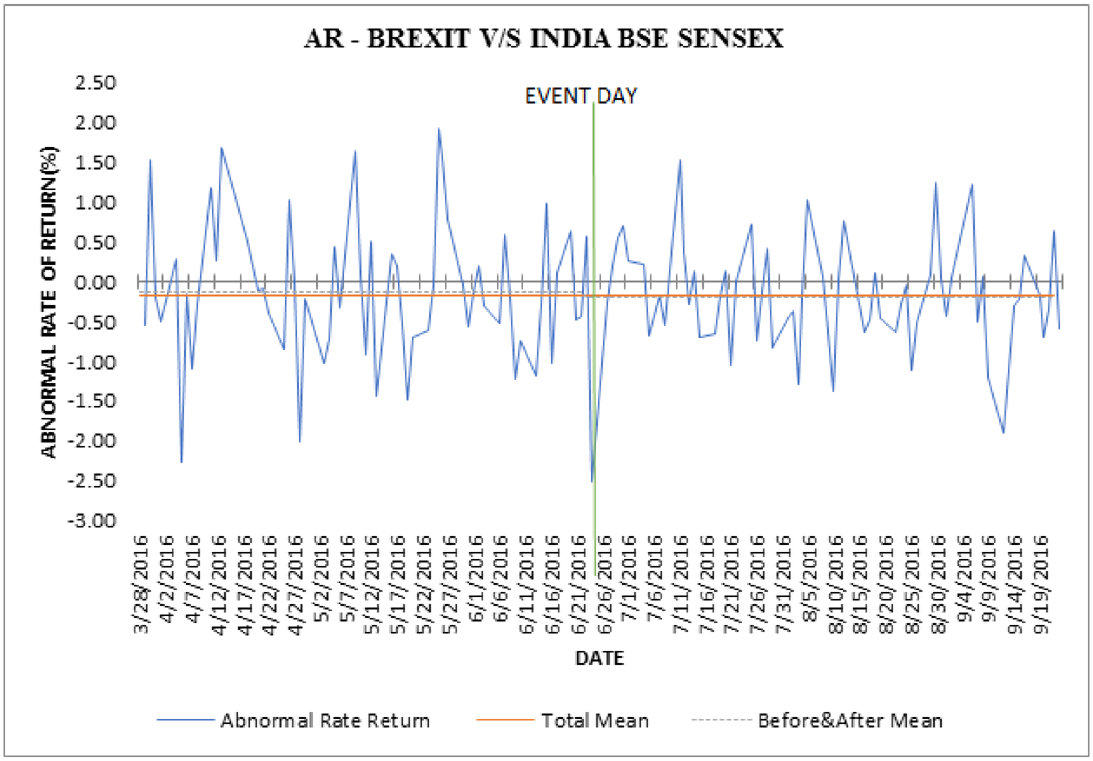


Figure 4.3: Plot of AR, total mean and before event mean & after event mean for the period of 03/24/2016 to 09/23/2016.

Table 4.5 reports a symmetric model for India - BSE Sensex. It can be seen from this table that we reject null hypothesis $\beta = 0$ for the one day window. Estimated regression equation for a 1 day event window is as follows:

$$AR_t = -0.14505 - 2.36369D_1 + \epsilon_{it}$$

With $D_1 = 1$ for the event day, there exists an Average abnormal returns of -2.509.

Table 4.5: Symmetric Model for India - BSE Sensex.

Event window	Variable	Parameter estimate	Standard error	t -value	p-value
1 day	Intercept	-0.14505	0.07014	-2.07	0.0408
	dummy	-2.36369	0.77475	-3.05	0.0028**
3 days	Intercept	-0.15021	0.07295	-2.06	0.0417
	dummy	-0.57812	0.46523	-1.24	0.2164
7 days	Intercept	-0.15402	0.07458	-2.07	0.0411
	dummy	-0.18141	0.31136	-0.58	0.5612
9 days	Intercept	-0.16856	0.07533	-2.24	0.0271
	dummy	0.056	0.27736	0.2	0.8403
15 days	Intercept	-0.1768	0.07736	-2.29	0.024
	dummy	0.10062	0.22063	0.46	0.6492

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance levels respectively.

Table 4.6 reports the asymmetric model for India - BSE Sensex. The model represents the results for four event windows i.e. 3 day, 7day, 9 day and 15 day. There is a significant impact of the event during a 3 day window. Therefore we reject the null hypothesis that there is no actual difference between the abnormal returns before the event and the after the event (See Appendix A) Estimated regression equation for a 3 day event window is as follows:

$$AR_t = -0.15021 + 0.72407D_1 - 1.22921D_2 + \epsilon_{it}$$

Since, β_2 - β_1 = -1.95328, there exists a net negative impact of the referendum. This shows that when $D_1 = 1$ then the average abnormal returns are 0.574. and when $D_2 = 1$ the AAR decreases to -1.379.

Table 4.6: Asymmetric Model for India - BSE Sensex.

Event window	**Variable**	**Parameter estimate**	**Standard error**	**t -value**	**p-value**
3 days	Intercept	-0.15021	0.07202	-2.09	0.0391
	DV1	0.72407	0.78897	0.92	0.3606
	DV2	-1.22921	0.56021	-2.19	0.0302
7 days	Intercept	-0.15402	0.07477	-2.06	0.0416
	DV1	0.03955	0.46893	0.08	0.9329
	DV2	-0.34713	0.40782	-0.85	0.3964
9 days	Intercept	-0.16856	0.07553	-2.23	0.0275
	DV1	0.239	0.40849	0.59	0.5596
	DV2	-0.0904	0.36692	-0.25	0.8058
15 days	Intercept	-0.1768	0.07758	-2.28	0.0244
	DV1	0.22843	0.31307	0.73	0.467
	DV2	-0.01122	0.29413	-0.04	0.9696

4.4 New Zealand

The AR for New Zealand'stock index was -2.561% on the day of the event and increased to 0.017% on the next day. However, the change in actual rate of return for 3 day, 7 day, 9 day and 15 day window is -1.398%, -0.515%, 0.407% and 1.477% respectively. Moreover, the 6-month average AR is -0.206% and there is a slight increase in the before event mean and after event mean from -0.220% to -0.192% (Figure 4.4).

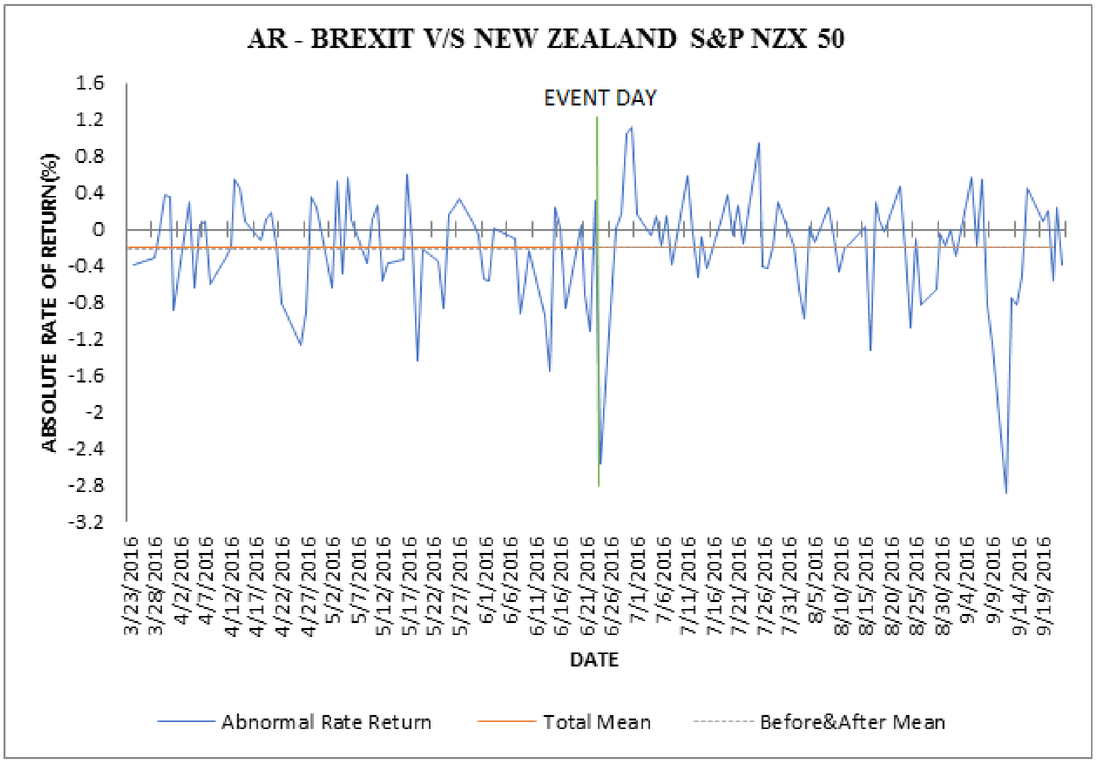


Figure 4.4: Plot of AR, total mean and before event mean & after event mean for the period of 03/24/2016 to 09/23/2016.

Table 4.7 reports a symmetric model for New Zealand - S&P NZX 50. It is evident from this table that AR of the New Zealand'index (p-value $<.0001$) is significant for a 1 day window and we reject the null hypothesis for one day window and the regression equation for the same is:

$$AR_t = -0.18745 - 2.37387D_1 + \epsilon_{it}$$

Table 4.7: Symmetric Model for New Zealand - S&P NZX 50.

Event window	Variable	Parameter estimate	Standard error	t –value	p-value
1 day	Intercept	-0.18745	0.04961	-3.78	0.0002
	dummy	-2.37387	0.56349	-4.21	<.0001***
3 days	Intercept	-0.19305	0.05286	-3.65	0.0004
	dummy	-0.55029	0.34665	-1.59	0.1149
7 days	Intercept	-0.19435	0.05408	-3.59	0.0005
	dummy	-0.2119	0.23214	-0.91	0.3631
9 days	Intercept	-0.20734	0.0547	-3.79	0.0002
	dummy	0.02133	0.20709	0.1	0.9181
15 days	Intercept	-0.21494	0.05607	-3.83	0.0002
	dummy	0.07813	0.16444	0.48	0.6355

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance levels respectively.

Table 4.8 reports the asymmetric model for New Zealand - S&P NZX 50. The model represents the results for four event windows i.e. 3 day, 7 day, 9 day and 15 day. There is a significant impact of the event during a 3 day window. Therefore we reject the null hypothesis that there is no actual difference between the abnormal returns before the event and the after the event (See Appendix A) Estimated regression equation for a 3 day event window is as follows:

$$AR_t = -0.19305 + 0.50712D_1 - 1.079D_2 + \epsilon_{it}$$

Since, β_2 - β_1 = -1.58612, there exists a net negative impact of the referendum.

Table 4.8: Asymmetric Model for New Zealand - S&P NZX 50.

Event window	Variable	Parameter estimate	Standard error	t –value	p-value
3 days	Intercept	-0.19305	0.05207	-3.71	0.0003
	DV1	0.50712	0.58677	0.86	0.3891
	DV2	-1.079	0.41654	-2.59	0.0107
7 days	Intercept	-0.19435	0.05426	-3.58	0.0005
	DV1	-0.31156	0.35024	-0.89	0.3754
	DV2	-0.13715	0.30453	-0.45	0.6532
9 days	Intercept	-0.20734	0.05478	-3.79	0.0002
	DV1	-0.15755	0.30499	-0.52	0.6064
	DV2	0.16443	0.27389	0.6	0.5493
15 days	Intercept	-0.21494	0.05609	-3.83	0.0002
	DV1	-0.08205	0.23319	-0.35	0.7255
	DV2	0.2183	0.21903	1	0.3208

4.5 Singapore

Singapore realized an AR of -0.032% one day prior to the event which decreased to -2.362% on the day of the event but which increased to -0.47% one day after the event. However, the change in actual rate of return for 3 day, 7 day, 9 day and 15 day window is -2.020%, 0.118%, 1.430% and 3.259% respectively. Moreover, the 6-month average AR is -0.270% and there is a marginal increase in the before event mean and after event mean from -0.283% to -0.256% (Figure 4.5).

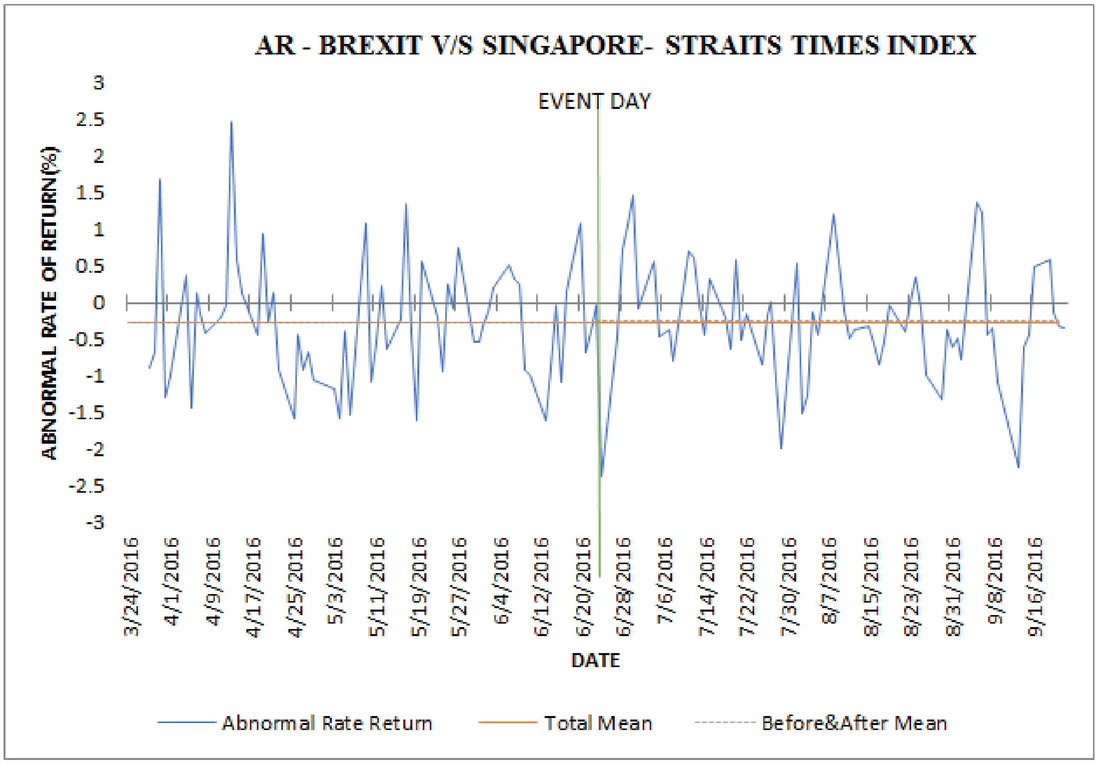


Figure 4.5: Plot of AR, total mean and before event mean & after event mean for the period of 03/24/2016 to 09/23/2016.

Table 4.9 reports a symmetric model for Singapore - Straits Times Index. It is evident from this table that AR of the Singapore'index is significant for a 1 day window and we reject the null hypothesis for one day window. Estimated regression equation for a 1 day event window:

$$AR_t = -0.25363 - 2.10882D_1 + \epsilon_{it}$$

This shows that when $D_1 = 1$ at the day of an event then the average abnormal returns are -2.362.

Table 4.9: Symmetric Model for Singapore - Straits Times Index.

Event window	**Variable**	**Parameter estimate**	**Standard error**	**t –value**	**p-value**
1 day	Intercept	-0.25363	0.07047	-3.6	0.0005
	dummy	-2.10882	0.79098	-2.67	0.0087***
3 days	Intercept	-0.25364	0.07239	-3.5	0.0006
	dummy	-0.70232	0.46916	-1.5	0.1369
7 days	Intercept	-0.26808	0.07426	-3.61	0.0004
	dummy	-0.04107	0.31505	-0.13	0.8965
9 days	Intercept	-0.29439	0.07446	-3.95	0.0001
	dummy	0.33628	0.2786	1.21	0.2297
15 days	Intercept	-0.30159	0.07646	-3.94	0.0001
	dummy	0.26227	0.22161	1.18	0.2389

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance levels respectively.

Table 4.10 reports the asymmetric model for Singapore. The model represents the results for four event windows i.e. 3 day, 7day, 9 day and 15 day. For hypothesis testing, t-values are postulated in the table with the respective p-values (See Appendix A). Since none of the event windows shows a significant result, therefore we fail to reject the null hypothesis $\beta_1 = \beta_2$.

Table 4.10: Asymmetric Model for Singapore - Straits Times Index.

Event window	Variable	Parameter estimate	Standard error	t –value	p-value
3 days	Intercept	-0.25364	0.0721	-3.52	0.0006
	DV1	0.22073	0.80291	0.27	0.7838
	DV2	-1.16385	0.57003	-2.04	0.0433
7 days	Intercept	-0.26808	0.07455	-3.6	0.0005
	DV1	-0.09847	0.47541	-0.21	0.8363
	DV2	0.00199	0.4134	0	0.9962
9 days	Intercept	-0.29439	0.07475	-3.94	0.0001
	DV1	0.28827	0.41114	0.7	0.4845
	DV2	0.37469	0.36925	1.01	0.3122
15 days	Intercept	-0.30159	0.0767	-3.93	0.0001
	DV1	0.15909	0.31493	0.51	0.6143
	DV2	0.35255	0.29584	1.19	0.2357

4.6 Sri Lanka

The AR is -0.624% one day prior to the event, and is -0.717% on the day of the event and marginally reduces to -1.085% one day post the event. The change in actual rate of return for 3 day, 7 day, 9 day and 15 day window is -1.598%, -2.420%, -2.753% and -3.388% respectively. Moreover, the 6-month average AR is -0.224% and there is a decrease in the before event mean and after event mean from -0.170% to -0.276% (Figure 4.6).

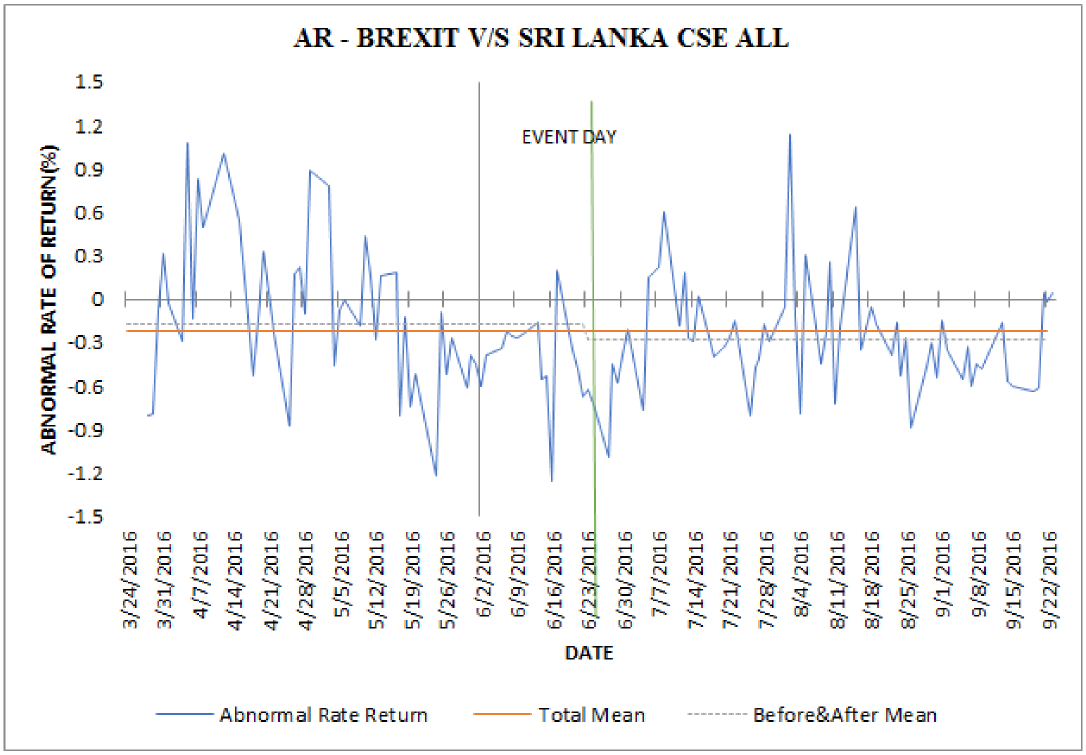


Figure 4.6: Plot of AR, total mean and before event mean & after event mean for the period of 03/24/2016 to 09/23/2016.

Table 4.11 reports a symmetric model for Sri Lanka - CSE ALL. It is evident from this table that event had a significant impact on Sri Lankan index for the 3 day, 7 day, 9 day and 15 day windows and the regression equation for the same are:

$$AR_t = -0.25363 - 2.10882D_1 + \epsilon_{it}$$

$$AR_t = -0.20901 - 0.59958D_1 + \epsilon_{it}$$

$$AR_t = -0.19711 - 0.4591D_1 + \epsilon_{it}$$

$$AR_t = -0.194 - 0.39822D_1 + \epsilon_{it}$$

$$AR_t = -0.18193 - 0.33471D_1 + \epsilon_{it}$$

Table 4.11: Symmetric Model for Sri Lanka - CSE ALL.

Event window	Variable	Parameter estimate	Standard error	t –value	p-value
1 day	Intercept	-0.21995	0.04153	-5.3	<.0001
	dummy	-0.49691	0.45299	-1.1	0.2749
3 days	Intercept	-0.20901	0.04117	-5.08	<.0001
	dummy	-0.59958	0.25927	-2.31	0.0225**
7 days	Intercept	-0.19711	0.04159	-4.74	<.0001
	dummy	-0.4591	0.17147	-2.68	0.0085***
9 days	Intercept	-0.194	0.04203	-4.62	<.0001
	dummy	-0.39822	0.15282	-2.61	0.0104**
15 days	Intercept	-0.18193	0.04308	-4.22	<.0001
	dummy	-0.33471	0.12134	-2.76	0.0067***

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance levels respectively.

Table 4.12 reports the asymmetric model for Sri Lanka - CSE ALL. The model represents the results for four event windows i.e. 3 day, 7day, 9 day and 15 day. We fail to reject the null hypothesis that There is no actual difference between the abnormal returns before the event and the after the event ($/beta_1 = /beta_2$) (See Appendix A)

Table 4.12: Asymmetric Model for Sri Lanka - CSE ALL.

Event window	**Variable**	**Parameter estimate**	**Standard error**	**t – value**	**p-value**
3 days	Intercept	-0.20901	0.0413	-5.06	<.0001
	DV1	-0.41515	0.4467	-0.93	0.3546
	DV2	-0.69179	0.31721	-2.18	0.0312
7 days	Intercept	-0.19711	0.04175	-4.72	<.0001
	DV1	-0.39592	0.25847	-1.53	0.1283
	DV2	-0.5065	0.22481	-2.25	0.0261
9 days	Intercept	-0.194	0.04218	-4.6	<.0001
	DV1	-0.3371	0.2252	-1.5	0.1371
	DV2	-0.44711	0.2023	-2.21	0.0291
15 days	Intercept	-0.18193	0.04326	-4.21	<.0001
	DV1	-0.34811	0.17228	-2.02	0.0456
	DV2	-0.32297	0.16188	-2	0.0484

4.7 United Kingdom

The AR is 0.948% on the day post the event and drops to -3.416 % on the day of the event. The change in actual rate of return for 3 day, 7 day, 9 day and 15 day window is -4.456%, 2.144%, 4.841% and 9.696% respectively. Moreover, the 6-month average AR is -0.177% and there is a slight increase in the before event mean and after event mean from -0.191% to -0.162% (Figure Graph:Graph 7).

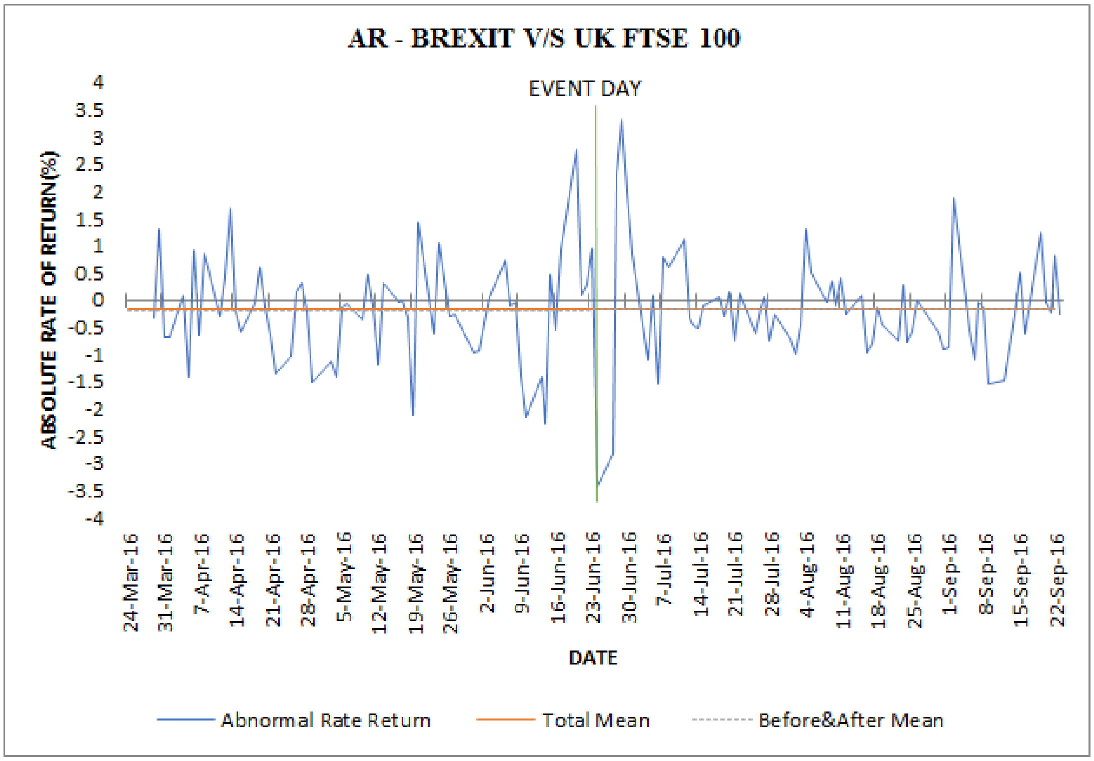


Figure 4.7: Plot of AR, total mean and before event mean & after event mean for the period of 03/24/2016 to 09/23/2016.

Table 4.13 reports a symmetric model for UK - FTSE100. It is evident from this table that we reject null hypothesis ($\beta = 0$) for 1 day, 3 day, 9 day and 15 day event windows.

$$AR_t = -0.15069 - 3.26552D_1 + \epsilon_{it}$$

$$AR_t = -0.13793 - 1.62443D_1 + \epsilon_{it}$$

$$AR_t = -0.23729 + 0.84959D_1 + \epsilon_{it}$$

$$AR_t = -0.25645 + 0.67071D_1 + \epsilon_{it}$$

Table 4.13: Symmetric Model for UK - FTSE.

Event window	Variable	Parameter estimate	Standard error	t –value	p-value
1 day	Intercept	-0.15069	0.08545	-1.76	0.0803
	dummy	-3.26552	0.95916	-3.4	0.0009***
3 days	Intercept	-0.13793	0.08722	-1.58	0.1163
	dummy	-1.62443	0.56524	-2.87	0.0048***
7 days	Intercept	-0.19317	0.09136	-2.11	0.0365
	dummy	0.2981	0.38761	0.77	0.4433
9 days	Intercept	-0.23729	0.09008	-2.63	0.0095
	dummy	0.84959	0.33704	2.52	0.013**
15 days	Intercept	-0.25645	0.09252	-2.77	0.0064
	dummy	0.67071	0.26814	2.5	0.0137**

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance levels respectively.

Table 4.14 reports the asymmetric model for UK - FTSE100. The model represents the results for four event windows i.e. 3 day, 7day, 9 day and 15 day. For hypothesis testing, t-values are postulated in the table with the respective p-values (see Appendix A). We reject the null hypothesis for 3 day event window. For 3 day event window, the equation of asymmetric model for UK is as follows:

$$AR_t = -0.13793 + 1.08629D_1 - 2.9798D_2 + \epsilon_{it}$$

Since, β_2 - β_1 = -4.06609, there exists a net negative impact of the referendum.

Table 4.14: Asymmetric Model for UK - FTSE.

Event window	Variable	Parameter estimate	Standard error	t –value	p-value
3 days	Intercept	-0.13793	0.08331	-1.66	0.1003
	DV1	1.08629	0.9277	1.17	0.2439
	DV2	-2.9798	0.65862	-4.52	<.0001
7 days	Intercept	-0.19317	0.09151	-2.11	0.0368
	DV1	0.63589	0.58355	1.09	0.278
	DV2	0.04476	0.50744	0.09	0.9299
9 days	Intercept	-0.23729	0.08997	-2.64	0.0094
	DV1	1.26379	0.49483	2.55	0.0119
	DV2	0.51824	0.44441	1.17	0.2458
15 days	Intercept	-0.25645	0.09245	-2.77	0.0064
	DV1	0.96353	0.37956	2.54	0.0124
	DV2	0.41448	0.35655	1.16	0.2473

4.8 United States of America

USA showed a decline in AR from 1.024% one the day before the event to -3.658% on the day of the event. The change in actual rate of return for 3 day, 7 day, 9 day and 15 day window is -3.603%, -0.757%, 0.703% and 1.578% respectively. Moreover, the 6-month average AR is -0.244% and there is a decrease in the before event mean and after event mean from -0.211% to -0.277% (Figure 4.8).

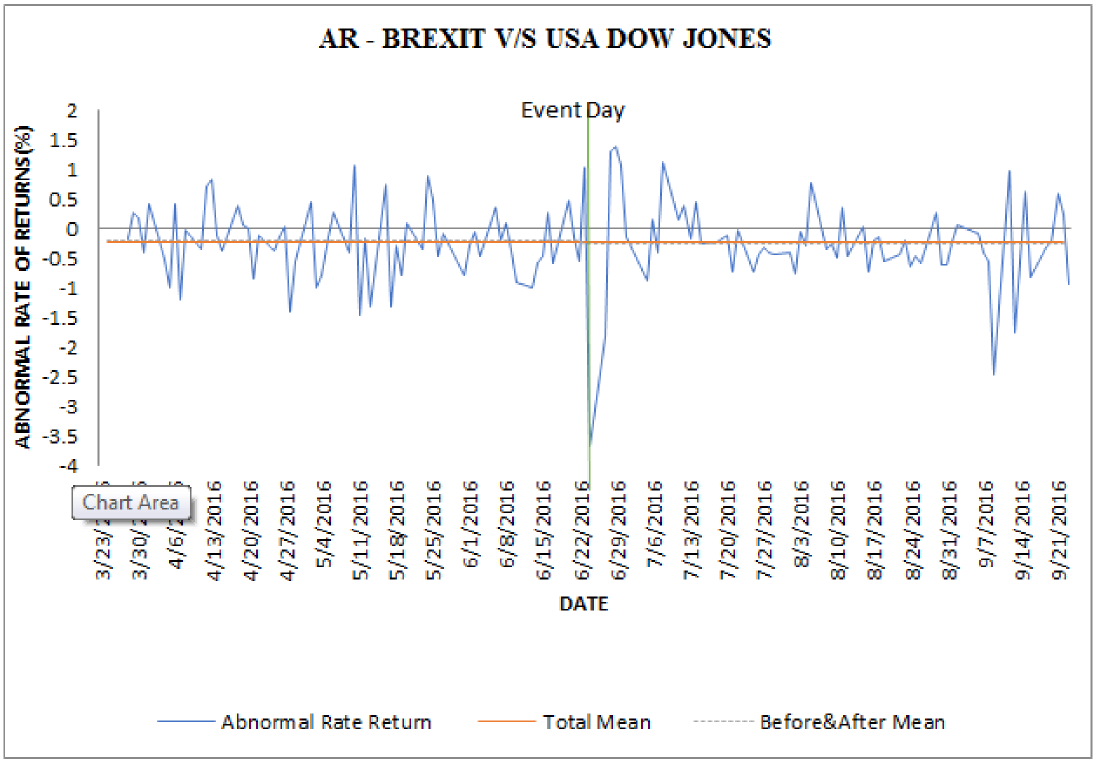


Figure 4.8: Plot of AR, total mean and before event mean & after event mean for the period of 03/24/2016 to 09/23/2016.

Table 4.15 reports a symmetric model for USA - Dow Jones. It is evident from this table that we reject null hypothesis ($\beta = 0$) for 1 day and 3 day event windows. and the regression equation for the same are:

$$AR_t = -0.21738 - 3.4412D_1 + \epsilon_{it}$$

$$AR_t = -0.21458 - 1.26569D_1 + \epsilon_{it}$$

Table 4.15: Symmetric Model for USA - Dow Jones.

Event window	Variable	Parameter estimate	Standard error	t –value	p-value
1 day	Intercept	-0.21738	0.0566	-3.84	0.0002
	dummy	-3.4412	0.63783	-5.4	<.0001***
3 days	Intercept	-0.21458	0.06091	-3.52	0.0006
	dummy	-1.26569	0.39632	-3.19	0.0018***
7 days	Intercept	-0.23827	0.06435	-3.7	0.0003
	dummy	-0.11265	0.27411	-0.41	0.6818
9 days	Intercept	-0.2553	0.06484	-3.94	0.0001
	dummy	0.15277	0.24356	0.63	0.5316
15 days	Intercept	-0.25419	0.06661	-3.82	0.0002
	dummy	0.08224	0.19381	0.42	0.6721

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance levels respectively.

Table 4.16 reports the asymmetric model for USA - Dow Jones. The model represents the results for four event windows i.e. 3 day, 7day, 9 day and 15 day. There is a significant impact of the event during a 3 day and 7 day event window (See Appendix A). Therefore we reject the null hypothesis that there is no actual difference between the abnormal returns before the event and the after the event for these two windows. Estimated regression equation for a 3 day event window is as follows:

$$AR_t = -0.21458 + 1.23946D_1 - 2.51827D_2 + \epsilon_{it}$$

Since, β_2 - β_1 = -3.7576, there exists a net negative impact of referendum for a 3 day event window..

Estimated regression equation for a 7 day event window is as follows:

$$AR_t = -0.23827 + 0.35169D_1 - 0.46091D_2 + \epsilon_{it}$$

Since, β_2 - β_1 = -0.1092, there exists a net negative impact of the referendum for a 7 day event window.

Table 4.16: Asymmetric Model for USA - Dow Jones.

Event window	**Variable**	**Parameter estimate**	**Standard error**	**t –value**	**p-value**
3 days	Intercept	-0.21458	0.05593	-3.84	0.0002
	DV1	1.23946	0.6253	1.98	0.0497
	DV2	-2.51827	0.44392	-5.67	<.0001
7 days	Intercept	-0.23827	0.06402	-3.72	0.0003
	DV1	0.35169	0.40993	0.86	0.3926
	DV2	-0.46091	0.35645	-1.29	0.1984
9 days	Intercept	-0.2553	0.06475	-3.94	0.0001
	DV1	0.45633	0.35759	1.28	0.2043
	DV2	-0.09007	0.32114	-0.28	0.7796
15 days	Intercept	-0.25419	0.06666	-3.81	0.0002
	DV1	0.25535	0.27486	0.93	0.3547
	DV2	-0.06924	0.25819	-0.27	0.789

CHAPTER 5: CONCLUSION

The core objective of the study was to analyze the impact of the British decision to leave the European Union on various world stock market indexes, namely Australia - ALL ORDINARIES; Canada - S&P TSX Composite Index; India - BSE Sensex; New Zealand - S&P NZX 50; Singapore - Straits Times Index; Sri Lanka - CSE ALL; UK - FTSE 100; and USA - Dow Jones Industrial Average for the period of 03/24/2016 to 09/23/2016. An event study methodology was employed to estimate whether the abnormal returns varied just before or just after the referendum. For the purpose of the study, the Brexit referendum is the event date (t = 0). The 1 day, 3 days, 7 days, 9 days, and 15 days enclosing the referendum (i.e., t = -1,0,+1), (-3 . . .,0,. . .+3), (-4. . .,0,. . .+4), (-7. . .,0,. . .+7) are the various event windows investigated.

The variation in the abnormal rate of returns is graphically analyzed for stock market indices of the eight countries. Also a symmetric and an asymmetric analysis is conducted for each country's stock market index with different event windows to test if there is any significant impact of the Brexit referendum on any of the stock markets under study. Table 5.1 and table 5.2 reports the overall results for symmetric and an asymmetric model, respectively.

Table 5.1: Results for Symmetric Model.

Country \ Event Window	1 day	3 days	7 days	9 days	15 days
Australia	Yes	Yes	No	No	No
Canada	Yes	Yes	No	No	No
India	Yes	No	No	No	No
New Zealand	Yes	No	No	No	No
Singapore	Yes	No	No	No	No
Sri Lanka	No	Yes	Yes	Yes	Yes
UK	Yes	Yes	No	Yes	Yes
USA	Yes	Yes	No	No	No

Yes indicates a significant impact of the Brexit referendum.
No indicates there is no significant impact of the Brexit referendum.

Table 5.2: Results for Asymmetric Model.

Country \ Event Window	3 days	7 days	9 days	15 days
Australia	No	No	No	No
Canada	Yes	No	No	No
India	Yes	No	No	No
New Zealand	Yes	No	No	No
Singapore	No	No	No	No
Sri Lanka	No	No	No	No
UK	Yes	No	No	No
USA	Yes	Yes	No	No

Yes indicates a significant impact of the Brexit referendum.
No indicates there is no significant impact of the Brexit referendum.

The evidence suggest that the AR for Australia decreased greatly on the day of the referendum to -3.36% before it jumped back to 0.18% on the referendum day. For Canada, the AR was 0.64% one day before the referendum and then collapsed to -2.00% the next day. A similar trend was observed for India and New Zealand where the AR was 0.57% and 0.31% one day before the referendum and then felt to -2.50% and -2.56% respectively on the next day. On the contrary, Singapore realized a slight decrease in the AR from -0.03% to -2.36% on the day of the referendum, but which fell to -0.47% one day after the referendum. Sri Lanka saw a marginal change in the

AR before and after the referendum. The UK and USA showed a decent decline in the AR from 0.94% one day before the referendum to -3.41% on the day of the referendum and from 1.02% one day before the referendum to -3.65 % on the referendum day, respectively.

From the symmetric model we can conclude that Australia, Canada and USA showed a significant impact of the referendum for the 1 day and 3 day event windows. On contrary India, New Zealand and Singapore showed a significant impact only on the day of the referendum. Sri Lanka showed significant impact for 3 day, 7 day, 9 day and 15 day event windows and UK showed a significant impact for 1 day, 3 day, 9 day and 15 day event windows.

From the asymmetric model, Australia, Singapore and Sri Lanka did not show any significant signs of an impact of the referendum. Moreover Canada, India, New Zealand and UK realized a significant impact of the referendum during a 3 day window. Brexit had a significant impact on USA for 3 day and 7 day windows as the null hypothesis stating no difference in AR in pre and post referendum was rejected. Furthermore, the parameter estimates show that as the event window increases in size the values of AR tend to become similar before and after the referendum.

The analyzed results are mostly in conjecture with the expected results. For asymmetric model, Australia as expected did not show significant impact of the brexit referendum due to it's declined dependence on Britain in the past few years. On the other hand, Singapore and Sri Lanka as opposing to the expected results did not show significant impact of the referendum. They were expected to at-least show some negative shock in the short run. Moreover, Canada, India and UK realized a negative impact on a 3 day event window and this is well aligned with the expected results. On the contrary, US realized a negative impact of the referendum on 3 day and 7 day window which is not aligned with the expected results but since the event windows are really small, therefore this is a very short lived impact.

This study investigates the immediate impact of the Brexit referendum on the seven commonwealth nations to analyse if the historical and culture dependence still realises a significant impact of the shock in one country to another. The results shows a picture of a changing momentum wherein the commenwealth nations might not be as dependent on Britain as they were back then. Also, the impact of the referendum is a short term shock to some of these nations which shows that as time passed the effect of the referendum on the stock indices dissipated. There is a possibility that investors may form a self-control (Lin, 2011) mechanism in order to prevent loss expansion during the crisis period. Moreover due to high uncertainty of an event like Brexit, investors become cautious and the impacts on the stock markets are short lived.

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APPENDIX A: HYPOTHESIS TESTING RESULTS

Hypothesis Test for the asymmetric model: Australia					
Event Window	**Source**	**DF**	**Mean Square**	**F-value**	**p-value**
3 days	Numerator	1	1.46391	2.36	0.1274
	Denominator	124	0.62146		
7 days	Numerator	1	1.06111	1.67	0.1989
	Denominator	124	0.63609		
9 days	Numerator	1	1.08353	1.69	0.1966
	Denominator	124	0.64297		
15 days	Numerator	1	0.35279	0.54	0.4625
	Denominator	124	0.64945		

Hypothesis Test for the asymmetric model: Canada					
Event Window	**Source**	**DF**	**Mean Square**	**F-value**	**p-value**
3 days	Numerator	1	4.18667	11.8	0.0008
	Denominator	122	0.35469		
7 days	Numerator	1	0.33013	0.82	0.3675
	Denominator	122	0.40343		
9 days	Numerator	1	0.55451	1.38	0.2421
	Denominator	122	0.4014		
15 days	Numerator	1	0.09892	0.24	0.6217
	Denominator	122	0.4041		

Hypothesis Test for the asymmetric model: India					
Event Window	**Source**	**DF**	**Mean Square**	**F-value**	**p-value**
3 days	Numerator	1	2.54355	4.12	0.0446
	Denominator	119	0.61729		
7 days	Numerator	1	0.25632	0.4	0.529
	Denominator	119	0.6429		
9 days	Numerator	1	0.24111	0.37	0.542
	Denominator	119	0.64464		
15 days	Numerator	1	0.21441	0.33	0.565
	Denominator	119	0.64396		

Hypothesis Test for the asymmetric model: New Zealand					
Event Window	**Source**	**DF**	**Mean Square**	**F-value**	**p-value**
3 days	Numerator	1	1.67719	4.91	0.0285
	Denominator	126	0.34159		
7 days	Numerator	1	0.05214	0.15	0.7038
	Denominator	126	0.35917		
9 days	Numerator	1	0.23039	0.64	0.4253
	Denominator	126	0.36008		
15 days	Numerator	1	0.33678	0.94	0.3344
	Denominator	126	0.35863		

Hypothesis Test for the asymmetric model: Singapore					
Event Window	**Source**	**DF**	**Mean Square**	**F-value**	**p-value**
3 days	Numerator	1	1.27804	2	0.16
	Denominator	123	0.63947		
7 days	Numerator	1	0.0173	0.03	0.8718
	Denominator	123	0.66137		
9 days	Numerator	1	0.0166	0.03	0.8737
	Denominator	123	0.65379		
15 days	Numerator	1	0.13972	0.21	0.6445
	Denominator	123	0.65308		

Hypothesis Test for the asymmetric model: Sri Lanka					
Event Window	**Source**	**DF**	**Mean Square**	**F-value**	**p-value**
3 days	Numerator	1	0.05102	0.26	0.6125
	Denominator	116	0.19784		
7 days	Numerator	1	0.02096	0.11	0.7437
	Denominator	116	0.19519		
9 days	Numerator	1	0.02689	0.14	0.7116
	Denominator	116	0.19573		
15 days	Numerator	1	0.00236	0.01	0.9125
	Denominator	116	0.19466		

Hypothesis Test for the asymmetric model: UK					
Event Window	**Source**	**DF**	**Mean Square**	**F-value**	**p-value**
3 days	Numerator	1	11.02204	12.91	0.0005
	Denominator	123	0.85368		
7 days	Numerator	1	0.59904	0.6	0.4396
	Denominator	123	0.99647		
9 days	Numerator	1	1.23521	1.3	0.2556
	Denominator	123	0.94703		
15 days	Numerator	1	1.12543	1.19	0.2782
	Denominator	123	0.94864		

Hypothesis Test for the asymmetric model: USA					
Event Window	**Source**	**DF**	**Mean Square**	**F-value**	**p-value**
3 days	Numerator	1	9.41369	24.27	<.0001
	Denominator	124	0.38787		
7 days	Numerator	1	9.41369	24.27	<.0001
	Denominator	124	0.38787		
9 days	Numerator	1	0.66345	1.34	0.2491
	Denominator	124	0.49471		
15 days	Numerator	1	0.39335	0.79	0.3757