

**Event Study Analysis of**

**Share Price and Stock Market Index Data**

**Lihuang Tong**

**September 2010**

**Dissertation submitted in partial fulfilment for the degree of**

**Master of Science in Computing for Financial Markets**

**Department of Computing Science and Mathematics**

**University of Stirling**

## **Abstract**

This dissertation is evaluated together with the MSc project as partial fulfilment for the degree of Master of Science in Computing for Financial Markets. Event study is widely used in finance to evaluate the influence of an event on the value of a firm, but it takes much time and involves repetitions of copying and pasting to run the data analysis by using EXCEL. Another drawback is the high frequency of errors when workload is huge. Also there are several choices of commercial software, but the user has to buy the membership and sometimes the complicated interfaces are not suitable for the new user. In response to these problems, this MSc project is to generate a Java application to automate the event study data analysis process in order to offer convenience to the user. In addition to providing share price and market index patterns, this software also gives accurate calculation of needed data. This dissertation aims to analyze the MSc project software by comparing it with two similar types of paid commercial software available online.

The main chapters are to expound the Methodology of event study analysis and all the aspects of this MSc project software. Detailed discussions of design and implementation phases together with testing and debugging will be made after the introduction of the methodology.

This software has been implemented by using Java, a programming language that can provide user-friendly interface, object-oriented and independent platform that can be run on almost all kinds of operating systems.

In the testing chapter, it has been found that this user-friendly purpose generated software can successfully achieve its primary goals. What has been delivered finally is a user-oriented auto-calculation software whose data process of event study is quite efficient.

## **Attestation**

I understand the nature of plagiarism, and I am aware of the University's policy on this

I certify that this dissertation reports original work by me during my University project except for the following (*adjust according to the circumstances*):

- Event study in finance in Section 2 definition is taken from [2]
- Ways of doing event study in Section 2.2 the market model assertion is taken from [6]
- Event study time line in Section 2.2 reference is taken from [8].
- Introduction of Eventus in Section 3.2 introduction is taken from [10]
- Support output file in Section 3.2.1 function is taken from [11]

**Signature**

(you must sign and date this page)

**Date**

## Acknowledgements

This MSc project is a three-month fruitful result and it is based on one year hard working with Computing for Financial Markets Postgraduate Course in University of Stirling. I would like to take this chance to appreciate all the people who have given me help.

I would like to appreciate all the faculty of Computing Science and Mathematics for imparting various kinds of useful knowledge and giving great help to me over this academic year. Specifically, I would like to extend my heartfelt thanks to Dr. Mario Kolberg, supervisor of this MSc project, whose suggestions and directions are inspiring and enlightening. I would also like to show my gratitude to Dr. Simon Jones and Dr. David Cairns since it was their detailed instruction on Java programming that helped me to conquer so many difficulties before I ultimately produced this piece of software. My appreciation will also be expressed to Dr. Kevin Campbell. Without those precious data and suggestions he provided for me, I would not have been able to conduct the software testing so successfully.

# Table of Contents

Abstract.....	i
Attestation.....	ii
Acknowledgements.....	iii
Table of Contents .....	iv
List of Figures.....	vi
1.1    Background and Context.....	1
1.2    Scope and Objectives.....	1
1.3    Achievements.....	2
1.4    Overview of Dissertation .....	2
2.1    Ways of doing event study analysis .....	4
2.2    Event study time line.....	5
2.3    Getting Parameter Estimates .....	5
2.4    Getting the Abnormal Returns .....	6
2.5    Significance Test .....	7
2.6    Typical Sequence of doing Event Study Analysis.....	7
2.6.1    Steps of doing Event Study .....	7
2.6.2    Sequence of doing Event Study in EXCEL .....	7
3.1    Event Study in EXCEL .....	11
3.2    Introduction of Eventus® 9.0.....	11
3.2.1    Support Output File.....	12
3.2.2    Calendar-Time Event Study Analysis .....	12
3.2.3    Retrieve Data from CRSP Database .....	13
3.2.4    Programming language .....	13
3.2.5    Drawbacks.....	14
3.3    Introduction of Stata.....	14
3.3.1    Advantages.....	15
3.3.2    Drawbacks.....	16
3.4    Conclusion .....	16
4.1    Preparing for Design .....	18
4.2    Ideas for Design .....	19
4.2.1    Brief Framework.....	19
4.2.2    Platform Selection.....	19
4.2.3    Programming Language.....	19
4.2.4    Detail Functions .....	20

4.2.4.1	Retrieving Data .....	20
4.2.4.2	Reading Data.....	20
4.2.4.3	Displaying Chart .....	21
4.2.4.4	Required Data Generation.....	21
4.2.4.5	Significance Test .....	21
4.2.5	Design of GUI.....	21
4.3	Internal Structure.....	23
5.1	GUI and Main Class.....	25
5.2	Import File.....	26
5.3	File Reading .....	27
5.4	Display Pattern Function.....	28
5.5	Regression and Calculation.....	31
5.6	Refreshable.....	34
6.1	General Result Comparison .....	35
6.2	Detail Result Comparison .....	37
7.1	Evaluation .....	42
7.2	Future improvement .....	42
7.3	Final Summary .....	43
References.....		44
Bibliography .....		46
Appendix 1.....		47
Appendix 2 – User guide .....		60
Questionnaire and potential user trial report.....		64

# List of Figures

Figure 1.	Event study time line.....	5
Figure 2.	Getting Alpha and Beta .....	6
Figure 3.	Getting Expected Return .....	6
Figure 4.	Getting Abnormal Return.....	6
Figure 5.	First step in EXCEL.....	8
Figure 6.	Second Step in EXCEL .....	9
Figure 7.	Third step in EXCEL .....	9
Figure 8.	Fourth step in EXCEL.....	10
Figure 9.	Fifth step in EXCEL.....	10
Figure 10.	Eventus Interface.....	12
Figure 11.	Stata Interface.....	14
Figure 12.	Stata Graphic Function 1 .....	15
Figure 13.	Stata Graphic Function 2 .....	15
Figure 14.	Stata Graphic Function 3 .....	16
Figure 15.	Original draft interface on workbook.....	22
Figure 16.	Internal Structure.....	23
Figure 17.	Project Software Interface .....	25
Figure 18.	File Chooser Window.....	26
Figure 19.	File to be input .....	27
Figure 20.	Import and display the share price .....	29
Figure 21.	Import and display the market index.....	29
Figure 22.	Enlarge and shrink the price charts .....	30
Figure 23.	CAR over Event Period.....	31
Figure 24.	Text Fields for inputting the required values.....	32
Figure 25.	Results being carried out.....	32
Figure 26.	Detail results of the Market Model .....	33
Figure 27.	Detail results of the Zero-One Model .....	33
Figure 28.	Detail results of the Mean-Adjusted Model .....	34
Figure 29.	Detail result for the Market Model produced by this software .....	38
	(Lengths of positive and negative periods are both15 days and estimation period is 60 days.) .....	38
Figure 30.	Detail result for the Market Model produced by EXCEL .....	39
Figure 31.	Detail result for the Zero-One Model produced by this software .....	39
Figure 32.	Detail result for the Zero-One Model produced by EXCEL .....	40
Figure 33.	Detail result for the Mean-Adjusted Model produced by this software .....	40

Figure 34.	Detail result for the Mean-Adjusted Model produced by EXCEL.....	41
Figure 35.	BOC general results by software.....	47
Figure 36.	BOC general results by EXCEL.....	47
Figure 37.	COURTAULDS PLC general results by software .....	47
Figure 38.	COURTAULDS PLC general results by EXCEL .....	48
Figure 39.	ICI IMPERIAL CHEMICAL INDUSTRIES PLC general results by software.....	48
Figure 40.	ICI IMPERIAL CHEMICAL INDUSTRIES PLC general results by EXCEL.....	48
Figure 41.	LAPORTE PLC general results by software.....	48
Figure 42.	LAPORTE PLC general results by EXCEL.....	49
Figure 43.	YULE CATTO & CO PLC general results by software .....	49
Figure 44.	YULE CATTO & CO PLC general results by EXCEL .....	49
Figure 45.	BOC the Market Model detail results by software.....	50
Figure 46.	BOC the Market Model detail results by EXCEL.....	50
Figure 47.	BOC the Zero-One Model detail results by software.....	51
Figure 48.	BOC the Zero-One Model detail results by EXCEL.....	51
Figure 49.	COURTAULDS PLC the Market Model detail results by software .....	51
Figure 50.	COURTAULDS PLC the Market Model detail results by EXCEL .....	52
Figure 51.	COURTAULDS PLC the Zero-One Model detail results by software .....	52
Figure 52.	COURTAULDS PLC the Zero-One Model detail results by EXCEL .....	53
Figure 53.	ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Market Model detail results by software	53
Figure 54.	ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Market Model detail results by EXCEL	54
Figure 55.	ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Zero-One Model detail results by software.....	54
Figure 56.	ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Zero-One Model detail results by EXCEL.....	55
Figure 57.	LAPORTE PLC the Market Model detail results by software .....	56
Figure 58.	LAPORTE PLC the Market Model detail results by EXCEL .....	56
Figure 59.	LAPORTE PLC the Zero-One Model detail results by software .....	56
Figure 60.	LAPORTE PLC the Zero-One Model detail results by EXCEL .....	57
Figure 61.	YULE CATTO & CO PLC the Market Model detail results by software.....	58
Figure 62.	YULE CATTO & CO PLC the Market Model detail results by EXCEL .....	58
Figure 63.	YULE CATTO & CO PLC the Zero-One Model detail results by software.....	58
Figure 64.	YULE CATTO & CO PLC the Zero-One Model detail results by EXCEL .....	59
Figure 65.	Interface of AutoCalculation .....	61
Figure 66.	Display Pattern in General Result Panel .....	62

Figure 67. CAR chart panel.....	62
---------------------------------	----

# **1 Introduction**

Auto-calculation is a piece of event study data analysis software, whose role is to automate the event study data analysis process in order to offer convenience to the user. Firstly, the user downloads historic price files of both individual security and market index from Yahoo Finance website. Then the software reads through both data files and calculates the needed results by using a built-in return generating model. The aim of this software is to give aid and convenience to users of event study analysis.

## **1.1 Background and Context**

McWilliams and Siegel define event study as 'a statistical method to assess the impact of an event on the value of a firm' [1]. For example, a takeover, a dividend payment or an announcement of a merger may have influence on a company's share price. These events can be analysed afterwards to see whether they increase or decrease the value of the firm so that better prediction can be made when the similar event happens next time. This is why event study analysis has become increasingly popular with analysts in recent years. Fundamentally, analysts use statistical method to find whether there is an abnormal return caused by an event.

EXCEL is a popular way for doing event study analysis, but it involves lots of copying and pasting to run the data analysis—a time consuming process with high frequency of errors. The idea for building this event study analysis software is to meet the demand of efficiently dealing with the event study data analysis process with no error. The software will calculate the Alpha and Beta of the return generating model together with the Cumulative Abnormal Return, Average Abnormal Return and Significance Test results based on the pre-settings of the user, who can get his/her needed result data to aid further event analysis just within a few clicks.

## **1.2 Scope and Objectives**

The objective of this MSc project is to generate a well-designed Java application with a user-friendly GUI to automate the event study data analysis process so that convenience can be provided for the user who has to undertake a heavy workload of event study analysis. There are many other types of paid professional software for doing event study, but this project software is free and will be available for all people who have interest in it. Although, compared with other types of professional applications, this two-month "Auto-Calculation" application can only be regarded as a prototype and it has many pitfalls that shall be improved later, it has been designed based on both the designer's and the user's views so as to fulfil the basic demand of doing event study analysis and to achieve its primary objectives successfully.

Briefly, the scope of this application encompasses a well organized GUI, reading traditional historic price file downloaded from Yahoo Finance, storing those data in files and displaying share price and market index charts as well as calculating needed result data. Coding details will be discussed in later chapters.

### **1.3 Achievements**

With all efforts made over the two-month program-development phase, several challenging problems have been overcome and a piece of easy-to-use event software has been produced. The software, which has a user-friendly GUI, can generate results needed to make further event analysis. In terms of programming techniques, the project has enhanced my understanding and ability of coding and Java programming. During those hours spent on debugging and testing, skills were learnt to identify and correct errors so that tasks such as reading files, displaying price charts, storing data into arrays and displaying needed results can be completed. By the end of completing this project, many non-technical skills have been achieved, which include strong determination to meet the weekly targets, high self-motivation and independent work to explore theories in areas that had never been mentioned in previous courses, attention to details to stand at both the designer's and the user's views and to get insight into the codes. Although there were some constructive and insightful ideas that were expected to be implemented in the journey of doing the project, yet due to time constraint, many of them cannot be put into practice. Those designs will be added later when the project is upgraded.

### **1.4 Overview of Dissertation**

The next chapter will introduce Event Study—a financial analysis method. This will be followed by explanation on the theory and methodology of doing event study analysis.

Then chapter three, entitled State-of-the-Art, is to discuss a type of professional paid event study analysis software and to compare it with the project software this dissertation tend to examine. The objective of the comparison is to indicate that this project software achieves its primary goals and provides the needed functions for and a convenient way of doing event study.

After that is the main chapter of this project, which is to explain details of the development and implementation of the software. Details range from theoretical basis of this software to its design and all adopted methods.

The main chapter will be followed by a chapter focusing on testing, in which detailed analysis will be made to explain how this software is checked to fulfil its original design and requirements.

Based on the above chapters, a conclusion will be made, in which possibility of further adjustments and improvements will be explored to produce a better project in the future.

In the appendix, a user specification of this software will be provided for quick start.

## **2 Event Study in Finance**

This MSc project is for building an auto event study data process software. So before this software is developed, the event study theory and several financial terms shall be clarified. This chapter will start from Event Study.

According to McWilliams and Siegel, 'event study is a statistical method to assess the impact of an event on the value of a firm' [2] and this method is gaining popularity in analysing many situations. For example, the announcement of a merger, a takeover, changes in management like CEO's resignation or an issue of dividend payment. All of such events can be analysed to see how they affect the company's value and react on the company's share price so that financial analysts can refer to the experience this time to make better prediction in the future about whether a similar event will have a positive or negative influence.

### **2.1 Ways of doing event study analysis**

The basic method of doing event study analysis is to find whether there is an abnormal return caused by this event [3]. It is widely acknowledged by most financial scholars that the abnormal return is the difference between the actual return and the expected return of a security. The abnormal return will be defined as long as we get the expected return.

There are many ways to calculate the expected return of a security, such as the Market Model, the Zero-One Model and the Mean-Adjusted Returns Model. The most prevalent way is to use the Market Model, which is assumed to have 'a liner relationship between the expected return of a company's share price and the stock market index' [4]. According to the Market Model, the return of a security not only depends on the return of the market portfolio, but also depends on conditions called systematic risk that are unique to the firm [5]. That means the influence shall be separated into two parts. One of them is generally to the firm, such as changes in interest rate, or price fluctuation in raw materials. The other part is uniquely to the company, such as changes in management, issues of dividend of payment or an announcement of a takeover. 'The market model states that the security's performance is related to its portfolio's performance according to its beta' [6]. Thus the expected return of a security can be calculated by using the Simple Liner Regression Model based on the market return. In statistics, simple linear regression is any approach to modelling the relationship between one scalar variable  $y$  and one variable denoted  $X$  [7]. The aim is to find out the relationship between two sets of values in order to build the equation and model the unknown parameters.

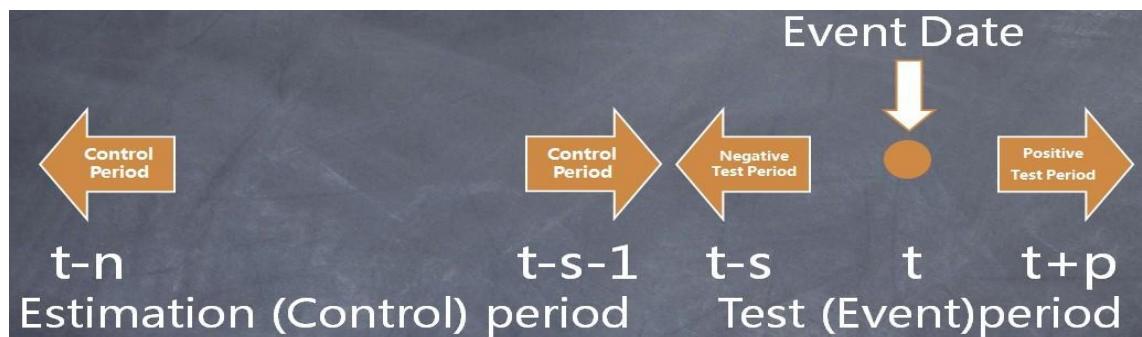
After that is to calculate the Cumulative Abnormal Return and Average Abnormal Return and see whether this event has a positive or negative influence on the company.

In terms of the Zero-One Model, it is assumed that in this model the parameter estimate Alpha equals zero and Beta equals one.

The Mean-Adjusted Model just assumes that the expected return equals the mean of daily returns of the share price in the estimation period.

## 2.2 Event study time line

Campbell thinks that 'event Study involves the conversion of calendar time to event time.' [8] The original file downloaded from the Internet is the common "open-high-low-close" file and it only contains calendar time. Firstly, we need to identify the specific event date and two more time periods in order to run the data analysis. One time period is called Test Period or Event Period. The other time period is called Estimation Period or Control Period. Please see the event study time line below:



**Figure 1. Event study time line**

The round point at right is the Event Date----one specific calendar date in original share price file and we denote it as ' $t$ '.

Positive Test Period means for how long this event will affect the company's share price after it happens and we denote it as ' $t + p$ '. Negative Test Period means for how many days this event will affect the company's share price before the occurrence of this event, say, a rumor or an official announcement of an acquisition. We denote it as ' $t - p$ '. The Test period is constructed by these three parts.

On the left is the Estimation period, which means how many days we need to get the parameter estimates by applying the return generating model.

## 2.3 Getting Parameter Estimates

The return generating model is based on the Least Square Regression by using calculus. The complicated steps of derivation process are omitted here. Please see the formulas of getting the two parameter estimates Alpha and Beta bellow:

$$\beta = \frac{\sum_{i=1}^n (R_{mi} - \bar{R}_m)(R_{si} - \bar{R}_s)}{\sum_{i=1}^n (R_{mi} - \bar{R}_m)^2}$$

$$\alpha = \bar{R}_s - \beta \bar{R}_m$$

**Figure 2. Getting Alpha and Beta**

Alpha and Beta are the two parameter estimates and are determined in estimation period. Alpha is the intercept of the regression line and stands for risk free rate. Beta is the slop coefficient of the regression line and stands for systematic risk. In the formula,  $R_{mi}$  is the daily return of market index in estimation period and  $\bar{R}_m$  is the average daily return of market index in estimation period. Similarly,  $R_{si}$  is the daily return of individual share price in estimation period and  $\bar{R}_s$  is the average daily return of individual share price in estimation period.

## 2.4 Getting the Abnormal Returns

After Alpha and Beta have been obtained, the focus should be turned to Event Period, in which the daily expected return of individual share price can be obtained by replacing the parameter estimations to event period. The formula is shown in the following figure.

$$E(R_s) = \alpha + \beta R_m$$

**Figure 3. Getting Expected Return**

Daily expected return of individual share price can be determined by replacing the Alpha and Beta from estimation period here.

Then the daily abnormal return in test period can be calculated by applying this equation. Please see the equation below:

$$AR_s = R_s - E(R_s)$$

**Figure 4. Getting Abnormal Return**

The daily abnormal return of the individual share price in test period equals the difference between the daily actual return in test period and the daily expected return in test period.

After that, the cumulative abnormal return in test period and average abnormal return in test period can be calculated based on the daily abnormal return in test period.

These are the typical required results for supporting further analysis of the event to see whether this event leads to a positive or negative effect on the value of the company.

## 2.5 Significance Test

Sometimes a result value may only be generated by chance. The result value always needs to be tested to see whether it is statistically significant. This leads to the Significance Test. Basic method is to see whether the final value generated from significance test is located in the accept region. The formula is: the mean of the tested sample times the square root of the tested sample size then divided by the standard deviation of the tested sample. People normally use the 95% significance level and the accept region is from -1.96 to +1.96. If the final value is between -1.96 to +1.96, this result value will be called statistically significant.

## 2.6 Typical Sequence of doing Event Study Analysis

### 2.6.1 Steps of doing Event Study

1. Identify specific calendar event dates of a company and set it as an event date point. [9]
2. Determine the length of both event period and estimation period.
3. Download the historical files of both share price and stock market index data. The data files should contain the calendar dates of both estimation period and event period.
4. Calculate the daily returns of both individual share price and market index data. Normally, daily returns are used, so the returns shall be daily returns. These are actual returns.
5. Calculate the two parameter estimates Alpha and Beta by using the return generating model to the data from the estimation period.
6. Get back to event period and use the two parameter estimates get from the estimation period to determine the (daily) expected return of the share price in event period.
7. Calculate the (daily) abnormal returns in event period and derive cumulative abnormal return and average abnormal return in event period.
8. Do significant test for the required results.

### 2.6.2 Sequence of doing Event Study in EXCEL

Microsoft EXCEL is one of the most popular ways to run the data analysis process. So before starting design and implementing the project software, it is vital to figure out the stages and sequences involved in doing event study data analysis in EXCEL

Before any calculation and analysis, the data must be retrieved firstly. So the first step is to download the historic prices for both individual component stock and market portfolio index data. Here the FTSE 100 index and BOCL.L are used as an example. First, the user logs on to the YAHOO finance website and selects the BOCL.L and FTSE 100 and then the user clicks historic prices and downloads them based on the manually presetting of specific time periods encompassing both event period and estimation period. After the user clicks the 'download' bottom, the default type is for downloading a Microsoft EXCEL spreadsheet of the common 'Open-High-Low-Close-Volume-Adj Close' data on local hard disk. The original file is like this and can be read in EXCEL 2003 or later version. Please see the screenshot below, here FTSE 100 is taken as an example:

	A	B	C	D	E	F	G
1	Date	Open	High	Low	Close	Volume	Adj Close
2	17-Sep-97	4914.2	4961.9	4898.5	2356.67	1.277E+09	4916.9
3	18-Sep-97	5071.7	5071.7	4899	2370.17	1.016E+09	4914.2
4	19-Sep-97	5046.5	5085.6	5024.7	2362.31	845187200	5071.7
5	22-Sep-97	5100.2	5130.5	5031.7	2381.51	1.189E+09	5046.5
6	23-Sep-97	5178.5	5211.8	5091	2364.85	979497800	5100.2
7	24-Sep-97	5247	5247.9	5165.8	2383.98	941044700	5178.5
8	25-Sep-97	5299.1	5299.1	5210	2379.37	1.124E+09	5247
9	26-Sep-97	5250.8	5331.5	5250.8	2445.86	797902500	5299.1
10	29-Sep-97	5253.9	5289.1	5239.4	2444.6	1.528E+09	5250.8
11	30-Sep-97	5237.9	5293.8	5233.2	2455.02	1.139E+09	5253.9
12	1-Oct-97	5217.8	5257.3	5209.4	2482.39	1.026E+09	5237.9
13	2-Oct-97	5202.1	5242.1	5149.1	2477.29	1.005E+09	5217.8
14	3-Oct-97	5163.7	5215.2	5163.7	2492.41	947984700	5202.1
15	6-Oct-97	5132.5	5184.4	5116.7	2480.25	1.105E+09	5163.7
16	7-Oct-97	5085.9	5149.7	5030.9	2483.45	1.365E+09	5132.5
17	8-Oct-97	5028.1	5085.9	4998.1	2469.13	1.094E+09	5085.9
18	9-Oct-97	5069.1	5084.1	4984.7	2451.49	1.199E+09	5028.1
19	10-Oct-97	5126	5126	5040.3	2455.93	900731400	5069.1
20	13-Oct-97	5211.2	5261.7	5102	2486.47	1.21E+09	5126
21	14-Oct-97	5151.3	5262.5	5151.3	2488.47	1.215E+09	5211.2
22	15-Oct-97	5163.3	5163.3	5072.5	2475.38	1.174E+09	5151.3
23	16-Oct-97	5188.4	5192.1	5063.2	2487.28	1.325E+09	5163.3

**Figure 5. First step in EXCEL**

The other individual share price file is almost the same as this one. There are seven columns in total in this file, but only two of them are needed, which are the data column and the close price column.

The second step is to create a new spreadsheet onto which these two columns of FTSE100 index are copied and pasted. Same operations shall be processed for the individual stock BOCL.L again and put them into the same new spreadsheet. In order to make sure the time series consistent, the calendar dates in both files shall be double checked. The finished screenshot of this step is shown in the picture below:

	A	BOC	FTSE ALL UK
1	Date	Price Line	Price Line
3	17-Sep-97	10.76	2356.67
4	18-Sep-97	11.04	2370.17
5	19-Sep-97	11.34	2362.31
6	22-Sep-97	11.36	2381.51
7	23-Sep-97	11.19	2364.85
8	24-Sep-97	11.26	2383.98
9	25-Sep-97	11.22	2379.37
10	26-Sep-97	11.31	2445.86
11	29-Sep-97	11.2	2444.6
12	30-Sep-97	11.05	2455.02
13	1-Oct-97	11.02	2482.39
14	2-Oct-97	10.95	2477.29
15	3-Oct-97	11.09	2492.41
16	6-Oct-97	11.15	2480.25
17	7-Oct-97	11.07	2483.45
18	8-Oct-97	10.98	2469.13
19	9-Oct-97	11.05	2451.49
20	10-Oct-97	11.15	2455.93
21	13-Oct-97	11.38	2486.47

**Figure 6. Second Step in EXCEL**

This one is for share price, the other one is for market index. What should be done next is to convert them into returns. So the third step is for calculating both daily returns. The way of calculating the return of day 't' is by applying this equation: (the close price of day 't' minus the close price of day 't-1') / the close price of day 't-1'. Please see the picture below:

	A	B	C	D	E	F
219	16-Jul-98	8.64	-1.26%	-18	2861.17	-0.43%
220	17-Jul-98	8.6	-0.46%	-17	2882.73	0.75%
221	20-Jul-98	8.69	1.05%	-16	2885.17	0.08%
222	21-Jul-98	8.53	-1.84%	-15	2867.81	-0.60%
223	22-Jul-98	8.6	0.82%	-14	2811.16	-1.98%
224	23-Jul-98	8.4	-2.33%	-13	2797.6	-0.48%
225	24-Jul-98	8.3	-1.19%	-12	2760.92	-1.31%
226	27-Jul-98	8.04	-3.13%	-11	2737.81	-0.84%
227	28-Jul-98	7.72	-3.98%	-10	2734.91	-0.11%
228	29-Jul-98	7.85	1.68%	-9	2733.57	-0.05%
229	30-Jul-98	7.9	0.64%	-8	2761.2	1.01%
230	31-Jul-98	7.82	-1.01%	-7	2734.72	-0.96%
231	3-Aug-98	7.88	0.77%	-6	2721.09	-0.50%
232	4-Aug-98	7.66	-2.79%	-5	2694.05	-0.99%
233	5-Aug-98	7.51	-1.96%	-4	2643.4	-1.88%
234	6-Aug-98	7.53	0.27%	-3	2628.5	-0.56%
235	7-Aug-98	7.54	0.13%	-2	2660.68	1.22%
236	10-Aug-98	7.4	-1.86%	-1	2625.13	-1.34%
237	11-Aug-98	7.36	-0.54%	0	2558.06	-2.55%
238	12-Aug-98	7.67	4.21%	1	2569.15	0.43%
239	13-Aug-98	7.77	1.30%	2	2539.67	-1.15%
240	14-Aug-98	8.2	5.53%	3	2562.2	0.89%
241	17-Aug-98	8.19	-0.12%	4	2561.89	-0.01%
242	18-Aug-98	8.33	1.71%	5	2629.09	2.62%
243	19-Aug-98	8.37	0.48%	6	2646.95	0.68%
244	20-Aug-98	8.55	2.15%	7	2636.19	-0.41%
245	21-Aug-98	8.37	-2.11%	8	2558.67	-2.94%
246	24-Aug-98	8.5	1.55%	9	2584.18	1.00%
247	25-Aug-98	8.48	-0.24%	10	2624.13	1.55%
248	26-Aug-98	8.2	-3.30%	11	2576.02	-1.83%
249	27-Aug-98	7.99	-2.56%	12	2497.31	-3.06%

**Figure 7. Third step in EXCEL**

Here is an example. The length of event period is 31days—15days before the event date and 15 days after the event date. And the estimation period is 60 days, which cannot be displayed in the above figure due to the large size of the picture.

The fourth step is to do the regression in the function of data analysis in order to get the two parameter estimates Alpha and Beta. What should be selected are the two areas for X value and Y value in the 60days estimation period. Then the result will be generated. Please see the picture below:

## **Figure 8. Fourth step in EXCEL**

After getting the value of Alpha and Beta, the fifth step is to apply them into the event period to get the estimated returns and then derive average abnormal return and cumulative abnormal return.

Please see the pattern below:

	A	B	C	D	E	F
1						
2						
3	<b>alpha</b>	-0.60%	-1.84%	-15	-0.76%	-1.08%
4	<b>-0.002620052</b>	-1.98%	0.82%	-14	-1.90%	2.72%
5	<b>beta</b>	-0.48%	-2.33%	-13	-0.66%	-1.66%
6	<b>0.829825529</b>	-1.31%	-1.19%	-12	-1.35%	0.16%
7		-0.84%	-3.13%	-11	-0.96%	-2.18%
8		-0.11%	-3.98%	-10	-0.35%	-3.63%
9		-0.05%	1.68%	-9	-0.30%	1.99%
10		1.01%	0.64%	-8	0.58%	0.06%
11		-0.96%	-1.01%	-7	-1.06%	0.05%
12		-0.50%	0.77%	-6	-0.68%	1.44%
13		-0.99%	-2.79%	-5	-1.09%	-0.14%
14		-1.88%	-1.96%	-4	-1.82%	-0.62%
15		-0.56%	0.27%	-3	-0.73%	1.00%
16		1.22%	0.13%	-2	0.75%	-0.62%
17		-1.34%	-1.86%	-1	-1.37%	-0.49%
18		-2.55%	-0.54%	0	-2.38%	1.84%
19		0.43%	4.21%	1	0.10%	4.11%
20		-1.15%	1.30%	2	-1.21%	2.52%
21		0.89%	5.53%	3	0.47%	5.06%
22		-0.01%	-0.12%	4	-0.27%	0.15%
23		2.62%	1.71%	5	1.91%	-0.21%
24		0.68%	0.48%	6	0.30%	0.18%
25		-0.41%	2.15%	7	-0.60%	2.75%
26		-2.94%	-2.11%	8	-2.70%	0.60%
27		1.00%	1.55%	9	0.57%	0.99%
28		1.55%	-0.24%	10	1.02%	-1.26%
29		-1.83%	-3.30%	11	-1.78%	-1.52%
30		-3.06%	-2.56%	12	-2.80%	0.24%
31		-2.26%	1.13%	13	-2.14%	3.26%
32		0.00%	0.00%	14	-0.26%	0.26%
33		-1.95%	-2.72%	15	-1.88%	-0.84%
34						
35					<b>Cumulative Abnormal Return</b>	14.05%
36					<b>Average Abnormal Return</b>	0.45%

**Figure 9. Fifth step in EXCEL**

These are the typical main results that analysts need to support their further analysis.

### **3 State-of-The-Art**

Although EXCEL is one option to carry out an event study analysis, any search on Google will still produce several types of commercial event study software, all of which look like very professional. They have very sophisticated interface as well as a large number of complicated functions. After the designer compares such software, 'Eventus' and 'Stata' have been selected as two examples that can represent excellent event study application.

The following subchapter will give a brief introduction of the advantage and disadvantage of doing event study analysis in Microsoft EXCEL and a quick look of the useful functions of both event study software Eventus® 9.0 and professional statistic data management Stata® as they are two types of paid professional software with outstanding data processing ability.

#### **3.1 Event Study in EXCEL**

The typical sequences and screen shoots of doing event study analysis in EXCEL have been discussed in the previous chapter. Using Microsoft EXCEL is one option to run the data analysis process. The advantage of using EXCEL is that this software is an accurate application with almost all powerful functions in it. Also it is one of the most popular commercial software in the world to process calculation. The proficient user knows how to manipulate it and get the required data through the data analysis function. Furthermore, the data analysis result is also able to provide graphic functions and settings can be personalized in order to meet the user's requirements. Although it is a type of powerful software, it is not exclusively for doing event study analysis after all. The five steps required to run the data analysis process involves too much copying and pasting. The real operations of doing event study in EXCEL are much more trivial than those pictures shown in the previous chapter. If the user needs to do event study analysis for ten different companies, then the whole process is error-prone since the workload is too trivial and heavy. Further event analysis is fully based on these accurate result data. If error figures arise in the supporting data, the later analysis will be totally useless.

#### **3.2 Introduction of Eventus® 9.0**

According to its official website statements, '*Cowan Research LC produces Eventus software for financial research, education and consulting. Eventus performs state-of-the-art event study estimation and testing by using the CRSP stock database or other stock return data and it also provides fast event-oriented data retrieval from the CRSP stock database*' [10]. The interface of the software is like the picture below:

The screenshot shows a software window titled "SAS with Eventus www.eventstudy.com - [VIEWTABLE: Work.Market\_pre\_offer]". The main area is a data grid with columns: PERMNO, Date of Data, Market index distinction, CRSPDay1, Running Compound Index Return, crspday, and Market. The data grid contains approximately 35 rows of financial data. Below the grid is a toolbar with various icons. At the bottom, there are tabs for Output - (Untitled), Log - (Untitled), Editor - Untitled1\*, Editor - Untitled3\*, and VIEWTABLE: Work.Ma... The status bar at the bottom right shows the path C:\Users\arnie.

	PERMNO	Date of Data	Market index distinction	CRSPDay1	Running Compound Index Return	crspday	Market
1	76104	19891212	Value	17222	0.0064290664	17222	0.0064290664
2	76104	19891213	Value	17222	0.0093640393	17223	0.0029162243
3	76104	19891214	Value	17222	0.0041830736	17224	-0.005132901
4	76104	19891215	Value	17222	0.0007162266	17225	-0.003452405
5	76104	19891218	Value	17222	-0.01592497	17226	-0.016629286
6	76104	19891219	Value	17222	-0.019968293	17227	-0.004108755
7	76104	19891220	Value	17222	-0.018608632	17228	0.0013873639
8	76104	19891221	Value	17222	-0.013239553	17229	0.0054708854
9	76104	19891222	Value	17222	-0.005294445	17230	0.0080517083
10	76104	19891226	Value	17222	-0.005802216	17231	-0.000510473
11	76104	19891227	Value	17222	-0.000716967	17232	0.005114927
12	76104	19891228	Value	17222	0.003911891	17233	0.0046321787
13	76104	19891229	Value	17222	0.0118450553	17234	0.0079022516
14	76104	19900102	Value	17222	0.0264493337	17235	0.014433315
15	76104	19900103	Value	17222	0.0264716426	17236	0.000021734
16	76104	19900104	Value	17222	0.0198133787	17237	-0.006486554
17	76104	19900105	Value	17222	0.0120309153	17238	-0.007631262
18	76104	19900108	Value	17222	0.0151430566	17239	0.0030751445
19	76104	19900109	Value	17222	0.0057336142	17240	-0.00926908
20	76104	19900110	Value	17222	-0.00114964	17241	-0.006844013
21	76104	19900111	Value	17222	0.0014667693	17242	0.0026194209
22	76110	19900108	Value	17239	0.0030751445	17239	0.0030751445
23	76110	19900109	Value	17239	-0.006222439	17240	-0.00926908
24	76110	19900110	Value	17239	-0.013023866	17241	-0.006844013
25	76110	19900111	Value	17239	-0.010438561	17242	0.0026194209
26	76110	19900112	Value	17239	-0.032753737	17243	-0.022550566
27	76110	19900115	Value	17239	-0.041364951	17244	-0.008902821
28	76110	19900116	Value	17239	-0.033002945	17245	0.0087228259
29	76110	19900117	Value	17239	-0.039720934	17246	-0.006947269
30	76110	19900118	Value	17239	-0.039401416	17247	0.0003327339
31	76110	19900119	Value	17239	-0.036375459	17248	0.0031500747
32	76110	19900122	Value	17239	-0.057782316	17249	-0.022214936
33	76110	19900123	Value	17239	-0.05785905	17250	-0.00008144
34	76110	19900124	Value	17239	-0.062357315	17251	-0.004774513
35	76110	19900125	Value	17239	-0.071596625	17252	-0.009853764

**Figure 10. Eventus Interface**

Many useful functions are built inside into this event study software

### 3.2.1 Support Output File

The latest version of Eventus has been implemented several new useful functions. One of them is for supporting output files. The software can generate a file including its calculation results. For example, several columns for the dates, actual daily returns and market-model abnormal returns can be included in the output file for double check conducted afterwards.

Also it supports many types of files such as the EXCEL option. The introduction of the new user specification says that '*it creates separate worksheets within the workbook file for the different combinations of benchmark and index. The worksheets can be read in Excel 2002 and 2003 even though the table indicates Excel 2007 and later versions.*' [11]

### 3.2.2 Calendar-Time Event Study Analysis

Eventus9.0 supports two different ways of doing calendar-time event study analysis, calendar-time portfolio regression and Jaffe-Mandelker-style tests. Both ways use statistical method to calculate the average abnormal returns of portfolios.

The calendar-time portfolio regression method uses the Market model generating a time-series simple liner regression to calculate the parameter estimates and then derive the means of abnormal return. The user specification also introduces that '*The Jaffe-Mandelker-style methods use a sepa-*

*rate estimation period to derive the parameters of a linear benchmark model, if one is used, at the security level, and also, in most of the methods of this type, to obtain the variances of portfolio mean abnormal returns.'* [12]

Finally the average abnormal return and cumulative abnormal return are tested directly by applying the significance test.

As it has two ways of calculating the abnormal returns, namely the Market Model and the Jaffe-Mandelker-style, the result is more rigorous and can be cross-referred to support further analysis.

### **3.2.3 Retrieve Data from CRSP Database**

Another edge of Eventus is that it uses CRSP stock database, which not only offers convenience to the user but also ensures the accuracy of retrieving required data.

Unlike normal software which requires the user to download individual share price and market index historic data from website manually or to get them on the fixed web page through software interface, this software can directly retrieve required information from the CRSP database.

CRSP is 'centre for research for security prices' located in the University of Chicago. It is widely acknowledged by most financial analysts that CRSP database is a non-profit securities price database that contains all the historic prices of listed companies in NYSE, AMEX and NASDAQ and provides full interpretation of historical information. The database is updated daily and monthly through rigorous check and verification to make sure the prices and data accurate and comprehensive.

So by using online database, especially these kinds of professional historic securities price databases, the user can benefit a lot since they are more accurate and convenient. The database will be updated from time to time. No problem will arise at the stage of data retrieving. If the user downloads the historic prices themselves or get them through the software on fixed web page, they probably will need to be concerned about the accuracy of the data, check time series consistency or the changes on the source page. All of these will lead to problems since retrieving data is one of the main stages in the event study analysis software.

### **3.2.4 Programming language**

As is known to all, Java coding language is an object orientated and platform independent language developed by SUN cooperation. It is a simple, stable, secure, high-performance and platform independent programming language. This Eventus event study analysis software is implemented in Java so that its operating system is independent. It can be run on Windows operating system or Mac OS operating system even the Linux operating system.

### 3.2.5 Drawbacks

One issue with the package is that the result of this software only provides calculating the average abnormal return. The result doesn't encompass the cumulative abnormal return. Although it is a very easy calculation, this index is also an important parameter to analysts. So in my project software, it provides both cumulative abnormal return and average abnormal return for the result.

The huge drawback of this software is its complicatedness. As the statements in the specification, this software with those new functions is not suitable for the new user. It is targeted at professional analysts who are quite experienced in using Eventus and who are proficient users of computers. It is quite hard for the new users to understand the software and to successfully start using this software when looking at the interface and function buttons even if they are provided with the specification.

## 3.3 Introduction of Stata

Stata is also a type of paid commercial software which was developed by StataCorp LP. The package contains all the data analysis and graphic functions exclusively for statistical data process. The interface has been showed in the following screenshots:

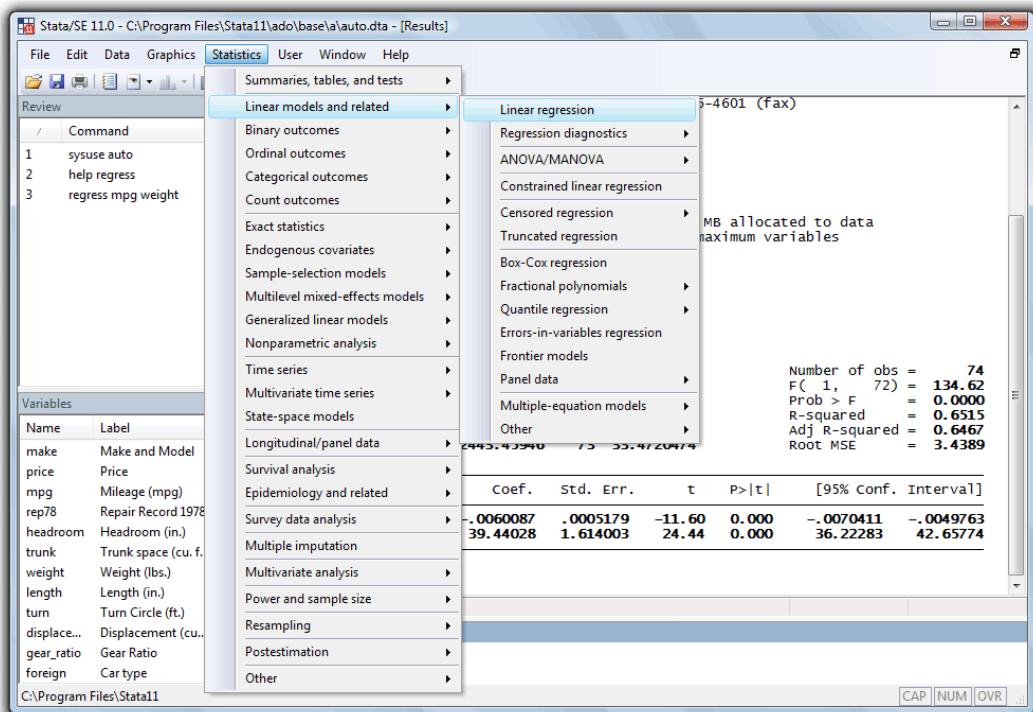
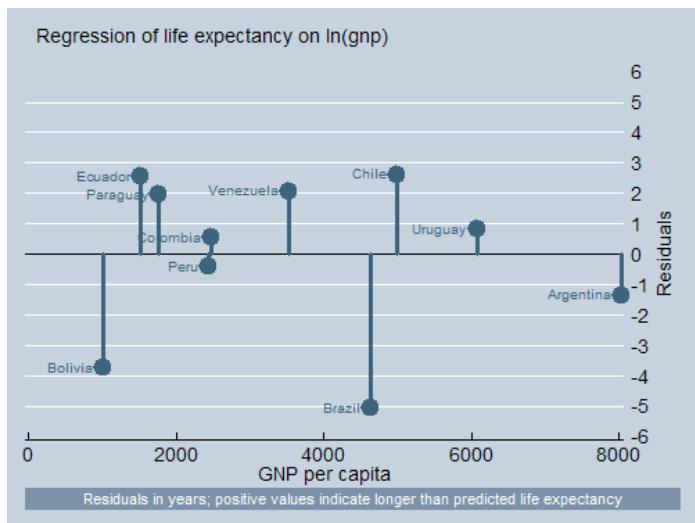


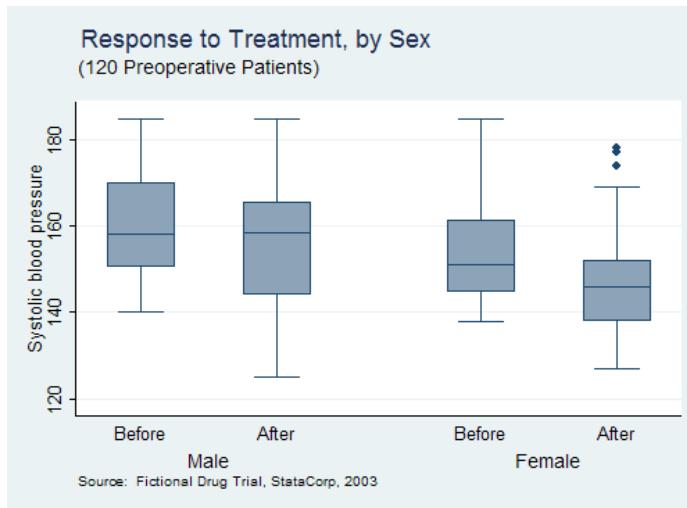
Figure 11. Stata Interface

### 3.3.1 Advantages

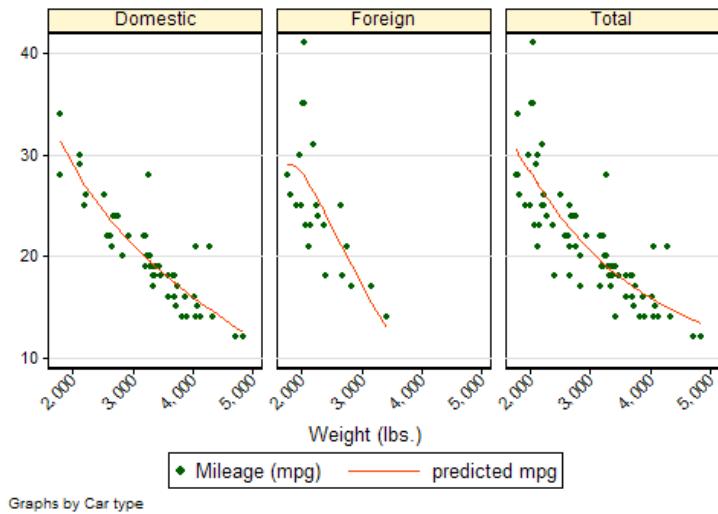
This is a type of more mature software with hundreds of statistical tools on the interface. Also the GUI has been designed more reasonable and more user-friendly. It support many kinds of files including EXCEL '.csv' file, which means it allows the user to directly input the original price files downloaded from YAHOO Finance or Google Finance. The biggest advantage of this package is that the user can not only process all the statistical data analysis to get the accurate result but also use the various kinds of professional quality graphical functions to give a clear idea of the result data. Here are some pictures to show the powerful graphic functions of this software:



**Figure 12. Stata Graphic Function 1**



**Figure 13. Stata Graphic Function 2**



**Figure 14. Stata Graphic Function 3**

Furthermore, this software has a professional documentation function, which means the results and graphics are allowed to be output on the local disk immediately and are ready for publication right away.

### 3.3.2 Drawbacks

Besides the membership payment, the drawback of this software is that it is a fully functioned statistical data process package not exclusively for doing event study. In this sense, to people whose ultimate objective is to conduct event study, there are hundreds of unnecessary statistical functions within this package and sometimes such functions bring confusion and complexity to the user. Also as a kind of commercial software, another drawback is that the data retrieving functions have not been implemented in this software. This is also because it is not a type of software exclusively for doing event study.

## 3.4 Conclusion

There are many choices that can be made to run the event study data analysis, but there are drawbacks involved in each of them. Too many trivial operations in EXCEL will easily lead to high frequency of errors and the functions and interfaces of those paid commercial event study software or statistics software are also too complicated to new users.

Based on the comparison and analysis of the above mentioned software, this MSc project is to generate a user-friendly and easy to be used application exclusively for doing event study. As it is a two-month free project software, it only contains the useful and main functions. However, it provides accurate calculation results as well as graphic functions which event study needed. Also this project software will provide three models which are the Market Model, the Zero-One Model and the Mean-Adjusted Model to generate the required result data in order to give the user better com-

parison. The purpose is to give convenience to those users who encounter many difficulties when using the error-prone EXCEL and who are not experienced and professional enough to understand the complicated functions of paid commercial event study software.

## **4 Project Software Design**

In this chapter, the designing process of this project software will be introduced in detail to give a clear concept about how this project idea is produced.

Before coding details are described, firstly, the brief framework of this project software shall be introduced. The basic criterion of developing any kind of competent software is to meet the originality of design as well as needs of clients.

### **4.1 Preparing for Design**

At the beginning of designing this project software, efforts are made to find out what an event study is and how its data analysis process runs.

As has been mentioned in Chapter two, event study is a popular statistical method to evaluate the influence of an event such as a merger, a takeover or an issue of dividend payment in order to analyse how this event affects the company's share price. And the detailed sequences also have been introduced in Chapter Two. The primarily required parameter is average abnormal return together with the cumulative abnormal return. Then analysts, by reading these two data and the specific daily abnormal returns, are able to know whether there is a positive or negative impact on the company through this event period and then to utilize these data to support their further analysis.

Since the theory and normal sequences of doing event study analysis have been clarified, now the design stage can be launched. According to the steps of doing event study introduced in Chapter Two, the design of this project software is fully based on the theory of the data analysis process of doing event study analysis. At the beginning the design stage, brief design idea is that this project software should contain the functions of:

- Identifying the event date and determining the lengths of event period and estimation period;
- Retrieving data from online website or containing a database,
- Reading data file;
- Calculations of daily returns, Alpha and Beta, cumulative abnormal return and average abnormal return.
- Being about to conduct significance test for the result
- Having a user-friendly Graphical User Interface.

## **4.2 Ideas for Design**

### **4.2.1 Brief Framework**

The design idea is primarily based on the theory of event study analysis, which has been introduced in Chapter Two. Also the design refers to the way people conduct event study by using Microsoft EXCEL as well as the analysis of other types of commercial event study software. But unlike EXCEL or other types of commercial software that contain many complicated functions and a complex GUI, this software aims to produce a piece of exclusive event study software with user-friendly GUI.

### **4.2.2 Platform Selection**

According to the project requirements on the university website, this software development can result in two different projects. One is for designing an application on computer. The other is for designing an application for mobile phones. In my opinion, the current suitable mobile phone operating systems for this kind of application are only APPLE iPhone OS system and Google Android system. The performance of mobile phones like iPhone 4 or HTC Hero based on either of these two operating systems is high enough to run this kind of small Java application. Even though the memory is enough for retrieving and reading large amount of data, the deadly pitfall is the screen size of such phones. Both iPhone and Google G series represent the typical screen size of these smart phones. Although their screens are big enough to check mails and surf the web for a short time, in my opinion, these screens are far from ideal for displaying the required information generated by this event study application. Furthermore, according to the investigation made before starting the project proposal, there are few people willing to run this kind of event study application on a screen less than four inches.

According to the above-mentioned analysis and investigation result, the final decision has been made to develop an event study application for PC.

### **4.2.3 Programming Language**

This software has been implemented by Java. The reason for choosing this specific language is that Java is not only a required programming language of this project, but also a simple, object-oriented, stable, secure, high-performance and easy-transplant programming language. The superiority of object-oriented and platform independent makes it possible to be run without any modification on almost all kinds of operating system ranging from Windows operating system to Mac OS operating system and even the Linux operating system. This reflects a saying—'write once and run anywhere'. Another advantage is that Java is born for the Internet and this language can do many things that other programming language cannot, which is what most users want to see.

#### **4.2.4 Detail Functions**

A brief function list has been made in the first session of this chapter. Now this session is to examine the detailed functions before application interface is discussed.

##### **4.2.4.1 Retrieving Data**

At the beginning of the design phase, many options are available for data retrieving. One is to retrieve data directly from online website like YAHOO Finance. Another is to get data from local or remote database like Eventus, which has been introduced in Chapter Three.

Unfortunately, due to the two-month time constraint and the nature of this non-profitable software, there is very little possibility to retrieve online data directly on webpage. To be more specific, unlike paid commercial software, this software will not be updated by changing codes from time to time, which means the function of retrieving data cannot be performed as long as there is some change of the layout of websites from which this software get data. Considering the time constraint, the function of retrieving data will not be implemented in the development phase. Therefore, the idea of obtaining data directly from the Internet or including a database will not be taken into consideration. The final decision on retrieving data is as follows:

The user firstly manually downloads the required common 'Open-High-Low-Close' historic price file online from YAHOO Finance. And it is assumed that no difficulties will be encountered at this step. And it takes only a few minutes to download data. Another merit of this way to obtain data is that the user is allowed sufficient flexibility.

##### **4.2.4.2 Reading Data**

The second step is reading file. Normally if the user has installed Microsoft Office application, the file downloaded from the Internet is the Microsoft EXCEL spreadsheet. However, because of the time constraint, decision has been made to only support reading '.txt' files. This may require the user to undertake an extra mini task after the spreadsheets are downloaded on the local hard disk. That is to open the spreadsheet and click 'save as' to save the downloaded data as Text Document and then to delete the last blank line in the Text Document files. Another thing has to be mentioned here is that the user must make time consistent in both price files before saving it as '.txt' files. When the preparation of files is ready and in order to select and open the price files, only one more 'local file choose' function shall be implemented in the software within this step. Then all the preparation of using this project application to choose and read data is ready. By implementing the previously discussed steps, the application will be able to read the historic price text document files.

#### 4.2.4.3 Displaying Chart

Inspired by other securities software during the designing process, the designer of this software assumes it will be of great help if the user is allowed the opportunity to directly compare the trends of both individual share price and market portfolio index data with the assistance of charts and graphs. Therefore, the third step has been settled for displaying the share price and market index data patterns. And it would be reasonable if displaying share price and market index pattern is combined with the process of reading data into the same stage. Therefore, after the user selects the required file manually, the second and third step will be carried out together. Another graphic function is displaying cumulative abnormal return over event period. It also will be of great help if the user is provided with both result data values and corresponding graphs.

#### 4.2.4.4 Required Data Generation

The step that follows is for calculating the daily returns of individual share price and market index. In order to get these results, data comes from step two will be further processed to generate cumulative abnormal return and average abnormal return. However, prior to the further process of the exact event data, lengths of positive and negative event period, length of estimation period need to be clarified, so decision has been made to provide several text fields for inputting these types of needed information. Then what the user needs to do is to click the 'Apply' button to run the data calculation and all the required result data will be generated instantly.

As has been mentioned in the previous session, 'user-friendly' is one merit of this software. So when providing the 'Apply' button, the designer also adds a 'Clear' button for the user to erase information on the interface and system memory.

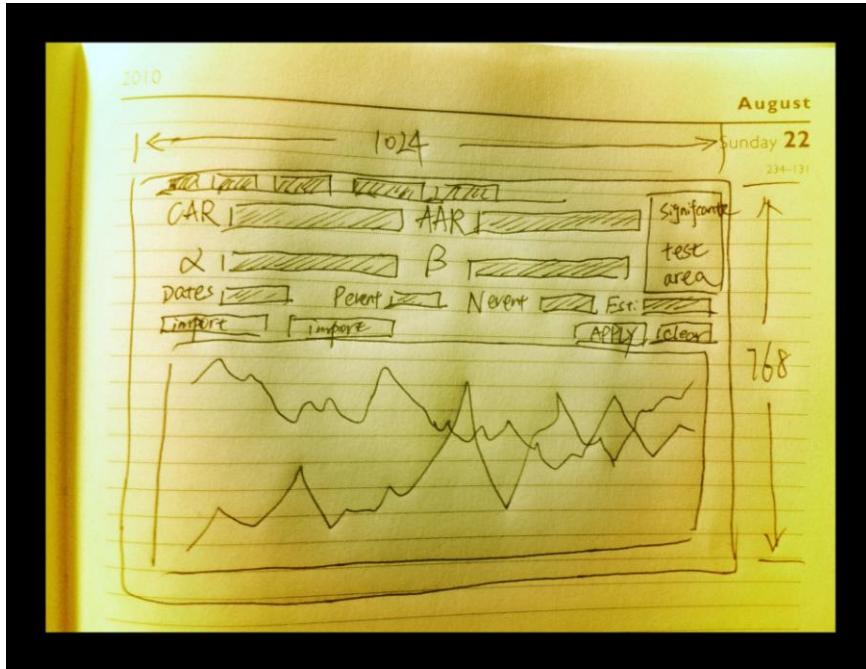
#### 4.2.4.5 Significance Test

Finally, it is necessary to test the significance of the required result values. This software is not implemented multiple event study data analysis process due to the time constraint and it is useless to run the significance test if the user only holds one result. So decision on Significance Test function has been made to provide a text filed for the user to manually input the required values.

### 4.2.5 Design of GUI

GUI stands for Graphical-User-Interface. According to its meaning, it is a way for users to communicate with the internal software. It serves as a bridge to link the outside world with the inside codes. It is vital for every application to have a user-friendly GUI so the user can easily understand the functions of different parts and start using the software quickly. This project software is for building an easy-to-use and user-friendly event study application and therefore the interface shall

be clear enough for users to quickly have a clear idea of how to use the software. The screenshot of original design draft is provided here:



**Figure 15. Original draft interface on workbook**

The last idea in the design has been made to include five tabbed panels on the interface. First panel is for displaying general information and results. The second panel is for displaying detailed calculation result of the Market Model. The third panel for displaying detailed calculation result of the Zero-One Model. The fourth panel is for displaying detailed calculation result of the Mean-Adjusted Model. The last panel is for displaying the cumulative abnormal returns over event period for all three models.

In the 'general' tabbed panel, there are five text fields on the first line, which display the result data. They are Average Abnormal Return; Cumulative Abnormal Return; Significance Test; Alpha and Beta. These five parameters are the typical main required data for the event study analysis. As these are results, the text fields are designed not to be editable by the user.

The four text fields located on the second line are Event Date; Positive Event Period; Negative Event Period and Estimation Period. These are the four required parameters that must be inputted in advance by the user in order to run the data analysis process. So the text fields in the second line are all editable. And the format is indicated in the round bracket.

There are four buttons on the third line, which have four different functions. The first two are for importing share price and market index data files. The 'Apply' button is for executing the data analysis and the 'Clear' button is for erasing the system memory and reset the GUI.

The lower part of GUI is for displaying the share price and market index data patterns by using a XY axis. X-coordinate is for displaying the time series. Y-coordinate is for displaying the price and market index. So the user can make comparison of the trends for both patterns.

In the 'Market Model' tabbed panel, the software will display the calculation details for the expected returns and abnormal returns of each day in event period for the Market Model by using J Table method. This can provide direct comparison for the impact on each day through the event period and give better support for further analysis.

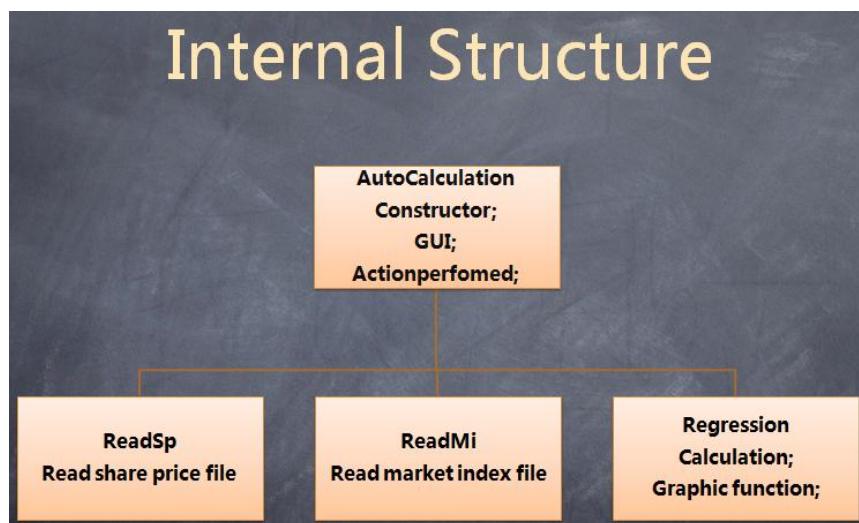
The 'Zero-One Model' panel and 'Mean-Adjusted Model' panel are similar to 'Market Model' panel. They both use J Table method to display detailed calculation result for giving better support for further analysis.

In the 'CAR over event period' panel, a graphic function is provided to give a direct comparison of all the cumulative abnormal returns over event period generated by three different return generating models. This function has been fulfilled by XY Series method. So the user is able to directly see the three different changes and trend of the cumulative abnormal return over the entire event period in order to find relationships between the event and the abnormal returns.

### 4.3 Internal Structure

Class diagram represents a kind of static diagram in unified modelling language of software engineering to show the relationships between system classes and to display the internal structure of the software. [13]

A class diagram provided here is to give a clear picture of the internal structure of this project software. Please see the diagram below:



**Figure 16. Internal Structure**

In this picture, there are four classes with four different tasks.

AutoCalculation is the main class of this software containing GUI and action performed method. There are three sub-classes included here. Two of them are for reading different files. ReadSP is for reading individual share price file. ReadMi is for reading stock market index data file. The last one is Regreesion which is for managing all the calculations in this software. The main class knows about all the remaining three sub-classes.

In the design phase, the browsing file function is going to be achieved by using 'JFileChooser' method in main class. The functions of opening and reading files functions are going to be achieved by using 'StringTokenizer' method in the first two sub-classes separately. The Regression designed to in charge of the remaining calculation and graphic functions by using algorithm in that class.

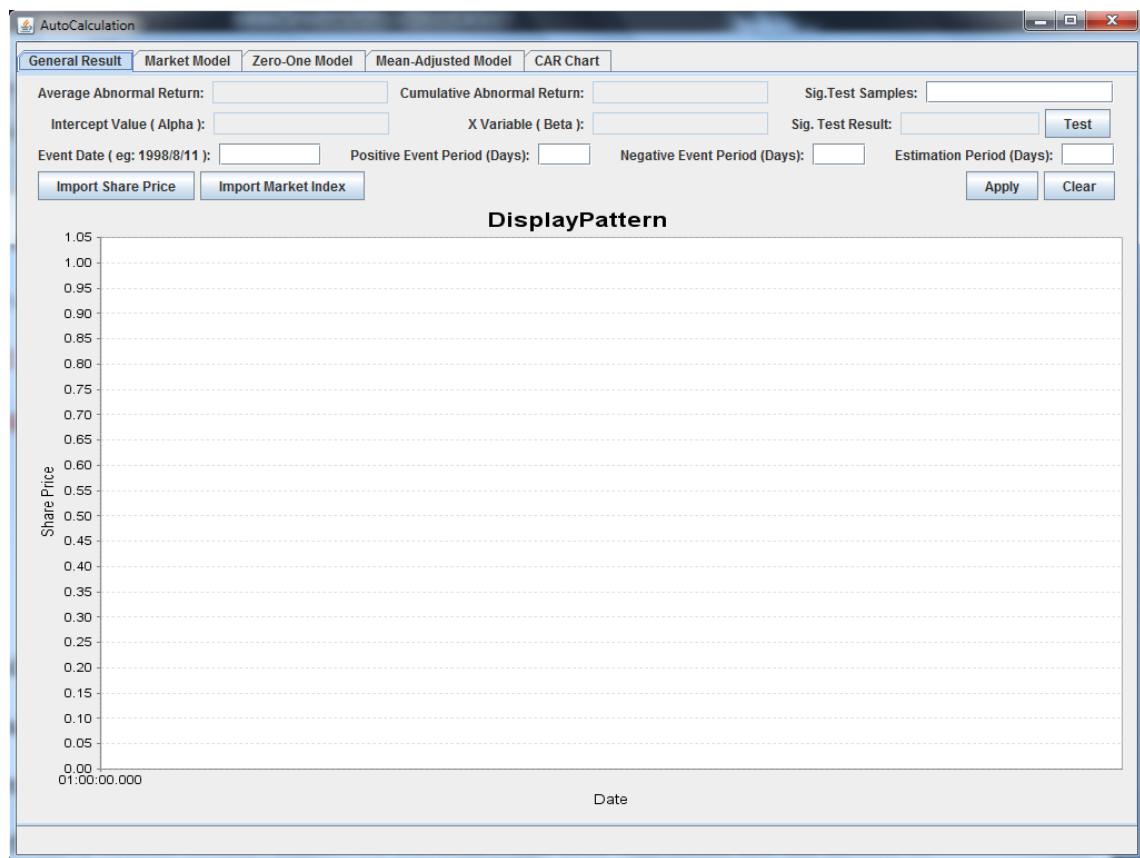
All of the above mentioned classes and their corresponding functions have formed the internal structure and relationship of this project software.

## 5 Project Software Implementation

This chapter will begin with the implementation phase to explain how each function listed in the previous chapter has been achieved. This project software has been implemented by Java. It has one main class and three sub-classes. Two of its sub-classes are for reading files and the remaining one sub-class is for doing regression and result calculation. The analysis will begin with the main class followed by the description of the subclasses.

### 5.1 GUI and Main Class

The main class mainly contains GUI and Action Performed method. As has been mentioned in the previous chapter, GUI is the interface of the software and it is important to keep GUI neat and tidy. The designer of this project software takes the perspective of both the designer and the customer and makes attempts to produce an easy-to-use program especially a user-friendly GUI. The following screenshot describes the interface of this project software.



**Figure 17. Project Software Interface**

At top left side of the General tabbed panel, the sequence is based on the position of the items on the interface from left to right and from top to bottom. At the beginning a Boolean has been used to control whether the text fields can be editable or not. As is shown in the four text fields on the top

left side, default means 'cannot be editable'. The four text fields are the results so they have been set to be default. The text field on the top right are provided for inputting the required information for doing significance test and the other text fields below is for displaying the result. So the upper one is 'editable' and the lower one is to be default. There are four text fields provided on the third line is for users inputting required parameter variables and they also has been set to 'editable'. The original price charts are designed to be displayed on a chart panel and the size of the panel is 'Dimension 1000\*600'.

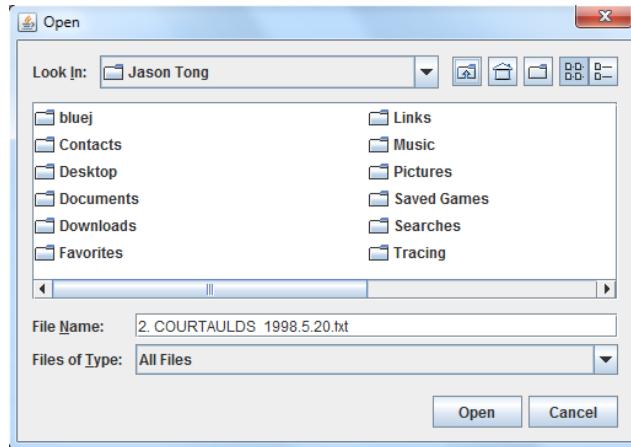
Furthermore, the initial size of the software is 1024\*768 pixels which suits the resolution of normal display.

What has been achieved here is a neat and ordered software interface with reasonable consideration for the user. Other panels will be discussed in later sub-chapter.

## 5.2 Import File

The import file function has been fulfilled by using an instance of 'JFileChooser' class.

When the user clicks a file import button on the software interface, the 'showOpenDialog' will be executed in Action Performed method and the file chooser window will be displayed. Only if a file has been selected, 'JFileChooser.APPROVE\_OPTION' will be approved and further codes will be triggered. Here is the screenshot of the FileChooser window.



**Figure 18. File Chooser Window**

Now the user is able to select and to highlight a required file at local place in 'FileChooser' window. After the user clicks the open button, the absolute path of this selected file will be retrieved and be put into an invisible text field. The format of the absolute path is a string and it will be immediately transferred to its corresponding file reading class for further file locating.

What has been achieved here is a file choose window. It allows the user to search and open a required file in local place.

### 5.3 File Reading

This is one of the key parts in the project software development cycle. If error arises in reading files, then the remaining calculation will all be wrong and useless. Because this application involves reading two different source files concurrently, so the decision has been made to create two different sub-classes but to provide the same function in order to make the structure clear. One is for importing the share price file. The other is for importing the market index data file. The codes implemented in both ReadSp.java and ReadMi.java are the despite the different names they use. (Read share price and Read Market index) So only the ReadSp.java will be taken as an example to explain how the file reading function has been achieved.

The format of the file prepared for software reading is Text Document (.txt file) and it must be a common 'Date-Open-High-Low-Close-Volume-Adj Close' historic data file which has been downloaded from YAHOO Finance.

The original file prepared for reading is like this:

Date	Open	High	Low	Close	Volume	Adj Close
1998/9/7	127.5	129.1	123.3	8.05	2881000	124.7
1998/9/4	124.4	125.8	122.3	7.9	2134000	124
1998/9/3	123	124.3	119	7.74	5661100	119
1998/9/2	118.5	127.4	118.5	8.16	5674000	126.5
1998/9/1	125.3	125.8	122.3	7.86	2919600	123.9
1998/8/31	123.9	125	121.9	8.08	1944500	122.2
1998/8/28	120.9	122.3	117.3	8.08	2317200	118
1998/8/27	118.2	123.5	118.2	7.99	2561700	119.9
1998/8/26	120	122.2	118.5	8.2	8361200	120
1998/8/25	119.4	127	117.7	8.48	5194500	126.54
1998/8/24	128.8	130.7	126.1	8.5	3333700	128.1
1998/8/21	128.8	130.7	127.6	8.37	3355900	128.74
1998/8/20	128.4	133	127.7	8.55	3061400	132.1
1998/8/19	135.5	140.6	134.4	8.37	14122000	
137.46						
1998/8/18	137.7	137.7	131.7	8.33	5510200	134.9
1998/8/17	135.5	137	133.5	8.19	4543700	136.06
1998/8/14	136.5	137.8	135.4	8.2	3117900	136.1
1998/8/13	138	139.5	136.2	7.77	4608500	138.4
1998/8/12	138.3	138.3	136.1	7.67	3137700	137.09
1998/8/11	137.3	137.6	131.6	7.36	3229300	132.3
1998/8/10	132.4	134.1	128	7.4	2757100	129.95
1998/8/7	129	131.7	127.5	7.54	1118800	130.95
1998/8/6	131.7	135.2	130.8	7.53	1204200	132
1998/8/5	133	144.1	133	7.51	3876200	141
1998/8/4	143.8	146.3	142.8	7.66	2030800	145.43
1998/8/3	145.8	150.5	143.6	7.88	1701900	150.2
1998/7/31	150	164.9	150	7.82	4585400	161.7
1998/7/30	163.9	171.5	162.4	7.9	5546100	169.9
1998/7/29	168.6	173.1	162	7.85	14050600	
171						
1998/7/28	169.7	170.8	166.8	7.72	2057800	168.72
1998/7/27	169.7	170.1	163	8.04	3500800	164
1998/7/24	164.7	171.1	161	8.3	2242700	170.9
1998/7/23	169.8	174.7	167.6	8.4	1047100	170.81
1998/7/22	170.9	176.9	169.7	8.6	3846200	175.6
1998/7/21	174.7	175.4	169.8	8.53	910900	173.9
1998/7/20	173.9	175.8	170.7	8.69	2142500	173.2
1998/7/17	171.1	173.4	170	8.6	1328100	172
1998/7/16	174	176.3	173.6	8.64	2311700	175.41
1998/7/15	175.4	191.5	174.4	8.75	2878500	188.11
1998/7/14	188	195.5	185.6	8.57	15037400	

Figure 19. File to be input

There are altogether six columns total in the file representing the 'Data Open High Low Close Volume Adj Close' and each column is separated by a 'Tab'. Only two of them are needed, which are Date and Close price for calculating the expected returns later, but the software will read all values in the file and store them into arrays. The way this project software extracts the Date and Close price columns is by using the 'StringTokenizer' method to split up these columns from 'Tab'. The conversion involved here is from type 'String' to type 'Double' involved here. Daily returns of both individual share price and market index will be generated and stored into arrays at the same time waiting for further process.

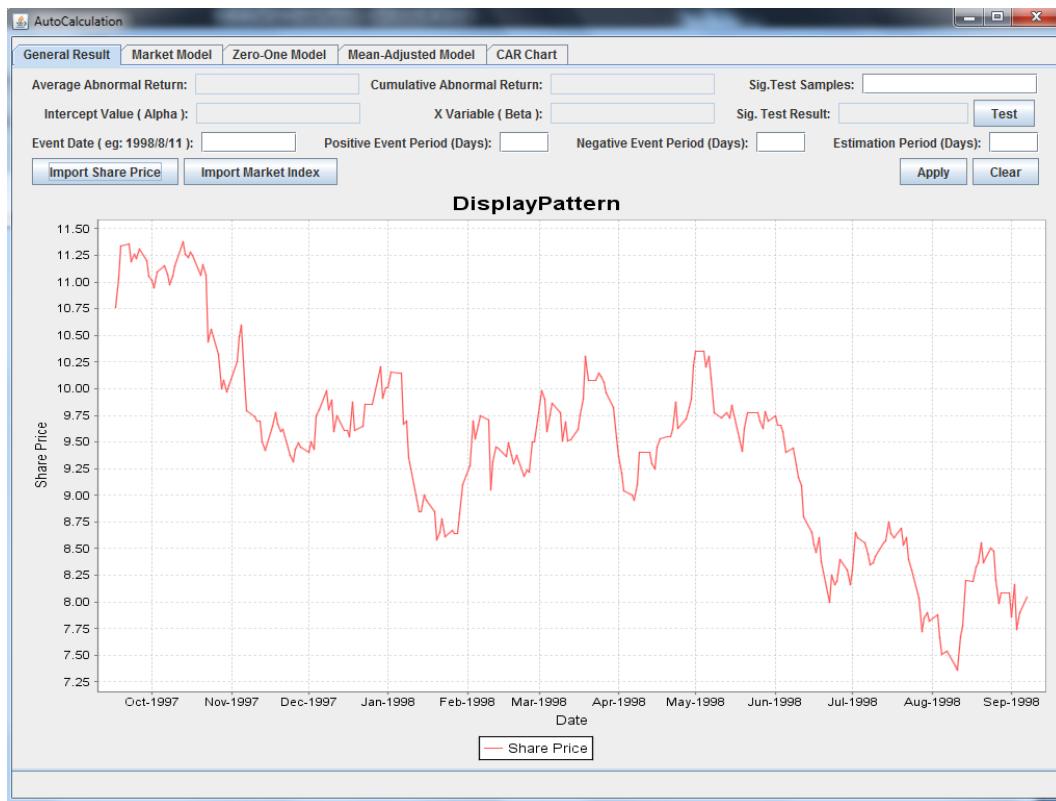
What has been achieved in this phase is a file reading function. This function identifies the location of the file which the user chooses in the local place. With this function, the file can be opened, the inside columns can be split and the data can be read line by line. This will be followed by another two steps, namely converting the individual data from type 'String' to type 'Double' and storing them into arrays for further processing and calculation. Meanwhile, the daily returns of both individual share price and market index will be generated and stored into arrays in the system memory.

## 5.4 Display Pattern Function

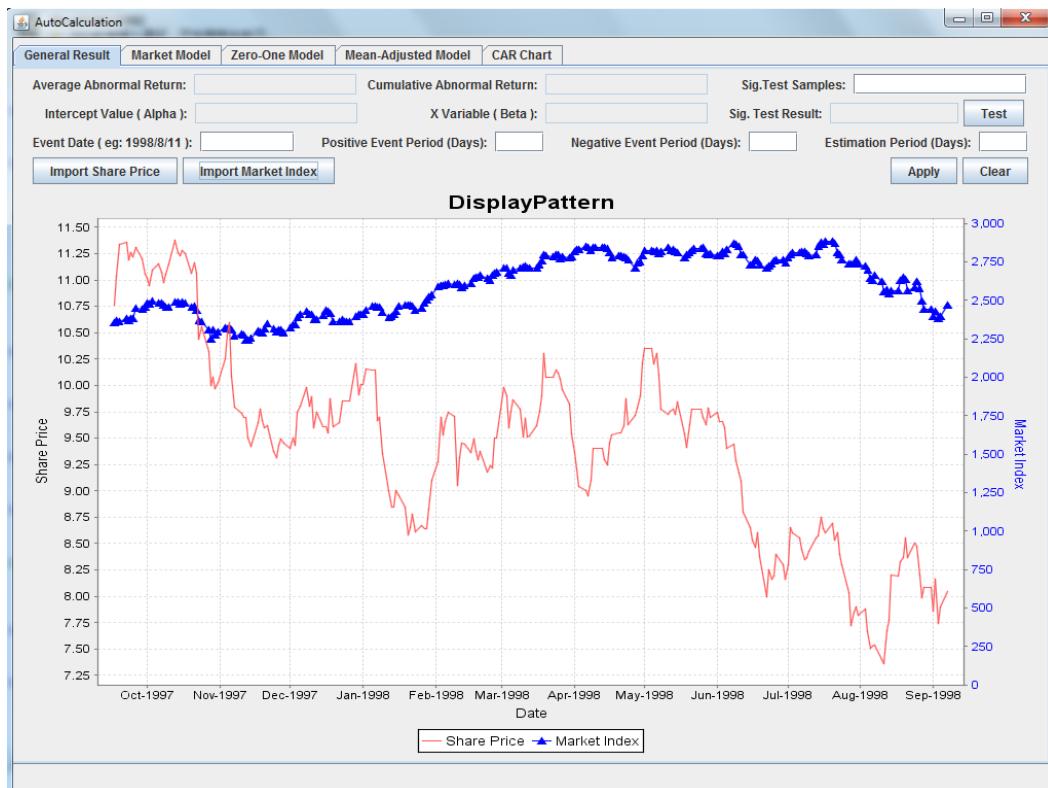
The aim for building this display pattern function is to give a direct comparison of both individual share price and market index in visually in order to give support for doing technical analysis.

This display function has been fulfilled by using a 'TimeSeriesChart'. There are two common ways of displaying charts in Java: the XY series method and the Time Series method. The reason why Time Series method is adopted here is that the required unit of X-coordinate is measured by time. However, the unit of X-coordinate of XY series only supports a value which does not meet the requirement here.

Decision has been made that this stage needs to be triggered immediately after the historic price file has been read successfully. Screenshots of this function is provided below:



**Figure 20. Import and display the share price**

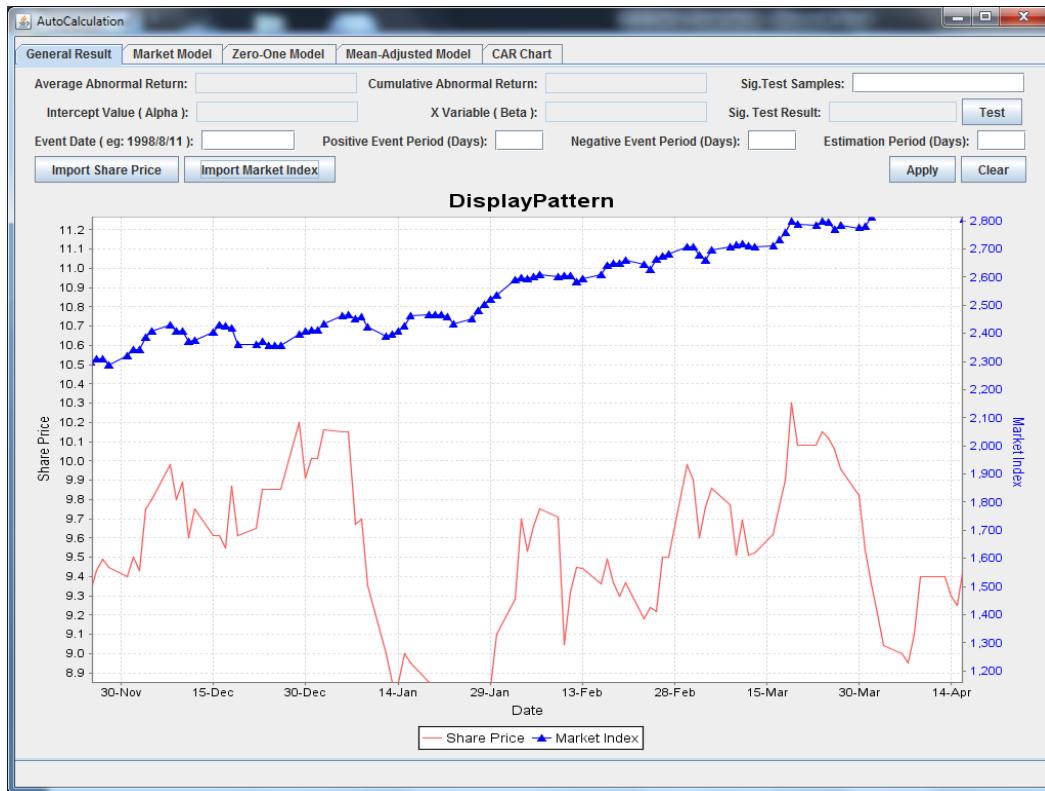


**Figure 21. Import and display the market index**

Multiple Y Axis has been implemented for better comparison. A second Y Axis on the right side has been built here due to the huge difference in unit of the individual share price and the market index

in order to put both charts together. Different color and line shape chose is also for better distinction.

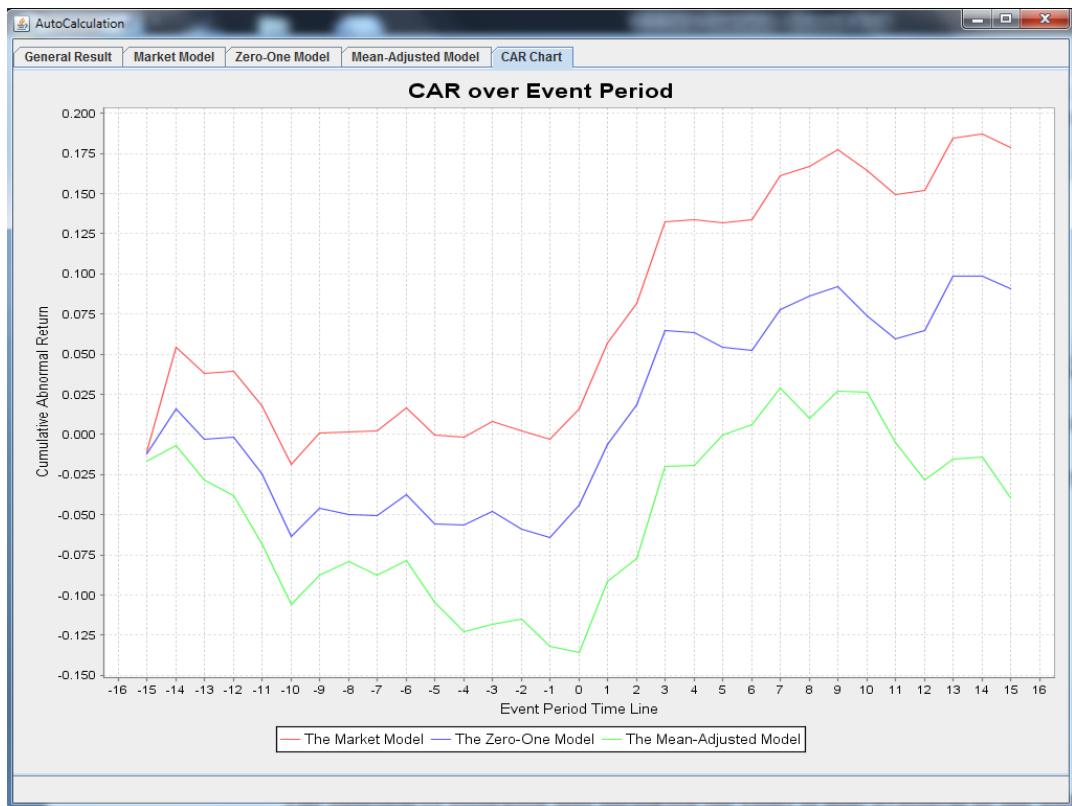
A useful function that the 'TimeSeriesChart' provided here is to support enlarging or shrinking the pattern with specific price interval and time period by dragging on the particular area from left to right in the chart panel. So the user can get a more precise pattern and to analyse the price within a shorter period of time on the chart panel. Also dragging from right to left will reset the pattern to its original size. The following figure is the enlarged share price pattern:



**Figure 22. Enlarge and shrink the price charts**

The range has been chosen from November 1997 to April 1998 and the price interval is between 8.5GBP to 10.2GBP. (BOC is one of the component stocks of UK FTSE 100) This is quite useful for detailed technical analysis.

Another chart is in 'CAR chart' panel, which is for displaying the cumulative abnormal return over event period. This chart is implemented by XY Series. Values on X Axis stands for the event period and Values on Y Axis is the cumulative abnormal return over event period. All three results from the three different models will be displayed on this chart panel right after the 'Apply' button has been clicked. Please see the following figure:



**Figure 23. CAR over Event Period**

The function of enlarging and shrinking the chart is also available to the user in CAR chart

In summary, what have been achieved in this phase are two displaying pattern functions. One is for showing share price and market index data. Another is for showing cumulative abnormal returns over event period. The software will automatically display the original price chart right after the user imports the price file. (Reading file and getting data is the step before display chart, but this occurs in the background and only takes a few milliseconds, which the user can hardly notice.) And the function of enlarging and shrinking the patterns will also be provided for further intensive observation.

## 5.5 Regression and Calculation

After reading the historic price files, the project software is ready to calculate the required data for doing event study analysis.

Theory and sequences have been discussed in Charter Two. Before calculating the two parameter estimates—Alpha and Beta, one more step is required to determine the four key elements of doing event study analysis, namely the specific event date, the length of positive event period, length of negative event period and the length of estimation period. Before the user clicks the Apply button, the four text fields on the interface need to be filled in with the corresponding elements that are

required for the data analysis. The format of the input information has also been indicated in the parenthesis. See the figure below:

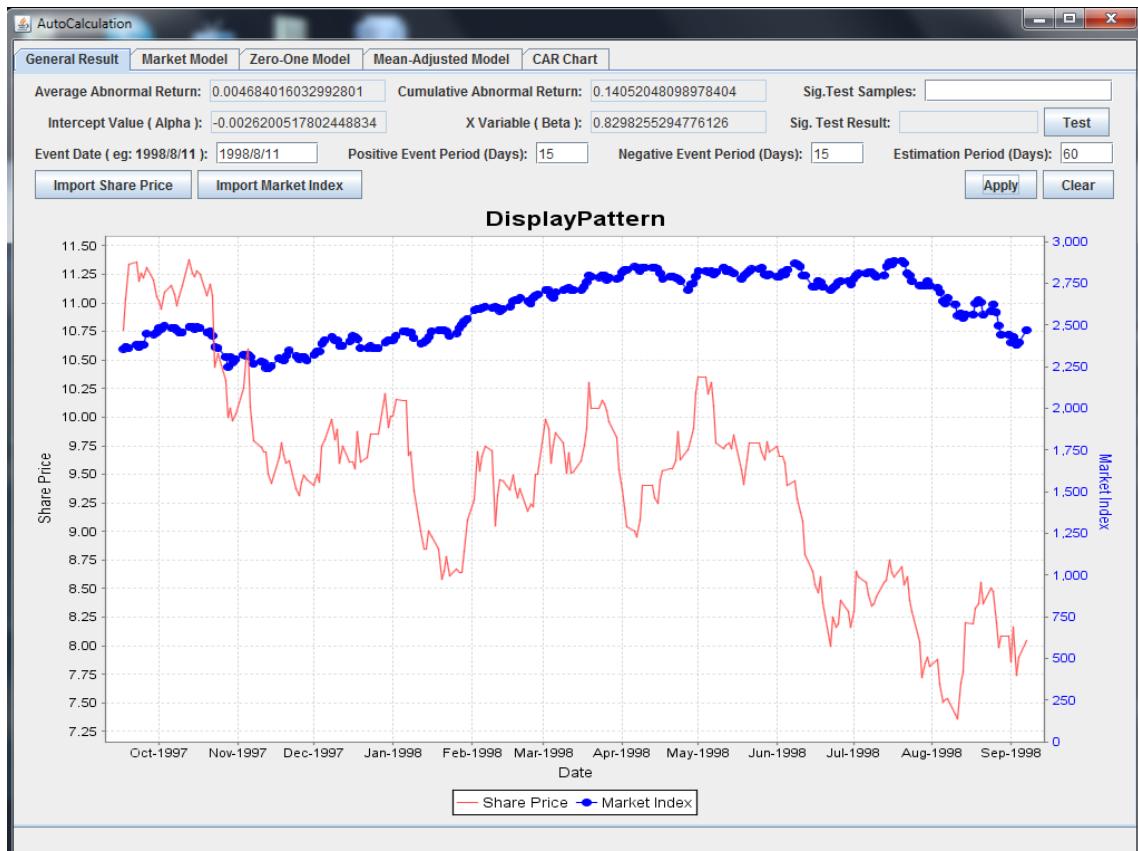
Event Date ( eg: 1998/8/11 ):	1998/8/11	Positive Event Period (Days):	15	Negative Event Period (Days):	15	Estimation Period (Days):	60
-------------------------------	-----------	-------------------------------	----	-------------------------------	----	---------------------------	----

**Figure 24. Text Fields for inputting the required values**

As is shown in the following figure, the user needs to input the required four parameters in order to run the data analysis.

Once the Apply button is clicked, these strings will be extracted from the text fields and will be converted into type Double for further usage. The event date the user has filled in will be compared with the date arrays already read from the share price and market index files so that the position of this specific date in the system arrays can be located. Length of estimation period is used as a variable to apply into the return generating model and calculate the two parameter estimates Alpha and Beta. Both the positive and negative event period is used to determine the range of event period and will then be used as two variables in the abnormal return generating formula.

The results will be displayed right after the user clicks the Apply button. Please see the figure below:



**Figure 25. Results being carried out**

The whole process of calculating the main result data takes only a few milliseconds.

Specific detail result values in Market Model tabbed panel, Zero-One Model panel and Mean-Adjusted panel are provided for the user to do intensive analysis. J Table method is adopted here in order to give a neat and clear impression for the user. Please see the three figures below:

AutoCalculation						
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart		
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return	(Alpha=0) Exp. Return	(Alpha=0) Abn. Return
-0.602%	-15	-1.841%	-0.761%	-1.080%	-0.499%	-1.342%
-1.975%	-14	0.821%	-1.901%	2.722%	-1.639%	2.460%
-0.482%	-13	-2.326%	-0.662%	-1.663%	-0.400%	-1.925%
-1.311%	-12	-1.190%	-1.350%	0.160%	-1.088%	-0.102%
-0.837%	-11	-3.133%	-0.957%	-2.176%	-0.695%	-2.438%
-0.106%	-10	-3.980%	-0.350%	-3.630%	-0.088%	-3.892%
-0.049%	-9	1.684%	-0.303%	1.987%	-0.041%	1.725%
1.011%	-8	0.637%	0.577%	0.060%	0.839%	-0.202%
-0.959%	-7	-1.013%	-1.058%	0.045%	-0.796%	-0.217%
-0.498%	-6	0.767%	-0.676%	1.443%	-0.414%	1.181%
-0.994%	-5	-2.792%	-1.087%	-1.705%	-0.825%	-1.967%
-1.880%	-4	-1.958%	-1.822%	-0.136%	-1.560%	-0.398%
-0.564%	-3	0.266%	-0.730%	0.996%	-0.468%	0.734%
1.224%	-2	0.133%	0.754%	-0.621%	1.016%	-0.883%
-1.336%	-1	-1.857%	-1.371%	-0.486%	-1.109%	-0.748%
-2.555%	0	-0.541%	-2.382%	1.842%	-2.120%	1.580%
0.434%	1	4.212%	0.098%	4.114%	0.360%	3.852%
-1.147%	2	1.304%	-1.214%	2.518%	-0.952%	2.256%
0.887%	3	5.534%	0.474%	5.060%	0.736%	4.798%
-0.012%	4	-0.122%	-0.272%	0.150%	-0.010%	-0.112%
2.623%	5	1.709%	1.915%	-0.205%	2.177%	-0.467%
0.679%	6	0.480%	0.302%	0.178%	0.564%	-0.084%
-0.407%	7	2.151%	-0.599%	2.750%	-0.337%	2.488%
-2.941%	8	-2.105%	-2.702%	0.597%	-2.440%	0.335%
0.997%	9	1.553%	0.565%	0.988%	0.827%	0.726%
1.546%	10	-0.235%	1.021%	-1.256%	1.283%	-1.518%
-1.833%	11	-3.302%	-1.783%	-1.519%	-1.521%	-1.781%
-3.055%	12	-2.561%	-2.798%	0.237%	-2.536%	-0.025%
-2.261%	13	1.126%	-2.138%	3.265%	-1.876%	3.003%
0.000%	14	0.000%	-0.262%	0.262%	0.000%	0.000%
-1.950%	15	-2.723%	-1.880%	-0.843%	-1.618%	-1.105%

Figure 26. Detail results of the Market Model

AutoCalculation						
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart		
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return		
-0.602%	-15	-1.841%	-0.602%	-1.239%		
-1.975%	-14	0.821%	-1.975%	2.796%		
-0.482%	-13	-2.326%	-0.482%	-1.843%		
-1.311%	-12	-1.190%	-1.311%	0.121%		
-0.837%	-11	-3.133%	-0.837%	-2.295%		
-0.106%	-10	-3.980%	-0.106%	-3.874%		
-0.049%	-9	1.684%	-0.049%	1.733%		
1.011%	-8	0.637%	1.011%	-0.374%		
-0.959%	-7	-1.013%	-0.959%	-0.054%		
-0.498%	-6	0.767%	-0.498%	1.266%		
-0.994%	-5	-2.792%	-0.994%	-1.798%		
-1.880%	-4	-1.958%	-1.880%	-0.078%		
-0.564%	-3	0.266%	-0.564%	0.830%		
1.224%	-2	0.133%	1.224%	-1.091%		
-1.336%	-1	-1.857%	-1.336%	-0.521%		
-2.555%	0	-0.541%	-2.555%	2.014%		
0.434%	1	4.212%	0.434%	3.778%		
-1.147%	2	1.304%	-1.147%	2.451%		
0.887%	3	5.534%	0.887%	4.647%		
-0.012%	4	-0.122%	-0.012%	-0.110%		
2.623%	5	1.709%	2.623%	-0.914%		
0.679%	6	0.480%	0.679%	-0.199%		
-0.407%	7	2.151%	-0.407%	2.557%		
-2.941%	8	-2.105%	-2.941%	0.835%		
0.997%	9	1.553%	0.997%	0.556%		
1.546%	10	-0.235%	1.546%	-1.781%		
-1.833%	11	-3.302%	-1.833%	-1.469%		
-3.055%	12	-2.561%	-3.055%	0.495%		
-2.261%	13	1.126%	-2.261%	3.388%		
0.000%	14	0.000%	0.000%	0.000%		
-1.950%	15	-2.723%	-1.950%	-0.773%		

Figure 27. Detail results of the Zero-One Model

The screenshot shows a software window titled 'AutoCalculation'. At the top, there is a menu bar with 'File', 'Edit', 'View', 'Analysis', 'Help', and a 'Toolbox' tab. Below the menu is a tab bar with 'General Result', 'Market Model', 'Zero-One Model', 'Mean-Adjusted Model' (which is selected), and 'CAR Chart'. The main area contains a table with the following data:

Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return
-0.602%	-15	-1.841%	-0.173%	-1.669%
-1.975%	-14	0.821%	-0.173%	0.993%
-0.482%	-13	-2.326%	-0.173%	-2.153%
-1.311%	-12	-1.190%	-0.173%	-1.018%
-0.837%	-11	-3.133%	-0.173%	-2.960%
-0.106%	-10	-3.980%	-0.173%	-3.807%
-0.049%	-9	1.664%	-0.173%	1.857%
1.011%	-8	0.637%	-0.173%	0.810%
-0.959%	-7	-1.013%	-0.173%	-0.840%
-0.498%	-6	0.767%	-0.173%	0.940%
-0.994%	-5	-2.792%	-0.173%	-2.619%
-1.880%	-4	-1.958%	-0.173%	-1.788%
-0.564%	-3	0.266%	-0.173%	0.439%
1.224%	-2	0.133%	-0.173%	0.305%
-1.336%	-1	-1.857%	-0.173%	-1.684%
-2.555%	0	-0.541%	-0.173%	-0.368%
0.434%	1	4.212%	-0.173%	4.385%
-1.147%	2	1.304%	-0.173%	1.476%
0.887%	3	5.534%	-0.173%	5.707%
-0.012%	4	-0.122%	-0.173%	0.051%
2.623%	5	1.709%	-0.173%	1.882%
0.679%	6	0.480%	-0.173%	0.653%
-0.407%	7	2.151%	-0.173%	2.323%
-2.941%	8	-2.105%	-0.173%	-1.933%
0.997%	9	1.553%	-0.173%	1.726%
1.546%	10	-0.235%	-0.173%	-0.063%
-1.833%	11	-3.302%	-0.173%	-3.129%
-3.055%	12	-2.561%	-0.173%	-2.388%
-2.261%	13	1.126%	-0.173%	1.299%
0.000%	14	0.000%	-0.173%	0.173%
-1.950%	15	-2.723%	-0.173%	-2.550%

**Figure 28. Detail results of the Mean-Adjusted Model**

## 5.6 Refreshable

The refreshable function has been built into the software so that it is possible for the user to make directly change on the interface. If the user wants to change to different event dates or to different length of periods, he/she just needs to retype the new information on the interface and clicks the Apply button again. The system will remove the old memory and display the new calculation on the screen. Also the system fully reset function has been implemented on the interface by clicking the Clear button in order to give convenience to the user for doing a whole new event study analysis. The user does not need to close the programme. The GUI will be refreshed automatically for the user after the Clear button is clicked.

What has been achieved finally is an easy-to-use exclusive event study auto-data generation software with three different return generating models and a user-friendly GUI. After the user downloads and imports the share price and market index files, data reading and basic calculation will be activated together with the price chart. Required calculation will be conducted in background within milliseconds and result data together with the CAR chart will be displayed right after the user finishes the presettings and clicks the Apply button.

## 6 Testing

Each application needs to be tested at the final development cycle to make sure the function and quality meet the original design and customers' demand. So far it has not been proved whether or not the event study analysis result data generated by this project software are correct; therefore to compare the result data with the results produced by Microsoft Excel is necessitated to see whether the software in question performs well or not. The following sub-chapter will be divided into two parts, namely general result comparison and detail process comparison.

### 6.1 General Result Comparison

In this subchapter, general results generated from this project software and EXCEL will be fully compared.

Data results of five companies are selected from Dr. Campbell's Excel file to be compared. They include the 'Quarterly Results' of BOC GROPU PLC, the 'Interim Results' of COURTAULDS PLC, the 'Quarterly Results' of ICI IMPERIAL CHEMICAL INDUSTRIES PLC, the 'Interim Results' of LAPORTE PLC and the 'Interim Results' of YULE CATTO & CO PLC. The events of these five companies occurred on 11<sup>th</sup> August, 1998, 20<sup>th</sup> May, 1998, 5<sup>th</sup> February, 1998, 9<sup>th</sup> March, 1998 and 26<sup>th</sup> March, 1998 respectively.

When comparing data results of each company, the designer first makes the data analysis by importing into the project software the relevant data of a company and the FTSE 100 index historic price of a corresponding period. Then, the generated results will be compared with those produced by Excel. The following figure compares the two sets of result data of the five companies. For the screens of the five companies' data generated by the software in question and those produced by Excel, please refer to the appendix.

**Tables: Comparing Two Sets of Result Data of Five Companies**

BOC GROUP PLC		
Compared Item	Result Data Generated by Software in Question	Result Data Generated by Microsoft Excel
Alpha	-0.002621813723334497	-0.002620052
Beta	0.8314623545508466	0.829825529
Average Abnormal Return	0.005055426240574808	0.0045
Cumulative Abnor-	0.15166278721724424	0.1405

<b>mal Return</b>		
-------------------	--	--

<b>COURTAULDS PLC</b>		
<b>Compared Item</b>	<b>Result Data Generated by Software in Question</b>	<b>Result Data Generated by Microsoft Excel</b>
<b>Alpha</b>	0.007237853414143988	0.007247063
<b>Beta</b>	2.0595335839174327	2.049467736
<b>Average Abnormal Return</b>	-0.009436695259469741	-0.0097
<b>Cumulative Abnor- mal Return</b>	-0.2831008577840922	-0.3022

<b>ICI IMPERIAL CHEMICAL INDUSTRIES PLC</b>		
<b>Compared Item</b>	<b>Result Data Generated by Software in Question</b>	<b>Result Data Generated by Microsoft Excel</b>
<b>Alpha</b>	1.2201846833269266E-4	0.000112301
<b>Beta</b>	1.2970377882239303	1.218457385
<b>Average Abnormal Return</b>	0.0009755927279899075	0.0013
<b>Cumulative Abnor- mal Return</b>	0.03024337456768713	0.0390

<b>LAPORTE PLC</b>		
<b>Compared Item</b>	<b>Result Data Generated by Software in Question</b>	<b>Result Data Generated by Microsoft Excel</b>
<b>Alpha</b>	1.7064202286831405E-4	0.000165253
<b>Beta</b>	0.28204777809161957	0.285154163
<b>Average Abnormal Return</b>	0.005068404230249788	0.0050
<b>Cumulative Abnor- mal Return</b>	0.15205212690749365	0.1549

<b>YULE CATTO &amp; CO PLC</b>		
<b>Compared Item</b>	<b>Result Data Generated by Software in Question</b>	<b>Result Data Generated by Microsoft Excel</b>

<b>Alpha</b>	0.0031748628544948465	0.003184533
<b>Beta</b>	0.05814129541357404	0.052812971
<b>Average Abnormal Return</b>	-5.568843293248892E-4	-0.0006
<b>Cumulative Abnor- mal Return</b>	-0.016706529879746676	-0.0195

As can be seen from the table above, the difference between the values of Alpha and Beta generated by two types of software is slight, with errors being controlled within an acceptable range. The reason for the existence of errors is that different decimal places have been chosen when the actual daily returns are calculated. At the testing stage, the 'system.out.println' method is used to compare the results of each actual daily return calculated by this software with those calculated by EXCEL. Besides the difference in decimal places adopted, they are all perfectly match. This leads to errors in Alpha and Beta, two important values that will be applied into the return generating model.

It seems that there is discrepancy in the values of Cumulative abnormal return and Average abnormal return. That is due to error in Alpha and Beta and also due to the different decimal places used in calculating daily expected return and daily abnormal return when applying the two parameter estimates back into event period.

Specific detailed check will be discussed in next sub-chapter to eliminate this is not the software's mistake.

What needs to be mentioned here is a value with too many decimal digits will change the way the value display on the screen. The value will end with E-N, with the 'N' standing for the number of decimal places

To summarize, this sub-chapter is for general result checking and comparison. All the data generated by this project software are similar to those generated by Microsoft EXCEL. The error is caused by two factors. Firstly, different decimal places are chosen to display the result. Secondly, when the decimal places of a variable in a formula differ, the final result will in turn be a bit different, in which case error arises. The sub-chapter that follows is to elaborate on the detail checking and the cause of the errors.

## 6.2 Detail Result Comparison

In this subchapter, detail results generated from this project software and EXCEL will be fully compared.

Detail data results of five companies are selected from Dr. Campbell's Excel file to be compared.

Firstly, detail results of daily expected return and daily abnormal return generated by the Market Models will be compared with those generated by EXCEL. Here only the BOC Company's data is used and other company's data comparison result will be put in appendix.

The following figure shows the detail values calculated by this project software:

AutoCalculation							
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart			
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return	(Alpha=0) Exp. Return	(Alpha=0) Abn. Return	
-0.602%	-15	-1.841%	-0.761%	-1.080%	-0.499%	-1.342%	
-1.975%	-14	0.821%	-1.901%	2.722%	-1.639%	2.460%	
-0.482%	-13	-2.326%	-0.662%	-1.663%	-0.400%	-1.925%	
-1.311%	-12	-1.190%	-1.350%	0.160%	-1.088%	-0.102%	
-0.837%	-11	-3.133%	-0.957%	-2.176%	-0.695%	-2.438%	
-0.106%	-10	-3.980%	-0.350%	-3.630%	-0.088%	-3.892%	
-0.049%	-9	1.684%	-0.303%	1.987%	-0.041%	1.725%	
1.011%	-8	0.637%	0.577%	0.060%	0.839%	0.202%	
-0.959%	-7	-1.013%	-1.058%	0.045%	-0.796%	-0.217%	
-0.498%	-6	0.767%	-0.676%	1.443%	-0.414%	1.181%	
-0.994%	-5	-2.792%	-1.087%	-1.705%	-0.825%	-1.967%	
-1.880%	-4	-1.958%	-1.822%	-0.136%	-1.560%	-0.398%	
-0.564%	-3	0.266%	-0.730%	0.996%	-0.468%	0.734%	
1.224%	-2	0.133%	0.754%	-0.621%	1.016%	-0.883%	
-1.336%	-1	-1.857%	-1.371%	-0.486%	1.109%	-0.748%	
-2.555%	0	-0.541%	-2.382%	1.842%	-2.120%	1.580%	
0.434%	1	4.212%	0.098%	4.114%	0.360%	3.852%	
-1.147%	2	1.304%	-1.214%	2.518%	-0.952%	2.256%	
0.887%	3	5.534%	0.474%	5.060%	0.736%	4.798%	
-0.012%	4	-0.122%	-0.272%	0.150%	-0.010%	-0.112%	
2.623%	5	1.709%	1.915%	-0.205%	2.177%	-0.467%	
0.679%	6	0.480%	0.302%	0.178%	0.564%	-0.084%	
-0.407%	7	2.151%	-0.599%	2.750%	-0.337%	2.488%	
-2.941%	8	-2.105%	-2.702%	0.597%	-2.440%	0.335%	
0.997%	9	1.553%	0.565%	0.988%	0.827%	0.726%	
1.546%	10	-0.235%	1.021%	-1.256%	1.283%	-1.518%	
-1.833%	11	-3.302%	-1.783%	-1.519%	-1.521%	-1.781%	
-3.055%	12	-2.561%	-2.798%	0.237%	-2.536%	-0.025%	
-2.261%	13	1.126%	-2.138%	3.265%	-1.876%	3.003%	
0.000%	14	0.000%	-0.262%	0.262%	0.000%	0.000%	
-1.950%	15	-2.723%	-1.880%	-0.843%	-1.618%	-1.105%	

**Figure 29. Detail result for the Market Model produced by this software**

(Lengths of positive and negative periods are both 15 days and estimation period is 60 days.)

The lower figure is the result calculated by EXCEL:

FTSE ALL UK days	BOC	estimated return	abnormal return	alpha=0	
				estimated return	abnormal return
-0.60%	-15	-1.84%	-0.76%	-1.08%	-0.50%
-1.98%	-14	0.82%	-1.90%	2.72%	-1.64%
-0.48%	-13	-2.33%	-0.66%	-1.66%	-0.40%
-1.31%	-12	-1.19%	-1.35%	0.16%	-1.09%
-0.84%	-11	-3.13%	-0.96%	-2.18%	-0.69%
-0.11%	-10	-3.98%	-0.35%	-3.63%	-0.09%
-0.05%	-9	1.68%	-0.30%	1.99%	-0.04%
1.01%	-8	0.64%	0.58%	0.06%	0.84%
-0.96%	-7	-1.01%	-1.06%	0.05%	-0.80%
-0.50%	-6	0.77%	-0.68%	1.44%	-0.41%
-0.99%	-5	-2.79%	-1.09%	-1.71%	-0.82%
-1.88%	-4	-1.96%	-1.82%	-0.14%	-1.56%
-0.56%	-3	0.27%	-0.73%	1.00%	-0.47%
1.22%	-2	0.13%	0.75%	-0.62%	1.02%
-1.34%	-1	-1.86%	-1.37%	-0.49%	-1.11%
-2.55%	0	-0.54%	-2.38%	1.84%	-2.12%
0.43%	1	4.21%	0.10%	4.11%	0.36%
-1.15%	2	1.30%	-1.21%	2.52%	-0.95%
0.89%	3	5.53%	0.47%	5.06%	0.74%
-0.01%	4	-0.12%	-0.27%	0.15%	-0.01%
2.62%	5	1.71%	1.91%	-0.21%	2.18%
0.68%	6	0.48%	0.30%	0.18%	0.56%
-0.41%	7	2.15%	-0.60%	2.75%	-0.34%
-2.94%	8	-2.11%	-2.70%	0.60%	-2.44%
1.00%	9	1.55%	0.57%	0.99%	0.83%
1.55%	10	-0.24%	1.02%	-1.26%	1.28%
-1.83%	11	-3.30%	-1.78%	-1.52%	-1.52%
-3.06%	12	-2.56%	-2.80%	0.24%	-2.54%
-2.26%	13	1.13%	-2.14%	3.26%	-1.88%
0.00%	14	0.00%	-0.26%	0.26%	0.00%
-1.95%	15	-2.72%	-1.88%	-0.84%	-1.62%

**Figure 30.** Detail result for the Market Model produced by EXCEL

Most of the results are perfectly match and the very tiny error exists here is also due to the different decimal places adopted and errors in Alpha and Beta. Calculations of both expected returns and abnormal returns are fully based on the values of actual returns and the two parameter estimates. This eliminates the question in the previous sub-chapter that the tiny errors in the two parameter estimates Alpha and Beta are not caused by system miscalculating.

This software also provides two more ways of calculating detail daily expected return and abnormal return, which are the Zero-more Model and the Mean-Adjusted Model.

The following figures also give comparisons with those data generated by EXCEL. Firstly, the Zero-One Model in this software:

General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return
-0.602%	-15	-1.841%	-0.602%	-1.239%
-1.975%	-14	0.821%	-1.975%	2.796%
-0.482%	-13	-2.326%	-0.482%	-1.843%
-1.311%	-12	-1.190%	-1.311%	0.121%
-0.837%	-11	-3.133%	-0.837%	-2.295%
-0.106%	-10	-3.980%	-0.106%	-3.874%
-0.049%	-9	1.684%	-0.049%	1.733%
1.011%	-8	0.637%	1.011%	-0.374%
-0.959%	-7	-1.013%	-0.959%	-0.054%
-0.498%	-6	0.767%	-0.498%	1.266%
-0.994%	-5	-2.792%	-0.994%	-1.798%
-1.880%	-4	-1.958%	-1.880%	-0.078%
-0.564%	-3	0.266%	-0.564%	0.830%
1.224%	-2	0.133%	1.224%	-1.091%
-1.336%	-1	-1.857%	-1.336%	-0.521%
-2.555%	0	-0.541%	-2.555%	2.014%
0.434%	1	4.212%	0.434%	3.778%
-1.147%	2	1.304%	-1.147%	2.451%
0.887%	3	5.534%	0.887%	4.647%
-0.012%	4	-0.122%	-0.012%	-0.110%
2.623%	5	1.709%	2.623%	-0.914%
0.679%	6	0.480%	0.679%	-0.199%
-0.407%	7	2.151%	-0.407%	2.557%
-2.941%	8	-2.105%	-2.941%	0.835%
0.997%	9	1.553%	0.997%	0.556%
1.546%	10	-0.235%	1.546%	-1.781%
-1.833%	11	-3.302%	-1.833%	-1.469%
-3.055%	12	-2.561%	-3.055%	0.495%
-2.261%	13	1.126%	-2.261%	3.388%
0.000%	14	0.000%	0.000%	0.000%
-1.950%	15	-2.723%	-1.950%	-0.773%

**Figure 31.** Detail result for the Zero-One Model produced by this software

Testing period		FTSE AL days	BOC	expected : abnormal return	
alpha	-0.00602	-15	-0.01841	-0.60%	-1.24%
0	-0.01975	-14	0.008206	-1.98%	2.80%
beta	-0.00482	-13	-0.02326	-0.48%	-1.84%
1	-0.01311	-12	-0.0119	-1.31%	0.12%
	-0.00837	-11	-0.03133	-0.84%	-2.30%
	-0.00106	-10	-0.0398	-0.11%	-3.87%
	-0.00049	-9	0.016839	-0.05%	1.73%
	0.010108	-8	0.006369	1.01%	-0.37%
	-0.00959	-7	-0.01013	-0.96%	-0.05%
	-0.00498	-6	0.007673	-0.50%	1.27%
	-0.00994	-5	-0.02792	-0.99%	-1.80%
	-0.0188	-4	-0.01958	-1.88%	-0.08%
	-0.00564	-3	0.002663	-0.56%	0.83%
	0.012243	-2	0.001328	1.22%	-1.09%
	-0.01336	-1	-0.01857	-1.34%	-0.52%
	-0.02555	0	-0.00541	-2.55%	2.01%
	0.004335	1	0.04212	0.43%	3.78%
	-0.01147	2	0.013038	-1.15%	2.45%
	0.008871	3	0.055341	0.89%	4.65%
	-0.00012	4	-0.00122	-0.01%	-0.11%
	0.026231	5	0.017094	2.62%	-0.91%
	0.006793	6	0.004802	0.68%	-0.20%
	-0.00407	7	0.021505	-0.41%	2.56%
	-0.02941	8	-0.02105	-2.94%	0.84%
	0.00997	9	0.015532	1.00%	0.56%
	0.015459	10	-0.00235	1.55%	-1.78%
	-0.01833	11	-0.03302	-1.83%	-1.47%
	-0.03055	12	-0.02561	-3.06%	0.49%
	-0.02261	13	0.011264	-2.26%	3.39%
	0	14	0	0.00%	0.00%
	-0.0195	15	-0.02723	-1.95%	-0.77%

**Figure 32. Detail result for the Zero-One Model produced by EXCEL**

Then the following figures are the comparison of the Mean-Adjusted Model:

AutoCalculation					
General Result		Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart
Return of Market Index		Calendar Date	Return of Share Price	Expected Return	Abnormal Return
-0.602%	-15		-1.841%	-0.173%	-1.669%
-1.975%	-14		0.821%	-0.173%	0.993%
-0.482%	-13		-2.326%	-0.173%	-2.153%
-1.311%	-12		-1.190%	-0.173%	-1.018%
-0.837%	-11		-3.133%	-0.173%	-2.960%
-0.106%	-10		-3.980%	-0.173%	-3.807%
-0.049%	-9		1.684%	-0.173%	1.857%
1.011%	-8		0.637%	-0.173%	0.810%
-0.959%	-7		-1.013%	-0.173%	-0.840%
-0.498%	-6		0.767%	-0.173%	0.940%
-0.994%	-5		-2.792%	-0.173%	-2.619%
-1.880%	-4		-1.958%	-0.173%	-1.786%
-0.564%	-3		0.266%	-0.173%	0.439%
1.224%	-2		0.133%	-0.173%	0.305%
-1.336%	-1		-1.857%	-0.173%	-1.684%
-2.555%	0		-0.541%	-0.173%	-0.368%
0.434%	1		4.212%	-0.173%	4.385%
-1.147%	2		1.304%	-0.173%	1.476%
0.887%	3		5.534%	-0.173%	5.707%
-0.012%	4		-0.122%	-0.173%	0.051%
2.623%	5		1.709%	-0.173%	1.882%
0.679%	6		0.480%	-0.173%	0.653%
-0.407%	7		2.151%	-0.173%	2.323%
-2.941%	8		-2.105%	-0.173%	-1.933%
0.997%	9		1.553%	-0.173%	1.726%
1.546%	10		-0.235%	-0.173%	-0.063%
-1.833%	11		-3.302%	-0.173%	-3.129%
-3.055%	12		-2.561%	-0.173%	-2.388%
-2.261%	13		1.126%	-0.173%	1.299%
0.000%	14		0.000%	-0.173%	0.173%
-1.950%	15		-2.723%	-0.173%	-2.550%

**Figure 33. Detail result for the Mean-Adjusted Model produced by this software**

Testing period		FTSE AL days	BOC	expected return	abnormal return
alpha	-0.00602	-15	-0.018412	-0.17%	-1.67%
	0	-0.01975	-14	0.0082063	-0.17%
beta	-0.00482	-13	-0.023256	-0.17%	-2.16%
	1	-0.01311	-12	-0.011905	-0.17%
	-0.00837	-11	-0.031325	-0.17%	-2.96%
	-0.00106	-10	-0.039801	-0.17%	-3.81%
	-0.00049	-9	0.0168394	-0.17%	1.85%
	0.010108	-8	0.0063694	-0.17%	0.81%
	-0.00959	-7	-0.010127	-0.17%	-0.84%
	-0.00498	-6	0.0076726	-0.17%	0.94%
	-0.00994	-5	-0.027919	-0.17%	-2.62%
	-0.0188	-4	-0.019582	-0.17%	-1.79%
	-0.00564	-3	0.0026631	-0.17%	0.44%
	0.012243	-2	0.001328	-0.17%	0.30%
	-0.01336	-1	-0.018568	-0.17%	-1.69%
	-0.02555	0	-0.005405	-0.17%	-0.37%
	0.004335	1	0.0421196	-0.17%	4.38%
	-0.01147	2	0.0130378	-0.17%	1.47%
	0.008871	3	0.0553411	-0.17%	5.70%
	-0.00012	4	-0.00122	-0.17%	0.05%
	0.026231	5	0.017094	-0.17%	1.88%
	0.006793	6	0.0048019	-0.17%	0.65%
	-0.00407	7	0.0215054	-0.17%	2.32%
	-0.02941	8	-0.021053	-0.17%	-1.94%
	0.00997	9	0.0155317	-0.17%	1.72%
	0.015459	10	-0.002353	-0.17%	-0.07%
	-0.01833	11	-0.033019	-0.17%	-3.13%
	-0.03055	12	-0.02561	-0.17%	-2.39%
	-0.02261	13	0.0112641	-0.17%	1.30%
	0	14	0	-0.17%	0.17%
	-0.0195	15	-0.027228	-0.17%	-2.55%

**Figure 34. Detail result for the Mean-Adjusted Model produced by EXCEL**

As the above figures show, all the tiny errors are within the acceptable range and are caused by the adoption of different decimal places. Other four companies' detailed comparison checks of the Zero-One Model and the Mean-Adjusted Model will be put in the appendix.

To summarize, in this Testing Chapter, the general results and detailed results generated by this project software has been checked with those results calculated by EXCEL and most of the result values are perfectly match. Some tiny errors arise due to the different decimal places adopted and sometimes the decimal places of a variable in a formula differ, errors will also exist in final result. This software has been proved accurate with no miscalculation.

## **7 Conclusion**

Event study is widely used recent years in finance. It is a method to evaluate the influence of an event on the value of a firm. EXCEL is one option to conduct the required data analysis process, but it takes much time and involves repetitions of copying and pasting. Both the use and the software are error-prone under heavy workload. Also there are several other choices of paid commercial software, but the user has to buy the membership and these types of software all have very complicated interfaces and are not suitable for new user. The aim of this project software is to generate a Java application in response to these problems and to automate the event study data analysis process in order to offer convenience to the user. In addition to providing original price files patterns and result graphic function, this software also gives accurate calculation of needed data and successfully achieves its primary goals.

### **7.1 Evaluation**

The evaluation is based on the achievements and user feedback of this MSc project software.

The advantage of this software is that it is an exclusive event study data generation software, which provides the three most popular return generating models, namely the Market Model, the Zero-One Model and the Mean-Adjusted Model. This package has been implemented by Java so that it is object-oriented and platform independent. It has a user-friendly GUI and provides accurate results and clear comparison together with the graphic functions. The designer of this project software, after studying the way EXCEL and other commercial Software produce event study data analysis, takes the perspective of both the designer and the customer and makes attempts to deliver an easy-to-use program especially a user-friendly GUI.

According to the user feedbacks, there are two major drawbacks within this package. One is the auto-data retrieving function is not implemented. The user thinks it will be much more user-friendly if the data can be collected automatically by the software. The other is this package does not have multiple data processing functions. It will also be of great help if this package can conduct the data analysis of more than one company in the same run. User feedbacks will be put into appendix.

### **7.2 Future improvement**

Besides the two major drawbacks illustrated in the previous sub-chapter, which are retrieving data online and multiple data processing function, there are also small pitfalls that need to be improved in the future. Tasks that need to be improved in the future are listed below:

- Directly read EXCEL.csv files.
- Ignore the last blank lines in the converted document TXT file.
- Auto-manage the inconsistency of the time series of both share price file and market index file.
- Catch error exceptions when the format of the values of the event date, days of positive/negative event period and days of estimation period inputted by the user does not meet the system requirement.
- Add user guide into the software interface for fast check.

### **7.3 Final Summary**

With all efforts made during these three-month program-development phase, a piece of user-friendly event study application has been developed successfully. Much experience gained on the problem solving of this MSc project software. Both the ability of coding and Java programming has been enhanced.

## **References**

[1] Event Study, McWilliams and Siegel, 1997

[http://en.wikipedia.org/wiki/Event\\_study](http://en.wikipedia.org/wiki/Event_study)

[2] Event Study, McWilliams and Siegel, 1997

[http://en.wikipedia.org/wiki/Event\\_study](http://en.wikipedia.org/wiki/Event_study)

[3] Event Study Basic method, Ronald J. Gilson and Bernard S. Black 1995, 194-5

[http://en.wikipedia.org/wiki/Event\\_study](http://en.wikipedia.org/wiki/Event_study)

[4] MacKinlay, A. C. "Event Studies in Economics and Finance," Journal of Economic Literature Vol. XXXV, Issue 1, 1997).

<http://www.jstor.org/pss/2729691>

[5] Campbell R. Harvey, 2004

<http://en.wikipedia.org/wiki/>

[6] Farlex Financial Dictionary. © 2009 Farlex, Inc

<http://financial-dictionary.thefreedictionary.com/Market+Model>

[7] Linear regression, Wikipedia

[http://en.wikipedia.org/wiki/Linear\\_regression](http://en.wikipedia.org/wiki/Linear_regression)

[8] Dissertation Presentation, Kevin Campbell, 2005

[9] Dissertation Presentation, Kevin Campbell, 2005

[10] Eventus Cowan Research LC, 2010

<http://www.eventstudy.com/>

[11] What's new in Eventus, 2010

<http://www.eventstudy.com/>

[12] What's new in Eventus, 2010

<http://www.eventstudy.com/>

[13] Class Diagram

[http://en.wikipedia.org/wiki/Class\\_diagram](http://en.wikipedia.org/wiki/Class_diagram)

## **Bibliography**

Java for Students, Douglas Bell & Mike Parr, fifth edition, 2006

Java in a Nutshell, David Flanagan, 4<sup>th</sup> Edition, 2002

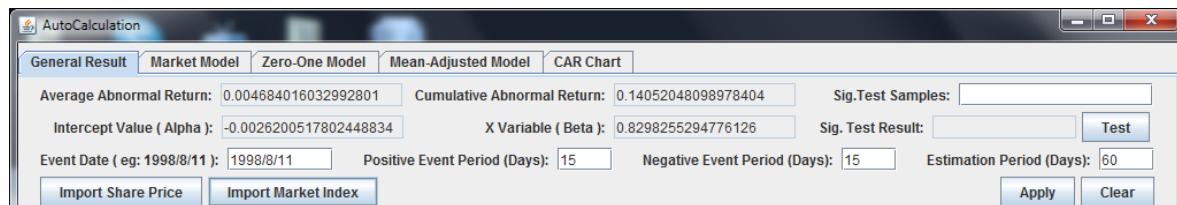
Introduction to econometrics, Christopher Dougherty, Third Edition, 2002

Fibonacci Trader, Gary Scott Scullion, 2006

## Appendix 1

General result comparison: (Alpha, Beta, Cumulative abnormal return, Average abnormal return)

1. BOC event happed on 11-Aug-1998 :



**Figure 35.** BOC general results by software

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.394543494							
R Square	0.155664569							
Adjusted R Square	0.141107061							
Standard Error	0.015538799							
Observations	60							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	0.002581889	0.00258	10.6931	0.001811985	alpha -0.002620052		
Residual	58	0.014004348	0.00024			beta 0.829825529		
Total	59	0.016586237						
Coefficients Standard Error t Stat P-value Lower 95% Upper 95% Lower 95% Upper 95%								
Intercept	-0.002620052	0.002024563	-1.29413	0.20075	-0.006672653	0.00143	-0.00667	0.00143
X Variable 1	0.829825529	0.253767158	3.27003	0.00181	0.321855753	1.3378	0.32186	1.3378
Cumulative AR 14.05% Average AR 0.45%								

**Figure 36.** BOC general results by EXCEL

2. COURTAULDS PLC event happed on 20-May-1998:

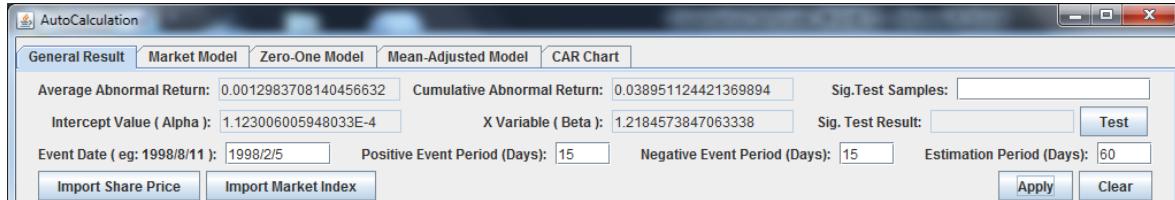


**Figure 37.** COURTAULDS PLC general results by software

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.33121							
R Square	0.1097							
Adjusted R Square	0.09435							
Standard E	0.0392							
Observatio	60							
ANOVA								
	df	SS	MS	F	Significance F			
Regressio	1	0.01098	0.01098	7.14682	0.00974	alpha 0.007247063		
Residual	58	0.08915	0.00154			beta 2.049467736		
Total	59	0.10013						
Coefficients Standard Err t Stat P-value Lower 95% Upper 95% Lower 95% Upper 95%								
Intercept	0.00725	0.00511	1.41829	0.16146	-0.00298	0.01748	-0.00298	0.01748
X Variable	2.04947	0.76663	2.67335	0.00974	0.5149	3.58404	0.5149	3.58404
Cumulative AR -30.22% Average AR -0.97%								

**Figure 38. COURTAULDS PLC general results by EXCEL**

3. ICI IMPERIAL CHEMICAL INDUSTRIES PLC event happed on 5-Feb-1998

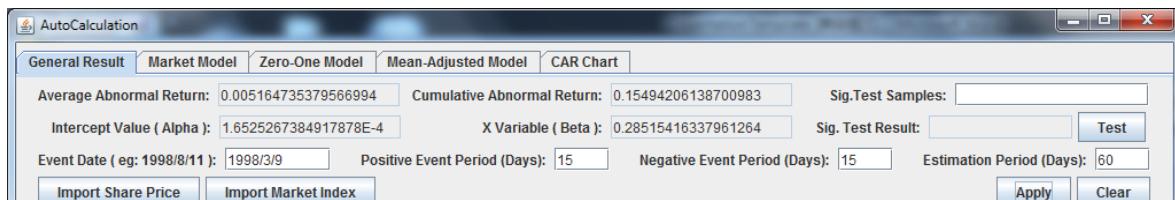


**Figure 39. ICI IMPERIAL CHEMICAL INDUSTRIES PLC general results by software**

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0.69846								
R Square	0.48785								
Adjusted R	0.47902								
Standard E	0.01431								
Observatio	60								
ANOVA									
	df	SS	MS	F	gnificance F				
Regression	1	0.01131	0.01131	55.2472	5.5E-10				
Residual	58	0.01187	0.0002						
Total	59	0.02318							
Cumulative AR									
	Coefficient	standard Err	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	3.90%
Intercept	0.00011	0.00185	0.0608	0.95173	-0.00359	0.00381	-0.00359	0.00381	Average AR
X Variable	1.21846	0.16393	7.43285	5.5E-10	0.89032	1.5466	0.89032	1.5466	0.13%

**Figure 40. ICI IMPERIAL CHEMICAL INDUSTRIES PLC general results by EXCEL**

4. LAPORTE PLC event happened on 9-Mar-1998



**Figure 41. LAPORTE PLC general results by software**

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0.18153								
R Square	0.03295								
Adjusted R	0.01628								
Standard E	0.01351								
Observatio	60								
ANOVA									
	df	SS	MS	F	gnificance F				
Regression	1	0.00036	0.00036	1.97649	0.1651				
Residual	58	0.01058	0.00018						
Total	59	0.01094							
Cumulative AR									
	Coefficient	standard Err	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	15.49%
Intercept	0.00017	0.00178	0.09289	0.92631	-0.0034	0.00373	-0.0034	0.00373	Average AR
X Variable	0.28515	0.20283	1.40588	0.1651	-0.12085	0.69116	-0.12085	0.69116	0.50%

**Figure 42. LAPORTE PLC general results by EXCEL**

5. YULE CATTO & CO PLC event happened on 26-Mar-1998



**Figure 43. YULE CATTO & CO PLC general results by software**

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0.03385								
R Square	0.00115								
Adjusted R	-0.01608								
Standard E	0.01285								
Observatio	60								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	1.1E-05	1.1E-05	0.06654	0.79736				
Residual	58	0.00958	0.00017						
Total	59	0.00959							
Coefficients Standard Error t Stat P-value Lower 95% Upper 95% Lower 95.0% Upper 95.0%									
Intercept	0.00318	0.0017	1.87269	0.06615	-0.00022	0.00659	-0.00022	0.00659	
X Variable	0.05281	0.20475	0.25794	0.79736	-0.35703	0.46265	-0.35703	0.46265	
alpha									
0.003184533									
beta									
0.052812971									
Cumulative AR									
-1.95%									
Average AR									
-0.06%									

**Figure 44. YULE CATTO & CO PLC general results by EXCEL**

#### Detail result comparison:

##### 1. BOC the Market Model

AutoCalculation							
General Result		Market Model		Zero-One Model		Mean-Adjusted Model	
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return	(Alpha=0) Exp. Return	(Alpha=0) Abn. Return	
-0.602%	-15	-1.841%	-0.761%	-1.080%	-0.499%	-1.342%	
-1.975%	-14	0.821%	-1.901%	2.722%	-1.639%	2.460%	
-0.482%	-13	-2.326%	-0.662%	-1.663%	-0.400%	-1.925%	
-1.311%	-12	-1.190%	-1.350%	0.160%	-1.088%	-0.102%	
-0.837%	-11	-3.133%	-0.957%	-2.176%	-0.695%	-2.438%	
-0.106%	-10	-3.980%	-0.350%	-3.630%	-0.088%	-3.892%	
-0.049%	-9	1.684%	-0.303%	1.987%	-0.041%	1.725%	
1.011%	-8	0.637%	0.577%	0.060%	0.839%	-0.202%	
-0.959%	-7	-1.013%	-1.058%	0.045%	-0.796%	-0.217%	
-0.498%	-6	0.767%	-0.676%	1.443%	-0.414%	1.181%	
-0.994%	-5	-2.792%	-1.087%	-1.705%	-0.825%	-1.967%	
-1.880%	-4	-1.958%	-1.822%	-0.136%	-1.560%	-0.398%	
-0.564%	-3	0.266%	-0.730%	0.996%	-0.468%	0.734%	
1.224%	-2	0.133%	0.754%	-0.621%	1.016%	-0.883%	
-1.336%	-1	-1.857%	-1.371%	-0.486%	-1.109%	-0.748%	
-2.555%	0	-0.541%	-2.382%	1.842%	-2.120%	1.580%	
0.434%	1	4.212%	0.098%	4.114%	0.360%	3.852%	
-1.147%	2	1.304%	-1.214%	2.518%	-0.952%	2.256%	
0.887%	3	5.534%	0.474%	5.060%	0.736%	4.798%	
-0.012%	4	-0.122%	-0.272%	0.150%	-0.010%	-0.112%	
2.623%	5	1.709%	1.915%	-0.205%	2.177%	-0.467%	
0.679%	6	0.480%	0.302%	0.178%	0.564%	-0.084%	
-0.407%	7	2.151%	-0.599%	2.750%	-0.337%	2.488%	
-2.941%	8	-2.105%	-2.702%	0.597%	-2.440%	0.335%	
0.997%	9	1.553%	0.565%	0.988%	0.827%	0.726%	
1.546%	10	-0.235%	1.021%	-1.256%	1.283%	-1.518%	
-1.833%	11	-3.302%	-1.783%	-1.519%	-1.521%	-1.781%	
-3.055%	12	-2.561%	-2.798%	0.237%	-2.536%	-0.025%	
-2.261%	13	1.126%	-2.138%	3.265%	-1.876%	3.003%	
0.000%	14	0.000%	-0.262%	0.262%	0.000%	0.000%	
-1.950%	15	-2.723%	-1.880%	-0.843%	-1.618%	-1.105%	

**Figure 45. BOC the Market Model detail results by software**

FTSE ALL UK days	BOC	estimated return	abnormal return	alpha=0	
				estimated return	abnormal return
-0.60%	-15	-1.84%	-0.76%	-1.08%	-0.50%
-1.98%	-14	0.82%	-1.90%	2.72%	-1.64%
-0.48%	-13	-2.33%	-0.66%	-1.66%	-0.40%
-1.31%	-12	-1.19%	-1.35%	0.16%	-1.09%
-0.84%	-11	-3.13%	-0.96%	-2.18%	-0.69%
-0.11%	-10	-3.98%	-0.35%	-3.63%	-0.09%
-0.05%	-9	1.68%	-0.30%	1.99%	-0.04%
1.01%	-8	0.64%	0.58%	0.06%	0.84%
-0.96%	-7	-1.01%	-1.06%	0.05%	-0.80%
-0.50%	-6	0.77%	-0.68%	1.44%	-0.41%
-0.99%	-5	-2.79%	-1.09%	-1.71%	-0.82%
-1.88%	-4	-1.96%	-1.82%	-0.14%	-1.56%
-0.56%	-3	0.27%	-0.73%	1.00%	-0.47%
1.22%	-2	0.13%	0.75%	-0.62%	1.02%
-1.34%	-1	-1.86%	-1.37%	-0.49%	-1.11%
-2.55%	0	<b>-0.54%</b>	-2.38%	1.84%	-2.12%
0.43%	1	4.21%	0.10%	4.11%	0.36%
-1.15%	2	1.30%	-1.21%	2.52%	-0.95%
0.89%	3	5.53%	0.47%	5.06%	0.74%
-0.01%	4	-0.12%	-0.27%	0.15%	-0.01%
2.62%	5	1.71%	1.91%	-0.21%	2.18%
0.68%	6	0.48%	0.30%	0.18%	0.56%
-0.41%	7	2.15%	-0.60%	2.75%	-0.34%
-2.94%	8	-2.11%	-2.70%	0.60%	-2.44%
1.00%	9	1.55%	0.57%	0.99%	0.83%
1.55%	10	-0.24%	1.02%	-1.26%	1.28%
-1.83%	11	-3.30%	-1.78%	-1.52%	-1.52%
-3.06%	12	-2.56%	-2.80%	0.24%	-2.54%
-2.26%	13	1.13%	-2.14%	3.26%	-1.88%
0.00%	14	0.00%	-0.26%	0.26%	0.00%
-1.95%	15	-2.72%	-1.88%	-0.84%	-1.62%

**Figure 46. BOC the Market Model detail results by EXCEL**

BOC the Zero-One Model:

AutoCalculation					
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart	
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return	
-0.602%	-15	-1.841%	-0.602%	-1.239%	
-1.975%	-14	0.821%	-1.975%	2.796%	
-0.482%	-13	-2.326%	-0.482%	-1.843%	
-1.311%	-12	-1.190%	-1.311%	0.121%	
-0.837%	-11	-3.133%	-0.837%	-2.295%	
-0.106%	-10	-3.980%	-0.106%	-3.874%	
-0.049%	-9	1.684%	-0.049%	1.733%	
1.011%	-8	0.637%	1.011%	-0.374%	
-0.959%	-7	-1.013%	-0.959%	-0.054%	
-0.498%	-6	0.767%	-0.498%	1.266%	
-0.994%	-5	-2.792%	-0.994%	-1.798%	
-1.880%	-4	-1.958%	-1.880%	-0.078%	
-0.564%	-3	0.266%	-0.564%	0.830%	
1.224%	-2	0.133%	1.224%	-1.091%	
-1.336%	-1	-1.857%	-1.336%	-0.521%	
-2.555%	0	-0.541%	-2.555%	2.014%	
0.434%	1	4.212%	0.434%	3.778%	
-1.147%	2	1.304%	-1.147%	2.451%	
0.887%	3	5.534%	0.887%	4.647%	
-0.012%	4	-0.122%	-0.012%	-0.110%	
2.623%	5	1.709%	2.623%	-0.914%	
0.679%	6	0.480%	0.679%	-0.199%	
-0.407%	7	2.151%	-0.407%	2.557%	
-2.941%	8	-2.105%	-2.941%	0.835%	
0.997%	9	1.553%	0.997%	0.556%	
1.546%	10	-0.235%	1.546%	-1.781%	
-1.833%	11	-3.302%	-1.833%	-1.469%	
-3.055%	12	-2.561%	-3.055%	0.495%	
-2.261%	13	1.126%	-2.261%	3.388%	
0.000%	14	0.000%	0.000%	0.000%	
-1.950%	15	-2.723%	-1.950%	-0.773%	

**Figure 47. BOC the Zero-One Model detail results by software**

	FTSE AL days	BOC	expected	abnormal
alpha	-0.00602	-15 -0.01841	-0.60%	-1.24%
	0 -0.01975	-14 0.008206	-1.98%	2.80%
beta	-0.00482	-13 -0.02326	-0.48%	-1.84%
1	-0.01311	-12 -0.0119	-1.31%	0.12%
	-0.00837	-11 -0.03133	-0.84%	-2.30%
	-0.00106	-10 -0.0398	-0.11%	-3.87%
	-0.00049	-9 0.016839	-0.05%	1.73%
	0.010108	-8 0.006369	1.01%	-0.37%
	-0.00959	-7 -0.01013	-0.96%	-0.05%
	-0.00498	-6 0.007673	-0.50%	1.27%
	-0.00994	-5 -0.02792	-0.99%	-1.80%
	-0.0188	-4 -0.01958	-1.88%	-0.08%
	-0.00564	-3 0.002663	-0.56%	0.83%
	0.012243	-2 0.001328	1.22%	-1.09%
	-0.01336	-1 -0.01857	-1.34%	-0.52%
	-0.02555	0 -0.00541	-2.55%	2.01%
	0.004335	1 0.04212	0.43%	3.78%
	-0.01147	2 0.013038	-1.15%	2.45%
	0.008871	3 0.055341	0.89%	4.65%
	-0.00012	4 -0.00122	-0.01%	-0.11%
	0.026231	5 0.017094	2.62%	-0.91%
	0.006793	6 0.004802	0.68%	-0.20%
	-0.00407	7 0.021505	-0.41%	2.56%
	-0.02941	8 -0.02105	-2.94%	0.84%
	0.00997	9 0.015532	1.00%	0.56%
	0.015459	10 -0.00235	1.55%	-1.78%
	-0.01833	11 -0.03302	-1.83%	-1.47%
	-0.03055	12 -0.02561	-3.06%	0.49%
	-0.02261	13 0.011264	-2.26%	3.39%
	0	14 0 0.00%	0.00%	0.00%
	-0.0195	15 -0.02723	-1.95%	-0.77%

**Figure 48. BOC the Zero-One Model detail results by EXCEL**

## 2. COURTAULDS PLC the Market Model:

AutoCalculation						
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart		
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return	(Alpha=0) Exp. Return	(Alpha=0) Abn. Return
0.361%	-15	-0.449%	1.465%	-1.915%	0.740%	-1.190%
1.403%	-14	-0.451%	3.599%	-4.051%	2.875%	-3.326%
1.211%	-13	0.000%	3.207%	-3.207%	2.482%	-2.482%
0.000%	-12	0.000%	0.725%	-0.725%	0.000%	0.000%
-0.192%	-11	0.227%	0.332%	-0.105%	-0.393%	0.620%
0.173%	-10	0.226%	1.080%	-0.853%	0.355%	-0.129%
-0.677%	-9	-0.451%	-0.663%	0.212%	-1.388%	0.936%
0.571%	-8	0.000%	1.895%	-1.895%	1.170%	-1.170%
0.896%	-7	5.215%	2.562%	2.654%	1.837%	3.378%
-0.855%	-6	1.940%	-1.027%	2.967%	-1.752%	3.691%
0.245%	-5	-0.211%	1.227%	-1.438%	0.502%	-0.714%
-0.276%	-4	0.000%	0.160%	-0.160%	-0.565%	0.565%
-0.382%	-3	0.000%	-0.059%	0.059%	-0.784%	0.784%
-1.178%	-2	-0.424%	-1.689%	1.266%	-2.414%	1.990%
0.694%	-1	0.000%	2.148%	-2.148%	1.423%	-1.423%
0.507%	0	0.000%	1.764%	-1.764%	1.039%	-1.039%
0.470%	1	0.000%	1.687%	-1.687%	0.962%	-0.962%
0.401%	2	0.213%	1.548%	-1.335%	0.823%	-0.610%
0.000%	3	0.000%	0.725%	-0.725%	0.000%	0.000%
0.273%	4	-0.212%	1.284%	-1.496%	0.559%	-0.771%
-1.438%	5	-0.426%	-2.221%	1.796%	-2.946%	2.521%
-0.054%	6	0.427%	0.613%	-0.186%	-0.111%	0.539%
0.125%	7	-0.426%	0.981%	-1.407%	0.256%	-0.682%
-0.454%	8	-0.855%	-0.206%	-0.648%	-0.931%	0.076%
0.055%	9	0.431%	0.838%	-0.407%	0.113%	0.318%
0.809%	10	-4.721%	2.384%	-7.105%	1.659%	-6.380%
-0.482%	11	0.000%	-0.264%	0.264%	-0.988%	0.988%
1.171%	12	0.000%	3.124%	-3.124%	2.399%	-2.399%
1.246%	13	0.225%	3.279%	-3.053%	2.554%	-2.329%
-0.197%	14	0.000%	0.322%	-0.322%	-0.403%	0.403%
-0.511%	15	0.000%	-0.322%	0.322%	-1.047%	1.047%

**Figure 49. COURTAULDS PLC the Market Model detail results by software**

	FTSE ALL UK	days	COURTAULDS estimated return	abnormal return	estimated return	abnormal return
alpha	0.36%	-15	-0.45%	1.47%	-1.91%	0.74%
0.007247063	1.40%	-14	-0.45%	3.60%	-4.05%	2.87%
beta	1.21%	-13	0.00%	3.21%	-3.21%	2.48%
2.049467736	0.00%	-12	0.00%	0.72%	-0.72%	0.00%
	-0.19%	-11	0.23%	0.33%	-0.11%	-0.39%
	0.17%	-10	0.23%	1.08%	-0.85%	0.35%
<b>Cumulative AR</b>	<b>-0.68%</b>	<b>-9</b>	<b>-0.45%</b>	<b>-0.66%</b>	<b>0.21%</b>	<b>-1.39%</b>
<b>-30.22%</b>	<b>0.57%</b>	<b>-8</b>	<b>0.00%</b>	<b>1.89%</b>	<b>-1.89%</b>	<b>1.17%</b>
<b>Average AR</b>	<b>0.90%</b>	<b>-7</b>	<b>5.22%</b>	<b>2.56%</b>	<b>2.65%</b>	<b>1.84%</b>
<b>-0.97%</b>	<b>-0.85%</b>	<b>-6</b>	<b>1.94%</b>	<b>-1.03%</b>	<b>2.97%</b>	<b>-1.75%</b>
	0.25%	-5	-0.21%	1.23%	-1.44%	0.50%
	-0.28%	-4	0.00%	0.16%	-0.16%	-0.56%
	-0.38%	-3	0.00%	-0.06%	0.06%	-0.78%
	-1.18%	-2	-0.42%	-1.69%	1.27%	-2.41%
	0.69%	-1	0.00%	2.15%	-2.15%	1.42%
	0.51%	0	0.00%	1.76%	-1.76%	1.04%
	0.47%	1	0.00%	1.69%	-1.69%	0.96%
	0.40%	2	0.21%	1.55%	-1.33%	0.82%
	0.00%	3	0.00%	0.72%	-0.72%	0.00%
	0.27%	4	-0.21%	1.28%	-1.50%	0.56%
	-1.44%	5	-0.43%	-2.22%	1.80%	-2.95%
	-0.05%	6	0.43%	0.61%	-0.19%	-0.11%
	0.13%	7	-0.43%	0.98%	-1.41%	0.26%
	-0.45%	8	-0.85%	-0.21%	-0.65%	-0.93%
	0.06%	9	0.43%	0.84%	-0.41%	0.11%
	0.81%	10	-4.72%	2.38%	-7.10%	1.66%
	-0.48%	11	0.00%	-0.26%	0.26%	-0.99%
	1.17%	12	0.00%	3.12%	-3.12%	2.40%
	1.25%	13	0.23%	3.28%	-3.05%	2.55%
	-0.20%	14	0.00%	0.32%	-0.32%	-0.40%
	-0.51%	15	0.00%	-0.32%	0.32%	-1.05%
						1.05%

**Figure 50.** COURTAULDS PLC the Market Model detail results by EXCEL  
COURTAULDS PLC the Zero-One Model:

AutoCalculation					
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart	
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return	
0.361%	-15	-0.449%	0.361%	-0.811%	
1.403%	-14	-0.451%	1.403%	-1.854%	
1.211%	-13	0.000%	1.211%	-1.211%	
0.000%	-12	0.000%	0.000%	0.000%	
-0.192%	-11	0.227%	-0.192%	0.418%	
0.173%	-10	0.226%	0.173%	0.053%	
-0.677%	-9	-0.451%	-0.677%	0.226%	
0.571%	-8	0.000%	0.571%	-0.571%	
0.896%	-7	5.215%	0.896%	4.319%	
-0.855%	-6	1.940%	-0.855%	2.794%	
0.245%	-5	-0.211%	0.245%	-0.456%	
-0.276%	-4	0.000%	-0.276%	0.276%	
-0.382%	-3	0.000%	-0.382%	0.382%	
-1.178%	-2	-0.424%	-1.178%	0.754%	
0.694%	-1	0.000%	0.694%	-0.694%	
0.507%	0	0.000%	0.507%	-0.507%	
0.470%	1	0.000%	0.470%	-0.470%	
0.401%	2	0.213%	0.401%	-0.189%	
0.000%	3	0.000%	0.000%	0.000%	
0.273%	4	-0.212%	0.273%	-0.485%	
-1.438%	5	-0.426%	-1.438%	1.012%	
-0.054%	6	0.427%	-0.054%	0.482%	
0.125%	7	-0.426%	0.125%	-0.551%	
-0.454%	8	-0.855%	-0.454%	-0.400%	
0.055%	9	0.431%	0.055%	0.376%	
0.809%	10	-4.721%	0.809%	-5.530%	
-0.482%	11	0.000%	-0.482%	0.482%	
1.171%	12	0.000%	1.171%	-1.171%	
1.246%	13	0.225%	1.246%	-1.021%	
-0.197%	14	0.000%	-0.197%	0.197%	
-0.511%	15	0.000%	-0.511%	0.511%	

**Figure 51.** COURTAULDS PLC the Zero-One Model detail results by software

	FTSE AL days	COURTA	expected	abnormal
alpha	0.003612	-15	-0.00449	0.36%
0.007247	0.014027	-14	-0.00451	1.40%
beta	0.012112	-13	0	1.21%
2.049468	0	-12	0	0.00%
	-0.00192	-11	0.002268	-0.19%
	0.001732	-10	0.002262	0.17%
	-0.00677	-9	-0.00451	-0.68%
	0.005708	-8	0	0.57%
	0.008964	-7	0.052154	0.90%
	-0.00855	-6	0.019397	-0.85%
	0.00245	-5	-0.00211	0.25%
	-0.00276	-4	0	-0.28%
	-0.00382	-3	0	-0.38%
	-0.01178	-2	-0.00424	-1.18%
	0.006943	-1	0	0.69%
	0.00507	0	0	0.51%
	0.004696	1	0	0.47%
	0.004015	2	0.002128	0.40%
	0	3	0	0.00%
	0.002728	4	-0.00212	0.27%
	-0.01438	5	-0.00426	-1.44%
	-0.00054	6	0.004274	-0.05%
	0.001251	7	-0.00426	0.13%
	-0.00454	8	-0.00855	-0.45%
	0.000552	9	0.00431	0.06%
	0.008094	10	-0.04721	0.81%
	-0.00482	11	0	-0.48%
	0.011707	12	0	1.17%
	0.012461	13	0.002252	1.25%
	-0.00197	14	0	-0.20%
	-0.00511	15	0	-0.51%

**Figure 52. COURTAULDS PLC the Zero-One Model detail results by EXCEL**

### 3. ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Market Model:

AutoCalculation						
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart		
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return	(Alpha=0) Exp. Return	(Alpha=0) Abn. Return
0.847%	-15	2.688%	1.043%	1.645%	1.032%	1.656%
1.433%	-14	-2.618%	1.757%	-4.375%	1.746%	-4.364%
0.242%	-13	-0.753%	0.306%	-1.059%	0.295%	-1.048%
0.023%	-12	-1.733%	0.039%	-1.773%	0.028%	-1.762%
-0.063%	-11	1.103%	-0.065%	1.168%	-0.077%	1.179%
-0.337%	-10	-0.872%	-0.399%	-0.473%	-0.411%	-0.462%
-1.067%	-9	-1.430%	-1.289%	-0.141%	-1.300%	-0.130%
0.780%	-8	0.000%	0.962%	-0.962%	0.951%	-0.951%
1.267%	-7	0.223%	1.555%	-1.332%	1.544%	-1.321%
0.784%	-6	1.670%	0.966%	0.704%	0.955%	0.716%
0.797%	-5	1.095%	0.982%	0.113%	0.971%	0.124%
0.604%	-4	1.733%	0.747%	0.986%	0.736%	0.998%
2.065%	-3	0.532%	2.527%	-1.995%	2.516%	-1.984%
0.329%	-2	1.059%	0.412%	0.647%	0.401%	0.658%
-0.154%	-1	-1.572%	-0.176%	-1.398%	-0.187%	-1.385%
0.241%	0	4.153%	0.305%	3.848%	0.294%	3.859%
0.388%	1	1.738%	0.484%	1.255%	0.472%	1.266%
-0.351%	2	-1.206%	-0.416%	-0.790%	-0.428%	-0.778%
0.208%	3	3.052%	0.265%	2.787%	0.253%	2.798%
-0.047%	4	3.455%	-0.046%	3.501%	-0.058%	3.513%
-0.781%	5	1.145%	-0.940%	2.085%	-0.951%	2.096%
0.435%	6	1.887%	0.541%	1.346%	0.530%	1.357%
0.521%	7	1.019%	0.646%	0.372%	0.635%	0.383%
1.287%	8	-0.550%	1.579%	-2.129%	1.568%	-2.118%
0.220%	9	-0.645%	0.280%	-0.925%	0.268%	-0.913%
-0.058%	10	-0.742%	-0.059%	-0.683%	-0.070%	-0.672%
0.500%	11	1.121%	0.621%	0.501%	0.609%	0.512%
-0.584%	12	-2.588%	-0.700%	-1.888%	-0.711%	-1.877%
-0.716%	13	0.854%	-0.861%	1.715%	-0.873%	1.726%
1.392%	14	2.634%	1.707%	0.927%	1.696%	0.938%
0.491%	15	0.825%	0.610%	0.215%	0.599%	0.226%

**Figure 53. ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Market Model detail results by software**

	FTSE ALL UK	days	ICI	estimated return	abnormal return	estimated return	abnormal return
alpha	0.85%	-15	2.69%	1.04%	1.65%	1.03%	1.66%
0.000112301	1.43%	-14	-2.62%	1.76%	-4.38%	1.75%	-4.36%
beta	0.24%	-13	-0.75%	0.31%	-1.06%	0.30%	-1.05%
1.218457385	0.02%	-12	-1.73%	0.04%	-1.77%	0.03%	-1.76%
	-0.06%	-11	1.10%	-0.07%	1.17%	-0.08%	1.18%
	-0.34%	-10	-0.87%	-0.40%	-0.47%	-0.41%	-0.46%
Cumulative AR	-1.07%	-9	-1.43%	-1.29%	-0.14%	-1.30%	-0.13%
3.90%	0.78%	-8	0.00%	0.96%	-0.96%	0.95%	-0.95%
Average AR	1.27%	-7	0.22%	1.56%	-1.33%	1.54%	-1.32%
0.13%	0.78%	-6	1.67%	0.97%	0.70%	0.95%	0.72%
	0.80%	-5	1.10%	0.98%	0.11%	0.97%	0.12%
	0.60%	-4	1.73%	0.75%	0.99%	0.74%	1.00%
	2.06%	-3	0.53%	2.53%	-1.99%	2.52%	-1.98%
	0.33%	-2	1.06%	0.41%	0.65%	0.40%	0.66%
	-0.15%	-1	-1.57%	-0.18%	-1.40%	-0.19%	-1.39%
	0.24%	0	4.15%	0.31%	3.85%	0.29%	3.86%
	0.39%	1	1.74%	0.48%	1.25%	0.47%	1.27%
	-0.35%	2	-1.21%	-0.42%	-0.79%	-0.43%	-0.78%
	0.21%	3	3.05%	0.26%	2.79%	0.25%	2.80%
	-0.05%	4	3.46%	-0.05%	3.50%	-0.06%	3.51%
	-0.78%	5	1.15%	-0.94%	2.09%	-0.95%	2.10%
	0.43%	6	1.89%	0.54%	1.35%	0.53%	1.36%
	0.52%	7	1.02%	0.65%	0.37%	0.64%	0.38%
	1.29%	8	-0.55%	1.58%	-2.13%	1.57%	-2.12%
	0.22%	9	-0.65%	0.28%	-0.92%	0.27%	-0.91%
	-0.06%	10	-0.74%	-0.06%	-0.68%	-0.07%	-0.67%
	0.50%	11	1.12%	0.62%	0.50%	0.61%	0.51%
	-0.58%	12	-2.59%	-0.70%	-1.89%	-0.71%	-1.88%
	-0.72%	13	0.85%	-0.86%	1.72%	-0.87%	1.73%
	1.39%	14	2.63%	1.71%	0.93%	1.70%	0.94%
	0.49%	15	0.82%	0.61%	0.22%	0.60%	0.23%

**Figure 54. ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Market Model detail results by EXCEL**

ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Zero-One Model:

General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart
	Return of Market Index	Calendar Date	Return of Share Price	Expected Return
0.847%	-15	2.688%	0.847%	1.841%
1.433%	-14	-2.618%	1.433%	-4.051%
0.242%	-13	-0.753%	0.242%	-0.995%
0.023%	-12	-1.733%	0.023%	-1.757%
-0.063%	-11	1.103%	-0.063%	1.165%
-0.337%	-10	-0.872%	-0.337%	-0.536%
-1.067%	-9	-1.430%	-1.067%	-0.363%
0.780%	-8	0.000%	0.780%	-0.780%
1.267%	-7	0.223%	1.267%	-1.044%
0.784%	-6	1.670%	0.784%	0.887%
0.797%	-5	1.095%	0.797%	0.298%
0.604%	-4	1.733%	0.604%	1.129%
2.065%	-3	0.532%	2.065%	-1.532%
0.329%	-2	1.059%	0.329%	0.730%
-0.154%	-1	-1.572%	-0.154%	-1.419%
0.241%	0	4.153%	0.241%	3.912%
0.388%	1	1.738%	0.388%	1.351%
-0.351%	2	-1.206%	-0.351%	-0.855%
0.208%	3	3.052%	0.208%	2.844%
-0.047%	4	3.455%	-0.047%	3.502%
-0.781%	5	1.145%	-0.781%	1.926%
0.435%	6	1.887%	0.435%	1.452%
0.521%	7	1.019%	0.521%	0.497%
1.287%	8	-0.550%	1.287%	-1.836%
0.220%	9	-0.645%	0.220%	-0.865%
-0.058%	10	-0.742%	-0.058%	-0.684%
0.500%	11	1.121%	0.500%	0.621%
-0.584%	12	-2.588%	-0.584%	-2.004%
-0.716%	13	0.854%	-0.716%	1.570%
1.392%	14	2.634%	1.392%	1.242%
0.491%	15	0.825%	0.491%	0.334%

**Figure 55. ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Zero-One Model detail results by software**

	FTSE AL days	ICI	expected	abnormal
alpha	0.008469	-15	0.026882	0.85% 1.84%
0.000112	0.014332	-14	-0.02618	1.43% -4.05%
beta	0.002421	-13	-0.00753	0.24% -0.99%
1.218457	0.000231	-12	-0.01733	0.02% -1.76%
	-0.00063	-11	0.011025	-0.06% 1.17%
	-0.00337	-10	-0.00872	-0.34% -0.54%
	-0.01067	-9	-0.0143	-1.07% -0.36%
	0.007804	-8	0	0.78% -0.78%
	0.012672	-7	0.002232	1.27% -1.04%
	0.007836	-6	0.016704	0.78% 0.89%
	0.007971	-5	0.010953	0.80% 0.30%
	0.00604	-4	0.017335	0.60% 1.13%
	0.020649	-3	0.005325	2.06% -1.53%
	0.003291	-2	0.010593	0.33% 0.73%
	-0.00154	-1	-0.01572	-0.15% -1.42%
	0.002414	0	0.041534	0.24% 3.91%
	0.003877	1	0.017382	0.39% 1.35%
	-0.00351	2	-0.01206	-0.35% -0.86%
	0.00208	3	0.030519	0.21% 2.84%
	-0.00047	4	0.034551	-0.05% 3.50%
	-0.00781	5	0.01145	-0.78% 1.93%
	0.004349	6	0.018868	0.43% 1.45%
	0.005212	7	0.010185	0.52% 0.50%
	0.012865	8	-0.0055	1.29% -1.84%
	0.002202	9	-0.00645	0.22% -0.87%
	-0.00058	10	-0.00742	-0.06% -0.68%
	0.005001	11	0.011215	0.50% 0.62%
	-0.00584	12	-0.02588	-0.58% -2.00%
	-0.00716	13	0.008539	-0.72% 1.57%
	0.013918	14	0.026341	1.39% 1.24%
	0.004913	15	0.008249	0.49% 0.33%

**Figure 56. ICI IMPERIAL CHEMICAL INDUSTRIES PLC the Zero-One Model detail results by EXCEL**

#### 4. LAPORTE PLC the Market Model:

AutoCalculation							
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart			
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return	(Alpha=0) Exp. Return	(Alpha=0) Abn. Return	
0.521%	-15	0.457%	0.165%	0.292%	0.149%	0.309%	
1.287%	-14	0.303%	0.383%	-0.080%	0.367%	-0.063%	
0.220%	-13	0.908%	0.079%	0.828%	0.063%	0.845%	
-0.058%	-12	-0.150%	0.000%	-0.150%	-0.016%	-0.133%	
0.500%	-11	0.000%	0.159%	-0.159%	0.143%	-0.143%	
-0.584%	-10	0.150%	-0.150%	0.300%	-0.166%	0.317%	
-0.716%	-9	-2.549%	-0.188%	-2.361%	-0.204%	-2.345%	
1.392%	-8	2.308%	0.413%	1.894%	0.397%	1.911%	
0.491%	-7	-0.602%	0.157%	-0.758%	0.140%	-0.742%	
0.290%	-6	0.303%	0.099%	0.203%	0.083%	0.220%	
0.910%	-5	3.167%	0.276%	2.892%	0.259%	2.908%	
-0.068%	-4	5.702%	-0.003%	5.705%	-0.019%	5.721%	
-1.013%	-3	-0.415%	-0.272%	-0.143%	-0.289%	-0.126%	
-0.651%	-2	0.000%	-0.169%	0.169%	-0.186%	0.186%	
1.265%	-1	0.417%	0.377%	0.039%	0.361%	0.056%	
0.528%	0	2.490%	0.167%	2.323%	0.150%	2.339%	
0.245%	1	1.889%	0.086%	1.803%	0.070%	1.819%	
0.145%	2	-0.132%	0.058%	-0.190%	0.041%	-0.174%	
-0.360%	3	0.265%	-0.086%	0.351%	-0.103%	0.368%	
-0.052%	4	-0.265%	0.002%	-0.266%	-0.015%	-0.250%	
0.082%	5	-0.133%	0.040%	-0.173%	0.023%	-0.156%	
0.784%	6	0.797%	0.240%	0.557%	0.224%	0.573%	
0.993%	7	0.000%	0.300%	-0.300%	0.283%	-0.283%	
1.390%	8	-0.791%	0.413%	-1.203%	0.398%	-1.187%	
-0.333%	9	0.531%	-0.078%	0.610%	-0.095%	0.626%	
-0.082%	10	0.396%	-0.007%	0.403%	-0.024%	0.420%	
0.471%	11	-0.132%	0.151%	-0.283%	0.134%	-0.266%	
-0.107%	12	2.372%	-0.014%	2.386%	-0.031%	2.402%	
-0.877%	13	0.129%	-0.234%	0.362%	-0.250%	0.379%	
0.509%	14	0.129%	0.162%	-0.033%	0.145%	-0.017%	
-0.375%	15	0.385%	-0.090%	0.476%	-0.107%	0.492%	

**Figure 57. LAPORTE PLC the Market Model detail results by software**

	FTSE ALL UK	days	LAPORTE	estimated return	abnormal return	estimated return	abnormal return
alpha	0.52%	-15	0.46%	0.17%	0.29%	0.15%	0.31%
0.000165253	1.29%	-14	0.30%	0.38%	-0.08%	0.37%	-0.06%
beta	0.22%	-13	0.91%	0.08%	0.83%	0.06%	0.84%
0.285154163	-0.06%	-12	-0.15%	0.00%	-0.15%	-0.02%	-0.13%
	0.50%	-11	0.00%	0.16%	-0.16%	0.14%	-0.14%
	-0.58%	-10	0.15%	-0.15%	0.30%	-0.17%	0.32%
<b>Cumulative AR</b>	<b>-0.72%</b>	<b>-9</b>	<b>-2.55%</b>	<b>-0.19%</b>	<b>-2.36%</b>	<b>-0.20%</b>	<b>-2.34%</b>
<b>15.49%</b>	<b>1.39%</b>	<b>-8</b>	<b>2.31%</b>	<b>0.41%</b>	<b>1.89%</b>	<b>0.40%</b>	<b>1.91%</b>
<b>Average AR</b>	<b>0.49%</b>	<b>-7</b>	<b>-0.60%</b>	<b>0.16%</b>	<b>-0.76%</b>	<b>0.14%</b>	<b>-0.74%</b>
<b>0.50%</b>	<b>0.29%</b>	<b>-6</b>	<b>0.30%</b>	<b>0.10%</b>	<b>0.20%</b>	<b>0.08%</b>	<b>0.22%</b>
	0.91%	-5	3.17%	0.28%	2.89%	0.26%	2.91%
	-0.07%	-4	5.70%	0.00%	5.70%	-0.02%	5.72%
	-1.01%	-3	-0.41%	-0.27%	-0.14%	-0.29%	-0.13%
	-0.65%	-2	0.00%	-0.17%	0.17%	-0.19%	0.19%
	1.27%	-1	0.42%	0.38%	0.04%	0.36%	0.06%
	0.53%	0	2.49%	0.17%	2.32%	0.15%	2.34%
	0.25%	1	1.89%	0.09%	1.80%	0.07%	1.82%
	0.15%	2	-0.13%	0.06%	-0.19%	0.04%	-0.17%
	-0.36%	3	0.27%	-0.09%	0.35%	-0.10%	0.37%
	-0.05%	4	-0.26%	0.00%	-0.27%	-0.01%	-0.25%
	0.08%	5	-0.13%	0.04%	-0.17%	0.02%	-0.16%
	0.78%	6	0.80%	0.24%	0.56%	0.22%	0.57%
	0.99%	7	0.00%	0.30%	-0.30%	0.28%	-0.28%
	1.39%	8	-0.79%	0.41%	-1.20%	0.40%	-1.19%
	-0.33%	9	0.53%	-0.08%	0.61%	-0.09%	0.63%
	-0.08%	10	0.40%	-0.01%	0.40%	-0.02%	0.42%
	0.47%	11	-0.13%	0.15%	-0.28%	0.13%	-0.27%
	-0.11%	12	2.37%	-0.01%	2.39%	-0.03%	2.40%
	-0.88%	13	0.13%	-0.23%	0.36%	-0.25%	0.38%
	0.51%	14	0.13%	0.16%	-0.03%	0.15%	-0.02%
	-0.38%	15	0.39%	-0.09%	0.48%	-0.11%	0.49%

**Figure 58. LAPORTE PLC the Market Model detail results by EXCEL  
LAPORTE PLC the Zero-One Model:**

AutoCalculation					
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart	
	Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return
0.521%	-15	0.457%	0.521%	-0.064%	
1.287%	-14	0.303%	1.287%	-0.983%	
0.220%	-13	0.908%	0.220%	0.688%	
-0.058%	-12	-0.150%	-0.058%	-0.092%	
0.500%	-11	0.000%	0.500%	-0.500%	
-0.584%	-10	0.150%	-0.584%	0.734%	
-0.716%	-9	-2.549%	-0.716%	-1.833%	
1.392%	-8	2.308%	1.392%	0.916%	
0.491%	-7	-0.602%	0.491%	-1.093%	
0.290%	-6	0.303%	0.290%	0.013%	
0.910%	-5	3.167%	0.910%	2.258%	
-0.068%	-4	5.702%	-0.068%	5.770%	
-1.013%	-3	-0.415%	-1.013%	0.598%	
-0.651%	-2	0.000%	-0.651%	0.651%	
1.265%	-1	0.417%	1.265%	-0.849%	
0.528%	0	2.490%	0.528%	1.962%	
0.245%	1	1.889%	0.245%	1.644%	
0.145%	2	-0.132%	0.145%	-0.278%	
-0.360%	3	0.265%	-0.360%	0.626%	
-0.052%	4	-0.265%	-0.052%	-0.213%	
0.082%	5	-0.133%	0.082%	-0.215%	
0.784%	6	0.797%	0.784%	0.013%	
0.993%	7	0.000%	0.993%	-0.993%	
1.390%	8	-0.791%	1.390%	-2.180%	
-0.333%	9	0.531%	-0.333%	0.864%	
-0.082%	10	0.396%	-0.082%	0.479%	
0.471%	11	-0.132%	0.471%	-0.603%	
-0.107%	12	2.372%	-0.107%	2.479%	
-0.877%	13	0.129%	-0.877%	1.006%	
0.509%	14	0.129%	0.509%	-0.381%	
-0.375%	15	0.385%	-0.375%	0.760%	

**Figure 59. LAPORTE PLC the Zero-One Model detail results by software**

	FTSE AL days	LAPORT expected	abnormal	alpha
0.000165	0.005212	-15	0.004573	0.52%
	0.012865	-14	0.003035	-0.98%
beta	0.002202	-13	0.009077	0.22%
0.285154	-0.00058	-12	-0.0015	-0.06%
	0.005001	-11	0	-0.09%
	-0.00584	-10	0.001502	0.50%
	-0.00716	-9	-0.02549	-0.58%
	0.013918	-8	0.023077	0.73%
	0.004913	-7	-0.00602	-1.83%
	0.0029	-6	0.003026	1.39%
	0.009097	-5	0.031674	0.92%
	-0.00068	-4	0.057018	0.01%
	-0.01013	-3	-0.00415	5.77%
	-0.00651	-2	0	-1.09%
	0.012653	-1	0.004167	0.65%
	0.005277	0	0.024896	1.27%
	0.002451	1	0.018893	0.96%
	0.001455	2	-0.00132	0.25%
	-0.0036	3	0.002653	1.64%
	-0.00052	4	-0.00265	-0.28%
	0.000823	5	-0.00133	-0.07%
	0.00784	6	0.007968	-0.21%
	0.009931	7	0	0.78%
	0.013896	8	-0.00791	0.99%
	-0.00333	9	0.005312	-2.18%
	-0.00082	10	-0.003963	-0.33%
	0.004713	11	-0.00132	0.48%
	-0.00107	12	0.023715	-0.60%
	-0.00877	13	0.001287	-0.11%
	0.005091	14	0.001285	2.48%
	-0.00375	15	0.003851	1.01%

**Figure 60. LAPORTE PLC the Zero-One Model detail results by EXCEL**

## 5. YULE CATTO & CO PLC the Market Model:

AutoCalculation						
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart		
Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return	(Alpha=0) Exp. Return	(Alpha=0) Abn. Return
-0.651%	-15	0.000%	0.284%	-0.284%	-0.034%	0.034%
1.265%	-14	0.000%	0.385%	-0.385%	0.067%	-0.067%
0.528%	-13	0.000%	0.346%	-0.346%	0.028%	-0.028%
0.245%	-12	0.000%	0.331%	-0.331%	0.013%	-0.013%
0.145%	-11	0.000%	0.326%	-0.326%	0.008%	-0.008%
-0.360%	-10	0.000%	0.299%	-0.299%	-0.019%	0.019%
-0.052%	-9	0.000%	0.316%	-0.316%	-0.003%	0.003%
0.082%	-8	0.000%	0.323%	-0.323%	0.004%	-0.004%
0.784%	-7	0.000%	0.360%	-0.360%	0.041%	-0.041%
0.993%	-6	0.888%	0.371%	0.517%	0.052%	0.835%
1.390%	-5	2.639%	0.392%	2.247%	0.073%	2.566%
-0.333%	-4	3.429%	0.301%	3.128%	-0.018%	3.446%
-0.082%	-3	0.276%	0.314%	-0.038%	-0.004%	0.281%
0.471%	-2	0.000%	0.343%	-0.343%	0.025%	-0.025%
-0.107%	-1	0.000%	0.313%	-0.313%	-0.006%	0.006%
-0.877%	0	1.653%	0.272%	1.381%	-0.046%	1.699%
0.509%	1	1.355%	0.345%	1.010%	0.027%	1.328%
-0.375%	2	1.604%	0.299%	1.306%	-0.020%	1.624%
0.240%	3	0.789%	0.331%	0.458%	0.013%	0.777%
1.139%	4	0.783%	0.379%	0.405%	0.060%	0.723%
0.485%	5	0.000%	0.344%	-0.344%	0.026%	-0.026%
0.191%	6	-1.036%	0.329%	-1.365%	0.010%	-1.046%
0.519%	7	-2.618%	0.346%	-2.964%	0.027%	-2.645%
-0.184%	8	-0.806%	0.309%	-1.115%	-0.010%	-0.797%
-0.580%	9	-1.626%	0.288%	-1.914%	-0.031%	-1.595%
0.669%	10	-1.102%	0.354%	-1.456%	0.035%	-1.137%
0.000%	11	0.000%	0.318%	-0.318%	0.000%	0.000%
0.000%	12	0.000%	0.318%	-0.318%	0.000%	0.000%
0.026%	13	0.000%	0.320%	-0.320%	0.001%	-0.001%
-0.363%	14	1.114%	0.299%	0.815%	-0.019%	1.133%
-0.951%	15	0.826%	0.268%	0.558%	-0.050%	0.877%

**Figure 61. YULE CATTO & CO PLC the Market Model detail results by software**

	FTSE ALL UK	days	YULE CATTO	estimated return	abnormal return	estimated return	abnormal return
alpha	-0.65%	-15	0.00%	0.28%	-0.28%	-0.03%	0.03%
0.003184533	1.27%	-14	0.00%	0.39%	-0.39%	0.07%	-0.07%
beta	0.53%	-13	0.00%	0.35%	-0.35%	0.03%	-0.03%
0.052812971	0.25%	-12	0.00%	0.33%	-0.33%	0.01%	-0.01%
	0.15%	-11	0.00%	0.33%	-0.33%	0.01%	-0.01%
	-0.36%	-10	0.00%	0.30%	-0.30%	-0.02%	0.02%
<b>Cumulative AR</b>	<b>-0.05%</b>	<b>-9</b>	<b>0.00%</b>	<b>0.32%</b>	<b>-0.32%</b>	<b>0.00%</b>	<b>0.00%</b>
<b>-1.95%</b>	<b>0.08%</b>	<b>-8</b>	<b>0.00%</b>	<b>0.32%</b>	<b>-0.32%</b>	<b>0.00%</b>	<b>0.00%</b>
<b>Average AR</b>	<b>0.78%</b>	<b>-7</b>	<b>0.00%</b>	<b>0.36%</b>	<b>-0.36%</b>	<b>0.04%</b>	<b>-0.04%</b>
<b>-0.06%</b>	<b>0.99%</b>	<b>-6</b>	<b>0.89%</b>	<b>0.37%</b>	<b>0.52%</b>	<b>0.05%</b>	<b>0.84%</b>
	1.39%	-5	2.64%	0.39%	2.25%	0.07%	2.57%
	-0.33%	-4	3.43%	0.30%	3.13%	-0.02%	3.45%
	-0.08%	-3	0.28%	0.31%	-0.04%	0.00%	0.28%
	0.47%	-2	0.00%	0.34%	-0.34%	0.02%	-0.02%
	-0.11%	-1	0.00%	0.31%	-0.31%	-0.01%	0.01%
	-0.88%	0	1.65%	0.27%	1.38%	-0.05%	1.70%
	0.51%	1	1.36%	0.35%	1.01%	0.03%	1.33%
	-0.38%	2	1.60%	0.30%	1.31%	-0.02%	1.62%
	0.24%	3	0.79%	0.33%	0.46%	0.01%	0.78%
	1.14%	4	0.78%	0.38%	0.40%	0.06%	0.72%
	0.49%	5	0.00%	0.34%	-0.34%	0.03%	-0.03%
	0.19%	6	-1.04%	0.33%	-1.36%	0.01%	-1.05%
	0.52%	7	-2.62%	0.35%	-2.96%	0.03%	-2.65%
	-0.18%	8	-0.81%	0.31%	-1.12%	-0.01%	-0.80%
	-0.58%	9	-1.63%	0.29%	-1.91%	-0.03%	-1.60%
	0.67%	10	-1.10%	0.35%	-1.46%	0.04%	-1.14%
	0.00%	11	0.00%	0.32%	-0.32%	0.00%	0.00%
	0.00%	12	0.00%	0.32%	-0.32%	0.00%	0.00%
	0.03%	13	0.00%	0.32%	-0.32%	0.00%	0.00%
	-0.36%	14	1.11%	0.30%	0.81%	-0.02%	1.13%
	-0.95%	15	0.83%	0.27%	0.56%	-0.05%	0.88%

**Figure 62. YULE CATTO & CO PLC the Market Model detail results by EXCEL**

YULE CATTO & CO PLC the Zero-One Model:

AutoCalculation					
General Result	Market Model	Zero-One Model	Mean-Adjusted Model	CAR Chart	
	Return of Market Index	Calendar Date	Return of Share Price	Expected Return	Abnormal Return
-0.651%	-15	0.000%	-0.651%	0.651%	
1.265%	-14	0.000%	1.265%	-1.265%	
0.528%	-13	0.000%	0.528%	-0.528%	
0.245%	-12	0.000%	0.245%	-0.245%	
0.145%	-11	0.000%	0.145%	-0.145%	
-0.360%	-10	0.000%	-0.360%	0.360%	
-0.052%	-9	0.000%	-0.052%	0.052%	
0.082%	-8	0.000%	0.082%	-0.082%	
0.784%	-7	0.000%	0.784%	-0.784%	
0.993%	-6	0.888%	0.993%	-0.106%	
1.390%	-5	2.639%	1.390%	1.250%	
-0.333%	-4	3.429%	-0.333%	3.761%	
-0.082%	-3	0.276%	-0.082%	0.359%	
0.471%	-2	0.000%	0.471%	-0.471%	
-0.107%	-1	0.000%	-0.107%	0.107%	
-0.877%	0	1.653%	-0.877%	2.530%	
0.509%	1	1.355%	0.509%	0.846%	
-0.375%	2	1.604%	-0.375%	1.979%	
0.240%	3	0.789%	0.240%	0.549%	
1.139%	4	0.783%	1.139%	-0.355%	
0.485%	5	0.000%	0.485%	-0.485%	
0.191%	6	-1.036%	0.191%	-1.227%	
0.519%	7	-2.618%	0.519%	-3.137%	
-0.184%	8	-0.806%	-0.184%	-0.622%	
-0.580%	9	-1.626%	-0.580%	-1.046%	
0.669%	10	-1.102%	0.669%	-1.771%	
0.000%	11	0.000%	0.000%	0.000%	
0.000%	12	0.000%	0.000%	0.000%	
0.026%	13	0.000%	0.026%	-0.026%	
-0.363%	14	1.114%	-0.363%	1.478%	
-0.951%	15	0.826%	-0.951%	1.778%	

**Figure 63. YULE CATTO & CO PLC the Zero-One Model detail results by software**

	FTSE AL	days	YULE C	expected	abnormal r
alpha	-0.00651	-15	0	-0.65%	0.65%
0.003185	0.012653	-14	0	1.27%	-1.27%
beta	0.005277	-13	0	0.53%	-0.53%
0.052813	0.002451	-12	0	0.25%	-0.25%
	0.001455	-11	0	0.15%	-0.15%
	-0.0036	-10	0	-0.36%	0.36%
	-0.00052	-9	0	-0.05%	0.05%
	0.000823	-8	0	0.08%	-0.08%
	0.00784	-7	0	0.78%	-0.78%
	0.009931	-6	0.008876	0.99%	-0.11%
	0.013896	-5	0.026393	1.39%	1.25%
	-0.00333	-4	0.034286	-0.33%	3.76%
	-0.00082	-3	0.002762	-0.08%	0.36%
	0.004713	-2	0	0.47%	-0.47%
	-0.00107	-1	0	-0.11%	0.11%
	-0.00877	0	0.016529	-0.88%	2.53%
	0.005091	1	0.01355	0.51%	0.85%
	-0.00375	2	0.016043	-0.38%	1.98%
	0.002404	3	0.007895	0.24%	0.55%
	0.011385	4	0.007833	1.14%	-0.36%
	0.004852	5	0	0.49%	-0.49%
	0.001907	6	-0.01036	0.19%	-1.23%
	0.00519	7	-0.02618	0.52%	-3.14%
	-0.00184	8	-0.00806	-0.18%	-0.62%
	-0.0058	9	-0.01626	-0.58%	-1.05%
	0.006693	10	-0.01102	0.67%	-1.77%
	0	11	0	0.00%	0.00%
	0	12	0	0.00%	0.00%
	0.000257	13	0	0.03%	-0.03%
	-0.00363	14	0.011142	-0.36%	1.48%
	-0.00951	15	0.008264	-0.95%	1.78%

**Figure 64. YULE CATTO & CO PLC the Zero-One Model detail results by EXCEL**

## **Appendix 2 – User guide**

### **Introduction**

**AutoCalculation** is an **Event-Study** data processing tool which incorporates three models for calculating the abnormal return. The software, with an aim to provide a **user-friendly GUI**, attaches charts to display the share price, the market index as well as the cumulative abnormal returns generated based on three different models, namely **Market Model, Zero-One Model and Mean-Adjusted Model**.

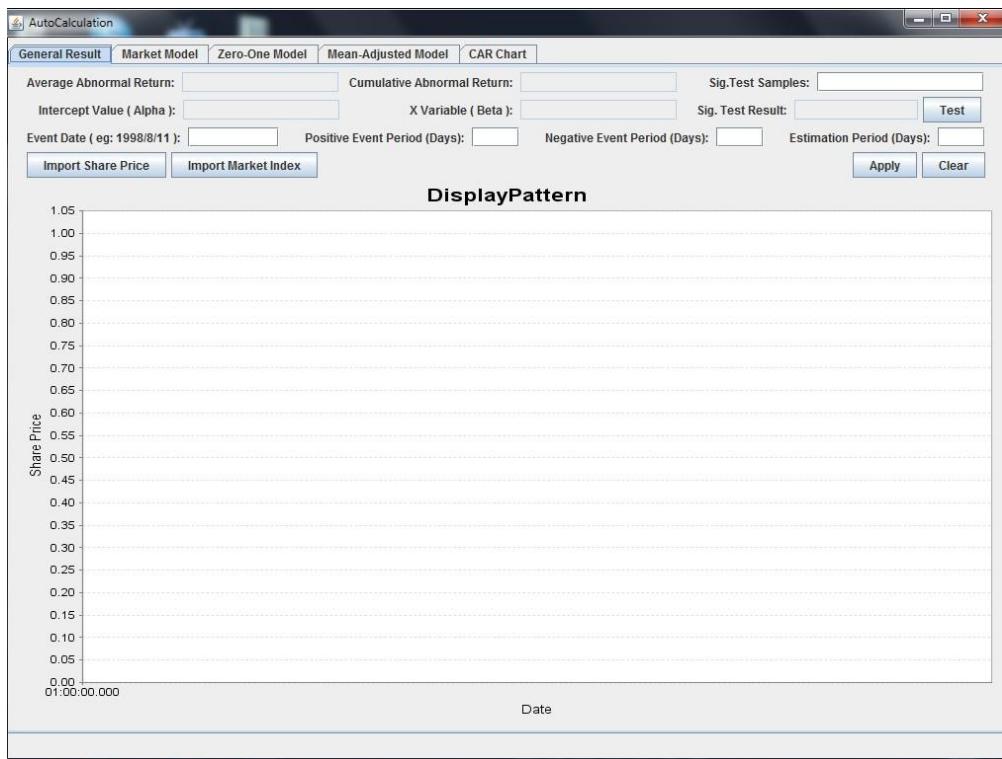
### **Interface**

The interface of the software consists of five tabbed panel, each of which performs different functions. By simply clicking the tab, you can switch from one panel to another to view different results.

The first panel, entitled '**General Result**', is divided into three parts, with the upper part for displaying results and imputing data, the middle part used for buttons and the lower part allocated for displaying the share price and the market price.

The second, third and fourth panels display tables of detailed even-period data calculated with the corresponding model stated in the tab, namely Market Model, Zero-One Model or Mean-Adjusted Model. It should be noted that these three panels contain no data when you initially use the software.

The fifth panel, **CAR Chart**, show the cumulative abnormal returns generated with three different models during the event period.



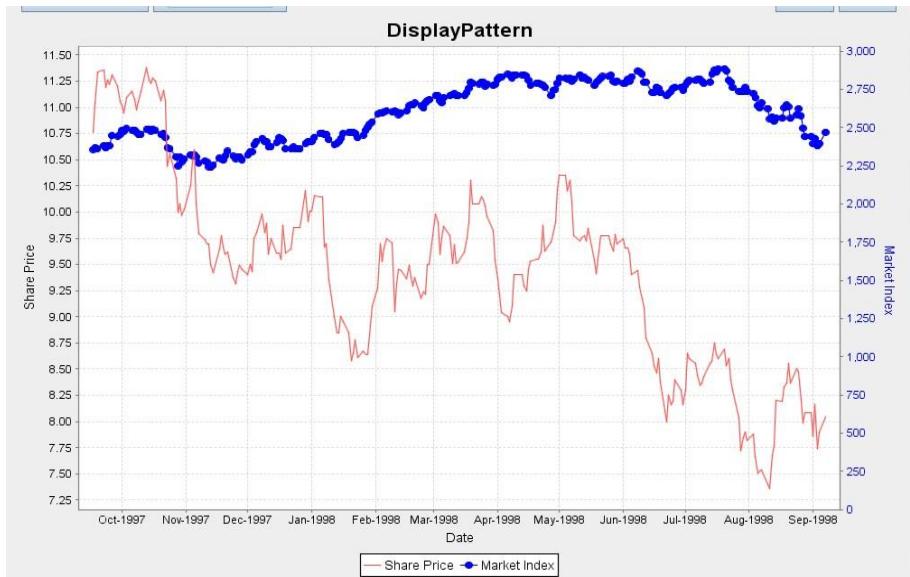
**Figure 65.** Interface of AutoCalculation

### Tips

- Adjust your PC screen display pixels to **1024\*768** or even bigger so that you can read all data and attached charts in their initial sizes.
- Download and install **JAVA** environment on your PC first to **ENSURE** the normal operation of this software.

### Steps to Run Auto-Calculation

- **Preparing Data**
  - Download the historic share price and market index from **YAHOO FINANCE** and save them as '**.CSV**' file in your PC.
  - Open these two groups of data with EXCEL and **DO MAKE SURE** their TIME SERIES CONSISTENCY.
  - Click 'Save as...' to save the data as a text document, namely '**.TXT**' document.
  - Open the '**.TXT**' document you have just saved to **DELETE THE BLANK LINE AT THE BOTTOM** to complete the data preparation.
- **Importing Data**
  - Double-click the software to open it.
  - Click the '**IMPORT SHARE PRICE**' button to import the needed data in the corresponding '**.TXT**' share price document. (Note: When data are imported, the curve of the share price will be displayed in red in the lower part of the **GENERAL RESULT PANEL**.)
  - Click the '**IMPORT MARKET INDEX**' button to import the required data in the corresponding '**.TXT**' market index document. (Note: When data are imported, the curve of the market index will be displayed in blue in the lower part of the **GENERAL RESULT PANEL**.)



**Figure 66. Display Pattern in General Result Panel**

- **Imputing Data**

- Fill the text fields of the event date, the positive event period, the negative event period and the estimation period with data in the required format which is displayed in the bracket on the left of each text field. (Note: the positive event period, the negative event period and the estimation period **MUST BE positive integer**).

- **Auto-calculating Results**

- Click the 'APPLY' button to generate needed results. The tables will be produced in the second, third and fourth panels to display detailed event-period results calculated with three different models. The cumulative abnormal returns based on the three models will be shown in the fifth panel in the form of curves.



**Figure 67. CAR chart panel**

- The significance test components are included the General Result Panel. Type the required testing samples into the given text fields separate each sample by a ',' (comma). Click the 'TEST' button to generate the significance, which will then be displayed in the lower test field.
- If you would like to know results of different event of a company, change the event date and the estimation period in the GENERAL RESULT PANEL and click the 'APPLY' button to replace the previous results. This change also applies to significance test.
- If you would like to conduct another Event Study, just click the 'CLEAR' button to refresh all the interfaces to be ready for new data.

## **Questionnaire and potential user trial report**

This project software has been sent to four different potential users for trial reports. One comes from Advanced Computing students, one comes from Banking and Finance students, one comes from Investment Analysis students and one comes from Financial PHD students.

Most of them have a good impression on the User Interface and think this software is user-friendly and very easy to be used. All of them approve the result data is accurate after their trial.

Pitfalls and further improvements are included below:

Strong needs for processing multiple events within the same run.

It would be better if this software can retrieve data automatically online.

It also would be better if this software can directly read the CSV file downloaded from website.

Store or output the data result function also needs to be implemented.