HAPTER FOUR  METHODOLOGY

.1 Research Hypotheses

The research hypotheses for this study are derived on the basis of the objectives drawn up in Section 1.1 of Chapter 1 and the literature review of Chapter 3. The research hypotheses developed for this study are as follows.

**Objective 1:**  
*To determine whether rating announcements provide new information to the investing public*

**Hypothesis H₀:** Ratings announcement has no impact on market efficiency during event window period.

**Hypothesis H₁:** Ratings announcement has impact on market efficiency during event window period.

**Objective 2:**  
*To determine the impact, if any, of initial ratings, reaffirmations, downgrades, and, upgrades during event window period.*

**Hypothesis H₀:** Rating announcements provide no significant abnormal returns during event window period.

**Hypothesis H₂:** Rating announcements provide significant abnormal returns during event window period.

.2 Selection of Measures

In this section, the methodology and specific measures involved in conducting this research are discussed and arguments are developed for the selection of some of these specific measures among available alternatives.
This study attempts to use event study methodology to test the hypotheses developed and identified above. Event study methodology is one of the most popular statistical designs used in research in the area of finance, as it is simple, elegant and functional. According to researchers, even the simpler version of this methodology works well and produces results.

The impact of the various classes of ratings would show in the form of significant abnormal returns or earnings (also called residuals or prediction errors), i.e. excess earnings or returns above what is normally expected for a particular security under the 'no-news' scenario.

Event study methodology generally involves the following areas:

1. Identification and definition of the event of interest
2. Identification of event window for the event basing on the event date
3. Selection of a sample set of rating related companies for testing the hypotheses
4. Prediction of normal returns
5. Determination of abnormal returns
6. Aggregation and averaging of abnormal returns across samples and periods.
7. Testing whether the abnormal returns are statistically different from zero

*Identification of the event of interest*

Identification of the event of interest is of particular importance in conducting event studies. The event is often normally related to the dissemination of some specific information to the investing public by means of the press or some commonly used media and it could be event specific relating to a particular firm (e.g. dividend announcement); sector or industry (e.g. relaxation of gaming
taxes), or an event affecting the overall market (e.g. reduction in corporate income taxes).

As explained earlier the event of interest for this study is the ratings announcement announced by RAM through the press on bonds issued by companies listed in the KLSE. As the event has been explained and mentioned earlier in this paper further elaboration may not be necessary.

Identification of event window
An event window is needed in event study to capture the impact of the rating announcement on dates surrounding the announcement. Too long an event window may allow for other events to creep in which case it would become difficult to determine the actual impact of a single event of interest. For example, it would be difficult to determine the exact impact of an upgrade announcement on a bond issued by a particular company if a dividend or bonus issue is also announced at the same time of the ratings announcement.

On the other hand, too short an event window may fail to capture the full impact of the rating announcement (the event of concern) even after eliminating multi-events during the event window period. Furthermore, the more days in the event window, the lower the power of the event study methodology (Brown and Warner, 1980).

There is no standard event window period among researchers in event studies. A comparison of event window periods among studies on bond rating announcements shows no standard event window periods. Holthausen et al (1986) used 4 event-window periods viz. day -300 through day -61, day -60 through day -1, day 0 through day +1 and day +2 through day +60. Richards and Deddouche, (1999) used a 6-week event window period. Goh and Ederington, (1993) used 5 event-window periods i.e. day -30 through day -11, day -10 through day -1, day 0 through day +1, day +2 through day +11 and day +12.
through day +30. Elayan, Hsu and Meyer, (2000) used a 50-day event window period.

In this study, an event window period of 11 days is chosen, day -5 through day -1 (pre-announcement) and day +1 through day +5 (post-announcement) as shown below using the time-line:

Event Window Period

```
-5  pre-announcement  0  post-announcement  +5
```

**Sample selection**

Sample selection is an important area of concern in research as the sample should be able to ultimately represent the total population and enable the researcher to draw generalisations in his research. There are various alternative sampling techniques available to a researcher to choose from depending on the circumstances of the case. This step is explained in greater detail in the next sub-section 4.3 entitled ‘Sampling Design’.

**Prediction of normal returns**

Normal returns would mean the return expected under a ‘no-news’ scenario, i.e. expected returns in the absence of any new information in the market place. There are 3 methods used in arriving at the normal return of a particular security. They are the market-model, market adjusted model and the mean adjusted model (Paterson, 1989).
In the market adjusted model, the current return on the general market is taken as representing the normal return of a particular security under a 'no-news' scenario. This is based on the premise that the best predictor of returns for a given security is the current return on the market (Paterson, 1989). The returns on a particular security are not used in this model in calculating the normal returns. This model assumes that the security in question should at a minimum earn the market return.

The return on the market here would mean the return on a representative index that broadly reflects the sectors of the economy. In the case of Malaysia Kuala Lumpur Composite Index (KLCI) is commonly used by researchers as the market indicator. A review of the literature on event studies pertaining to bond ratings' impact on equity returns indicates a marked absence in the use of this method.

In the mean adjusted model the average return on a particular security over an extended period, called the estimation period, is determined.

In the market model, a slightly more complicated procedure is used in arriving at the normal returns of a particular security. Here, both the market and the specific stock returns are used in calculating the normal returns unlike the other two methods. The ordinary least square (OLS) technique is used to regress the daily market returns against the daily returns on a particular security collected over the pre-determined estimation period. The OLS technique also assumes a linear relationship between these 2 variables (market and stock returns). This linear relationship produces 2 values, $\alpha_i$, a constant or the intercept value and $\beta$, the slope coefficient to arrive at the following equation of normal returns. A simplified version of the linear relationship is as follows.

$$ R_{it}^* = \alpha_i + \beta R_{mt}, $$
Where,

\[ R_{it}^* \] \quad \text{means normal return on security } i \text{ for period } t

\[ \alpha_i \] \quad \text{means the intercept or constant of security } i

\[ \beta_i \] \quad \text{means the slope coefficient of security } i.

\[ R_{mt} \] \quad \text{means return on market index for period } t

In the case of Malaysia, the market index would mean the KLCI for obvious reasons stated earlier.

The market model is the most popularly used model in event studies including in studies on rating announcements. The availability of data (daily share prices and the KLCI) for the OLS technique in calculating \( \alpha \) and \( \beta \) figures permit the use of the market model in event studies.

For the purpose of this study, the market model will be used in calculating normal returns.

In choosing the representative index representing the general market for the market model, theory suggests the use of a value-weighted index that approximately reflects total market performance (Roll, 1981, Ohlson and Rosenberg, 1982). However, evidence by Brown and Warner, (1980 and 1985); and Paterson, (1989) indicates that using an equally weighted index is more likely to detect abnormal returns. However, the KLCI is a value-weighted index and not an equally weighted index. Furthermore, the KLSE presently does not maintain an equally weighted index in its system and the use of an equally weighted index for the study is not feasible. The study utilizes the market model in testing \( H_1 \) till \( H_2 \).

As explained earlier for the event window period, judgement on the part of the researcher is required in deciding the parameters for the estimation-period as
there are no standards as to the number of days to be included. Typical lengths range from a low of 100 days to a high of 300 days (Peterson, 1989). A long period would contaminate the calculation of $\alpha$ and $\beta$ with the occurrence of major events during this period. Richards and Dedouche, (1999) used a 33 week period; Goh and Ederington, (1993) used 254 days; and Holthausen et al, (1986) used 300 days to name a few.

This study uses a 100 day estimation period as it is felt that it would be sufficient to determine the mean returns; and the $\alpha$ and $\beta$ figures of the securities concerned and at the same time to avoid major events from contaminating the calculation of $\alpha$ and $\beta$. Furthermore, the period also falls within the typical lengths used by researchers (Paterson, 1989). The estimation period would commence from day +6 through +106 in this study.

The other issue is the selection of the estimation period in relation to the event window period. Some researchers use an estimation period which falls immediately before the event window period; some use the period immediately after the event window period and even some others apportion the estimation period partially before and partially after the event window period. Goh and Ederington, (1999) used the period immediately before the event window period; Goh and Ederington, (1993) used a combination of before and after the event window period; and Richards et al, (1999) used the period immediately after the event window period.

However, data and previous studies on bond rating changes show that the period immediately after the event window period is commonly used for the estimation period, especially for downgrades as bad news tend to precede downgrades. At the same time, a firm's stock tends to perform badly before the downgrade occurrence. Hence, taking the pre-event window estimation period may contaminate the application of the OLS technique (market model). The determination of normal returns with such contamination is expected to change.
because of the bad news occurring before the event window period (Akhigbe, Madura, Whyte, 1997).

A complete time line for this study with the event window and estimation periods is shown below:

<table>
<thead>
<tr>
<th>Event Window</th>
<th>Estimation Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>t_{pre}</td>
<td>t_{e}</td>
</tr>
<tr>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>+5</td>
</tr>
<tr>
<td></td>
<td>t_{post}</td>
</tr>
<tr>
<td></td>
<td>+106</td>
</tr>
<tr>
<td></td>
<td>t_{post(ep)}</td>
</tr>
</tbody>
</table>

Where,

* $t_{pre}$ means pre-announcement period (day -5 till day -1)
* $t_{e}$ means the announcement day (day 0)
* $t_{post}$ means the post-announcement period (day +1 till day +5)
* $t_{post(ep)}$ means the ending point of the estimation period (day +6 till day +106)

In the study, daily returns are used as opposed to monthly returns. Studies on bond ratings have been carried out using either one of them. Monthly returns may not be appropriate as ratings convey little new information to the market and hence, there may be no noticeable reaction in the announcement month (Pinches and Singleton, 1978) and (Griffin and Sanvicente, 1982). However, significant announcement effects were found using daily returns (Glascock, Davidson and Henderson, 1987). Furthermore, a study on daily returns not only increases the statistical power through additional degrees of freedom but it also facilitates the study of daily trends or security price reactions on specific pre-determined days (Gallinger, 1990).
This study therefore uses the daily returns to take advantage of the accruing benefits explained above.

Abnormal returns
Daily abnormal returns during the event window period from day -5 through day +5 are determined using the following formula.

$$AR_{it} = R_{it} - R_{it}^*$$

Where,

- $AR_{it}$ means abnormal security return for security i in period t.
- $R_{it}$ means return on security i in period t
- $R_{it}^*$ means expected or predicted or normal return for security i in period t

In this study $AR_{it}$ is calculated for each of the days in the event window period, i.e. from day -5 through day +5 using this formula for each of the ratings sampled for this study.

Aggregation and averaging of abnormal returns across sample ratings and periods
The $AR_{it}$, i.e. abnormal security return for security i in period t for each of the ratings sampled for this study for each of the days in the event window period are then averaged across ratings for each of the samples and sub-samples (identified and explained in Section 4.2 under 'Sample Design') using the following formula.

$$AR_{Nt} = \frac{1}{N} \sum_{i=1}^{N} AR_{it}$$
Where,

\( AR_{Nt} \) means the daily arithmetic mean of the \( AR_{it} \) of the sample or sub-sample from day \(-5\) through day \(+5\).

\( N \) means the total rating related companies in the sample or sub-sample.

\( AR_{it} \) means abnormal security return for security \( i \) in period \( t \)

Aggregation of the individual security excess returns requires examining the cross section of excess returns for each period, where each period is relative to the announcement date. The announcement date may be a different calendar time period for each security and thus excess returns are aligned in event time (Paterson, 1989).

The \( AR_{Nt} \) (arithmetic mean of the \( AR_{it} \) in the sample or sub-sample for the particular day \( t \) from day \(-5\) through day \(+5\)) is next aggregated for the event window period to arrive at the cumulative abnormal return or \( CAR \) using the following formula.

\[
CAR_{Nn} = \sum_{i=71}^{T1} AR_{Nt}
\]

Where,

\( CAR_{Nn} \) means cumulative abnormal returns for \( N \) rating related companies for a period of length \( n \) (event window period).

\( AR_{Ni} \) means the daily arithmetic mean of the \( AR_{it} \) of the sample or sub-sample for day \(-5\) through day \(+5\).

\( T_i \) means the first period in which the \( AR_{Ni} \) is accumulated, i.e. day \(-5\)
$T_2$ means the last period of which the $AR_{N_t}$ is accumulated, i.e. day +5.

The $CAR_{N_n}$ is then divided by $n$ (event window period) a period of 11 days to arrive at $CAAR_{N_n}$ which is the cumulative average abnormal return for $N$ rating related companies in a sample or sub-sample for a period of length $n$. The formula used in arriving at $CAAR_{N_n}$ is as follows.

$$CAAR_{N_n} = \frac{1}{n} \sum_{t=t_1}^{t_2} AR_{N_t}$$

Where,

$CAAR_{N_n}$ means cumulative average abnormal returns for a period of length $n$, the event window period for the sample or sub-sample.

$n$ means the number of days in the event window period.

$t_1$ means the first day of the event window period, i.e. day −5

$t_2$ means the last day of the event window period, i.e. day +5

$AR_{N_t}$ means the daily arithmetic mean of the $AR_{H_t}$ of the sample or sub-sample for day −5 through day +5.

**Statistical test of significance**

The statistical test of significance (at 95% confidence level) is carried out to determine whether the abnormal returns computed are statistically different from zero in deciding whether to accept or reject the hypothesis in question.

There are many statistical tools used in event studies by researchers. However, the commonly used test of significance by almost all researchers is the student t-test. In this study too, the t-test of significance is utilized to test statistically whether the abnormal returns due to the occurrence of the rating announcement
is significantly different from zero. The t-test is appropriate as the sample sizes are small. In this study, the t-test of significance is undertaken at two levels.

The first level is for testing the significance on abnormal returns for a particular rating for each of the days in the event window period. There are two steps involved at this level.

**Step 1:** Calculating the standard deviation for the estimation period (day +6 through day +106) for each of the ratings in the sample or sub-sample using the following formula

\[
\sigma_i = \sqrt{\frac{\sum_{T_1+6}^{T_2-106} (R_{it} - R_{i*})^2}{T}}
\]

Where,

- \( \sigma_i \) means the standard deviation on security i of each rating
- \( T_1 \) means the first day of the estimation period (day +6) from which the differences between \( R_{iT} \) and \( R_{i*} \) are to be accumulated
- \( T_2 \) means the last day of the estimation period (day +106) till which the differences between \( R_{iT} \) and \( R_{i*} \) are to be accumulated
- \( R_{it} \) means daily returns on security i in the estimation period (day +6 through day +106)
- \( R_{i*} \) means the mean return on the security i over period the estimation period from day +6 through day +106
- \( T \) means the estimation period, i.e. 100 days from day +6 through day +106

There are some modifications done in the calculation of \( \sigma_i \) by some researchers although the simpler version as shown above is also commonly used. Although the simpler version used here is not precisely correct in the statistical sense, the
effect upon the outcome of the statistical tests is usually minimal because the adjustment done to $\sigma_i$ in the complex version is generally close to one (Paterson, 1989).

**Step 2** - Calculating the t-test value using the following formula

$$t_{\text{statistic}} = \frac{AR_i}{\sigma_i}$$

*Where,*

- $AR_i$ means abnormal security return for security $i$ in period $t$
- $\sigma_i$ means standard deviation on security $i$ of each rating related security calculated under Step 1 above

If the abnormal returns $AR_i$ are significant on rating announcement date (day 0) but insignificant during the pre-announcement (day -5 till day -1) and post-announcement (day +1 till day +5) periods then the hypothesis can reasonably be concluded that the particular rating announcement carries new information and is reflected in the market reacting to it in the form of share price movements leading to significant abnormal returns thereby confirming the efficient-market hypothesis in the semi-strong form at the KLSE.

The next level of the t-test of significance is undertaken in testing hypothesis at cross-sectional level where many samples and sub-samples are involved and the t-test of significance will be calculated for each of these samples. The t-test here involves two steps as follows.

**Step 1** - Determining the composite standard deviation of the sample ($\sigma_N$)

The variances of all individual rating related companies, $\sigma_i^2$ in the sample as calculated above for the first level (Step 1) using the estimation period are aggregated and averaged by $N$, the total number of rating related companies per
sample or sub-sample) according to the hypothesis to be tested. The calculation of the standard deviation, \( \sigma_N \), is then done using the following formula.

\[
\sigma_N = \sqrt{\frac{\sum_{i=1}^{N} \sigma_i^2}{N}}
\]

Where,

\( \sigma_N \) means the composite standard deviation of the sample or sub-sample concerned

\( \sigma_i^2 \) means the variance of the individual security \( i \) calculated using the estimation period (day +6 through day +106)

\( N \) means the number of rating related companies in the sample or sub-sample.

Step 2- Calculating the t-test of significance

In this step the following formula is used on the calculated cumulative average abnormal return or CAAR \( N_n \) to test for its significance.

\[
t \text{ statistic } = \frac{CAAR_{N_n}}{\sigma_N}
\]

Where,

\( CAAR_{N_n} \) means the cumulative average abnormal return for the event window period

\( \sigma_N \) means composite standard deviation of the sample concerned used in testing the particular hypothesis.

Hypothesis 2 involves the information usefulness study that attempts to determine the degree of impact of the rating announcement by RAM throughout the event window period of 11 days. A high absolute t-test value away from zero would indicate that the event is of significance to the investing public as reflected in the form of abnormal returns.
4.3 Sampling Design

This section details out the procedures undertaken in selecting and designing the sample for testing the data in the study. As explained in Chapter 2 under ‘Theory Definition’, RAM and MARC accord credit ratings in Malaysia apart from other international rating agencies. In the selection of ratings for this study only one agency is chosen to avoid heterogeneity in rating sources and rating type. It also narrows the focus to only one agency. In this regard RAM ratings are used for the study as it is the pioneer agency in credit ratings in the country.

As a starting point RAM’s library was approached to gather a list of ratings announced from 1996 through 2001 and the NSTP and Star on-line dailies were referred to obtain the announcement dates. The first list provided an initial of population of around 1478 ratings (excluding aborted issues) as announced by RAM from 1996 through 2001. From the 1478 ratings, ratings pertaining to private companies not listed in the KLSE numbering around 702 were excluded bringing the number to 776 ratings for further action. As the study concentrates solely on bonds (listed and OTC), short-term debts, financial institution ratings, claims paying ability ratings, and senior debt ratings numbering around 197 were next excluded from the listing, as they do not come within the scope of this study leaving the balance of around 537 ratings as the sample frame.

Sometimes, two or more rating announcements are made on the same date for the same listed firm by RAM. Such announcements are excluded too as it is felt that the focus on only one event (rating) would be lost in the study. However, for rating upgrades and downgrades, a change in rating on long term debts with no change in rating on short-term debts was included. Likewise, multiple ratings carrying the same rating grades are included in the sample frame.
Next, the remaining 537 ratings are stratified according to the type of ratings as follows:

\begin{align*}
  \text{Initial Assignment} : & \quad 072 \\
  \text{Reaffirmations} : & \quad 299 \\
  \text{Downgrades} : & \quad 096 \\
  \text{Upgrades} : & \quad 070 \\
  \text{Total} : & \quad 537
\end{align*}

From each of the strata above, samples were picked randomly. To spread out the sample selection throughout the period of study from 1996 through 2001 an effort was made to spread out the random pickings covering all these years. In case of insufficient samples in a particular year samples were picked from the other years. As there are 20 types of rating scales ranging from AAA to D care was taken as far as possible to pick samples covering all the grades. Although this condition was not fulfilled in some cases due to non-availability of data.

As the sample is based on rating announcements there could be a repetition of companies in the sample. However, care was taken to minimize this so that a broad spectrum of listed companies could be covered.

The sample or sub-sample size may be small but it is not without precedence. Many event studies on rating announcement had used small sample sizes. Bhattacharya et al, (1998) used a sample size of 32 events and Schweizer et al, (1992) used only 18 events in his event study.
The preliminary lists of ratings sampled for testing are as follows.

<table>
<thead>
<tr>
<th>Initial Assignment</th>
<th>31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaffirmation</td>
<td>50</td>
</tr>
<tr>
<td>Upgrades</td>
<td>21</td>
</tr>
<tr>
<td>Downgrades</td>
<td>42</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>144</strong></td>
</tr>
</tbody>
</table>

The sample breakdown explained above does not contain some of the scales from the AAA till D as the sample frame itself does not contain them. Expanding the time frame 1996-2001 either forward or backward may not be of much help as the trends are similar for the other years.

Using the sample list of 144 ratings the next task is to determine the estimated event window and estimation periods in terms of calendar dates using the announcement date as the focal date. Care was taken in clearly identifying the announcement or event day or day 0. If the announcement day falls on a Saturday, Sunday, public holiday or any other day on which the KLSE is closed, then the following trading day will be taken as the announcement day. If the announcement day falls on a day on which the security concerned is suspended at KLSE then that rating is dropped from the list and replaced with another rating from the sample frame, if available.

The estimated time frame for the data collection is one month backwards from the announcement date and five months forward from the announcement date. For example, if the announcement date for a particular rating is 4th of July, 2000, then the estimated time frame for the data collection is from 4th of June, 2000 till 4th of January, 2001. More days are included in the estimated event window and estimation periods at this stage to ensure data sufficiency after eliminating weekends, public holidays, and other days on which the KLSE is closed. Apart from these, days on which a particular security is suspended are also excluded.
4.4 Data Collection Procedures

This section explains in detail the procedures involved in gathering data for the study. The data to be collected will be based on the preliminary listings of ratings prepared under Section 4.3 above.

The three types of data that will be collected for the study are as follows:

a. Daily closing share prices
b. Daily closing KLCI

Daily closing share prices
Using the preliminary list of ratings prepared in Section 4.3 above, the daily closing share prices are obtained using Hydra for the estimated event window and estimation periods.

Hydra, installed at University Of Malaya library, will be used to gather the share prices and KLCI data for the study. Hydra contains a host of current and past market information on share prices and KLCI and it enables the user to download the required data into EXCEL format. This saves time and eliminates the problem of keying-in errors. Hydra also provides share price data in two versions. One version provides share prices adjusted for bonus issues, rights issues, capital reductions etc. whereas the other version provides for unadjusted share prices, the relevant version for this study.

Using Hydra, the closing share prices for the estimated period is downloaded into Excel and printed out for each of the rating related security. The dates to be eliminated (for public holidays, weekends etc.) are manually deleted from the printed list of closing share prices. Only after this process are the real calendar dates for the event window period and the estimation period is determined. On
days where the KLCI or the share price remained flat, such days are taken as valid days for both the event window and estimation periods.

Next, reference is made to the NSTP-on line and KLSE Daily Diary, available at KLSE public library, to check for material events (including share suspension) that could have occurred during the event window period. This is to allow for concentration on the effect of one event only, i.e. the ratings announcement. At the same time this procedure also avoids excessive concentration of other events at the same time. In the case where other significant events occurring during the event window period are identified, then that particular rating will be removed and replaced by another rating of the same grade from the sample frame, if available. The same procedure will be carried out till all the ratings in the sample list are sanitized. The uncontaminated list of sample ratings prepared after the sanitization process is as attached in Appendix 1.0.

Daily closing KLCI

Hydra, the finance application software, as explained earlier is again used to gather the daily closing KLCI for the estimated event window period and the estimation period. Using Hydra, the daily closing KLCI from 01.01.1996 through 31.12.2001 are downloaded to Excel and stored. These closing KLCI are then matched to each of the rating related security according to the estimation event window and estimation periods calendar dates.

Any elimination of dates on the estimated event window period and estimation periods are done likewise for such calendar dates on the KLCI data. This is to ensure that the KLCI dates matches with the sanitized dates for the event window period and the estimation period. The complete set of share prices and KLCI for the related dates are used subsequently for data analysis as explained in section 4.5 (Data Analysis Techniques) below.
4.5 Data Analysis Techniques

This section elaborates on the techniques or procedures used in analysing the sample and raw data gathered as explained in Section 4.3 entitled ‘Sampling Design’ and 4.4 entitled ‘Data Collection Procedures’. There are several steps involved at this stage of the research process as enumerated below.

- **Step 01**: Coding the individual ratings
- **Step 02**: Coding the samples and sub-samples
- **Step 03**: Modifying the date fields of the event window and estimation periods.
- **Step 04**: Computing the daily share and market returns, $R_{it}$ and $R_{mt}$ respectively.
- **Step 05**: Computing normal returns under the market model for each of the rating related security.
- **Step 06**: Computing the abnormal returns, $AR_{it}$ for each rating related security.
- **Step 07**: Computing the average abnormal returns, $AR_{Nt}$ across samples and sub-samples.
- **Step 08**: Computing cumulative abnormal returns across periods, $CAR_{Nn}$.
- **Step 09**: Computing CAAR or cumulative average abnormal returns across periods, $CAAR_{Nn}$.
- **Step 10**: Computing the t-test statistic values using $AR_{it}$ and $CAAR_{Nn}$ for each rating and samples/sub-samples respectively.
- **Step 11**: Preparation of charts and tables for analysis.

EXCEL software program will be used to perform the steps involving computations enumerated above.
Step 01  Coding the individual ratings
The individual ratings in each of the samples and sub-samples will be identified by the rating related company' name or its abbreviation to allow for concise reporting and efficient space usage. In case the same company's name appears more than once in the same sample or sub-sample then a number will be affixed to the company's name to differentiate it from the other rating within the same rating class. For example, if a company's name, Palmco, appears under 'Initial Assignment' class and appears again the same class then Palmco will be identified as Palmco-1 and Palmco-2 respectively. However, in case the same company's name appears more than once but in different rating class (es), then the number is not affixed to the company's name in the lists.

Step 02  Coding the samples and sub-samples
The samples for each of the rating class are classified as investment grade, speculative grade and overall summary (comprising all the shares in the rating class).

Step 03  Modifying the date fields of the event window and estimation periods.
Appendix 1 apart from rating announcement showing details, lists the announcement date, event window date and estimation period dates. These dates are different for each of the rating announcements as they occur at different times of the year. To facilitate processing, consolidation and reporting of the ratings the dates need to be brought under a common platform. To achieve this, for each and every rating announcement the dates are changed to the '+/−day' form. The event window period of 11 days will be converted from specific dates to day −5,−4,−3,−2,−1,0,+1,+2,+3,+4, and +5 respectively. Likewise the 100 day estimation period also will be stated in the form of day +6, +7,+8 and so on till day +106. After this conversion the dates will be referred to in this day form and the actual dates will no longer be used.
Step 04  Computing the daily share returns, $R_{it}$.

This step will be done separately for the event window period and the estimation period. For each of the days and for each of the rating related security the daily returns on the related share price are computed and expressed in percentage form using the following formula:

$$(\text{New Value} - \text{Old value}) / \text{Old Value} \times 100 = \%$$

Value here means the daily share price.

Step 05  Computing normal returns $R_{it}^*$

The KLCI data for the window period and the estimation period is next used to compute daily market returns $R_{mt}$ using the same formula (New Value-Old Value)/Old Value x 100 = %.

The computed daily returns $R_{it}$ on each rating related security as computed in step 4 is then regressed against the market returns, $R_{mt}$, for the estimation period using the OLS technique and the $\alpha$ and $\beta$ values are derived. This step is repeated for each of the rating related security listed in Appendix 1.0 and the $\alpha$ and $\beta$ values are noted for further analysis.

The KLCI for the event window period computed earlier is next used along with the $\alpha$ and $\beta$ values for each rating related security to compute the normal returns $R_{it}^*$ using equation $R_{it}^* = \alpha_i + \beta_i R_{mt}$ for each of the 11 days of the event window period.

Step 06  Computing the abnormal returns, $AR_{it}$ for each rating related security.

Step 6 involves computation of abnormal, residual or prediction error as it is variously called using equation $AR_{it} = R_{it} - R_{it}^*$ as mentioned and explained in
Section 4.2, under 'Selection of Measures', for each of the 11 days of the event window period.

Daily normal share price return for each of the rating related security $R_{it}^{*}$ computed in Step 5 above is deducted from the daily share price returns, $R_{it}$, computed in Step 4 above, to arrive at abnormal returns, AR$_{it}$.

**Step 07 Computing the average abnormal returns, AR$_{Nt}$ across samples and sub-samples.**

Step 7 involves the averaging of abnormal returns across samples and sub-samples as listed under Step 2 above. This step is done separately for each of the sample and sub-sample classes.

For each of the samples and sub-samples, the AR$_{it}$ as computed in Step 6 above are totalled and divided by the number of ratings related securities in each of the samples or sub-samples to arrive at average abnormal returns, AR$_{Nt}$ for each of the 11 days in the event window period.

**Step 08 Computing cumulative abnormal returns across periods, CAR$_{Nn}$.**

In Step 8 the average abnormal return, AR$_{Nt}$, for each of the 11 days of the event window period are aggregated to arrive at a single value, the CAR$_{Nn}$ or cumulative abnormal return for each sample and sub-sample listed under step 2 above. This action is performed separately for the market and the mean adjusted models and the results noted.
Step 09  **Computing CAAR\(_{Nn}\) or cumulative average abnormal returns across periods**

In this step, the computation of CAAR\(_{Nn}\) or cumulative average abnormal return is attempted by averaging across period the CAR\(_{Nn}\) value over the 11 days of the event window period for each sample or sub-sample listed under step 2 above.

Step 10  **Computing the t-test statistic values using AR\(_{it}\) and CAAR\(_{Nn}\) for each rating and samples/sub-samples respectively.**

Step 10 involves the computation of t-test value of significance. It is done at two levels in this study. At the first level, the daily abnormal return for each of the rating related security during the event window period. AR\(_{it}\) is tested for significance level. Here, the AR\(_{it}\) value is divided by the standard deviation or \(\sigma_i\) to arrive at the t-statistic value for each of the 11 days of the event window period.

At the second level, the test of significance is conducted in total on CAAR\(_{Nn}\) for each of the samples and sub-samples for the event window period. CAAR\(_{Nn}\) value for each sample and sub-sample is divided by \(\sigma_N\), the standard deviation of the sample or sub-sample, to arrive at the t-statistic value. The t-statistic values are then used to accept or reject the hypotheses formulated under Section 4.1 entitled 'Research Hypotheses'.

Step 11  **Preparation of charts and tables for analysis.**

The values computed in Step 4 till Step 10 above are used in preparing summaries in the form of charts and tables as shown in Appendix 2.0 and 3.0.