

CHAPTER 4 : RESEARCH METHODOLOGY

4.1 Research Hypotheses

The research hypotheses reflect the objective discussed in Chapter 1 and the research hypotheses are as follows.

Objective 1: To study if the impact of market efficiency during the event window period

Hypothesis Ho: Ratings announcement has no impact on market efficiency during the event window period.

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

Objective 2: To determine the impact on average abnormal return if any, of initial rating, reaffirmation, downgrade, and upgrade

Hypothesis Ho: Rating announcements provide significant abnormal returns over event window period.

Hypothesis H₁: Rating announcements provide no significant abnormal returns over event window period.

4.2 Selection of Measures

This section explains the details of the methodology and measures that to be used in the research analysis.

Since event study methodology is one of the most popular statistical designs used in research in most finance researches, I have decided to use the same method as it is simple and produces good results as per a researcher's comments.

Event study usually used to determine the behaviour of stock prices or stock returns in a specific event period. In this research, the method is being used to further study the reactions of the stockholders towards to the information. The reactions will be observed before, after and during the availability of the information.

The event could be interpreted as positive, neutral or negative news in the market place; and is expected to influence the return to investors on their investments in the form of shares, bonds or other assets.

There are two types of event studies, i.e. market efficiency and information usefulness studies. There were researches conducted based on the said methodology. First, by Fama, Fisher, Jensen and Roll (1969) with regard to market efficiency. Another research by Ball and Brown (1968) concentrated information usefulness (Henderson Jr, and Glenn V, 1990).

In the market efficiency type, the study attempts to examine how quickly and correctly the market reacts to the occurrence of a pre-determined event. If the market is efficient, the share prices should be able to adjust on the day of the event announcement, and not linger on significantly after or before the announcement date. Whereas, the information usefulness type indicates the degree of impact of the event occurrence on selected variables like share returns, bond returns or even on trading volumes. New information of value should be able to create a significant positive or negative impact around the announcement date (pre, during and post announcement period) of the good or bad news respectively. In this study, hypothesis H1 involves event study of the market efficiency type and hypothesis H2 pertains to the information usefulness type.

The computation of abnormal returns has been used to measure the impact of the various classes of ratings. The abnormal returns for a particular security is the excess in earnings above the normal expected earning which is the earning without occurrence of any event or under the 'no-news' scenario.

The areas involved in the event study methodology can be generally outlined as follows.

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

The event is often and normally related to the announcement 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).

For the purpose of the study, the event of interest is the ratings announcement announced by RAM through the press on bonds issued by companies listed in the KLSE.

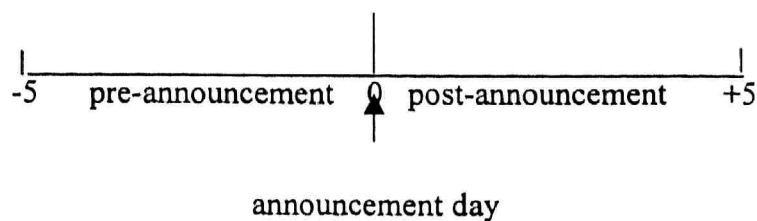
Identification of event window

An event window is required to observe the impact of rating announcement on dates surrounding the announcement. Appropriate event window period is essential to determine the actual impact of a single event of interest. If the period is too long, it could allow the occurrence of more than one event. 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. Too short event- window period may fail to capture the full impact of the rating announcement (the event of concern). Furthermore, the more days in the event window, the lower the statistical 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



Sample selection

Sample selection is an important area of concern in research because it will determine the characteristic of the population and enable the researcher to draw generalisations in his research.

Prediction of normal returns

As mentioned, normal returns is the return appears under 'no-news' scenario which is the returns without any new market information available. Normally, there are 3 methods used in computing the normal return of a particular security, viz market-model, market

adjusted model and the mean adjusted model (Paterson, 1989). For the purpose of the study, I have specifically narrowed to the mean adjusted model.

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

$$R_{it}^* = (1/T) \sum_{t=1}^T R_{it}$$

Where,

R_{it}^* means expected or normal return on security i

T means the total number of days in the estimation period

R_{it} means return on security i for period t

Mean adjusted method assumes that the average return calculated over the estimation period would be the indication of the normal return under the 'no-news' scenario. Thus, returns on the general market using a representative index (KLCI in the case of Malaysia) is not applicable. This method is commonly used by researchers in conducting event studies in the area of bond ratings. For the purpose of this study the returns been calculated in normal percentage.

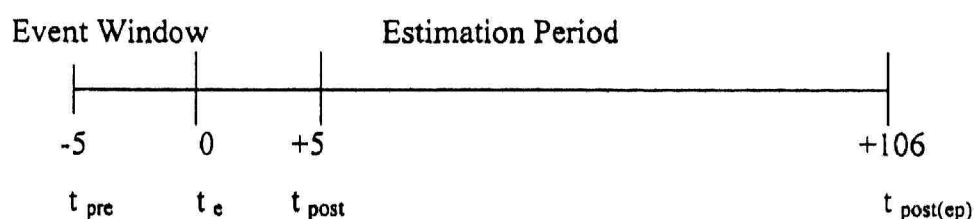
As explained earlier for the event window period, judgement on the part of the researcher is required in deciding the parameters for the estimation-period as there are no standards as to the number of days to be included. Typical lengths range from a low of 100 days to a high of 300 days (Paterson, 1989). A long period would contaminate the calculation of the mean returns (mean adjusted model) with the occurrence of major events during this period

This study uses a 100-day estimation period as it is felt that it would be sufficient to determine the mean returns. 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. 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, and Whyte, 1997).

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



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)

Daily return is more appropriate compared to monthly return because the analysis surrounding number of days where market react towards new information. Adjustments would take place within a short period even it could be immediate if the market is efficient. Monthly return carries no significant value to the study. However, the longer period used to obtain estimated normal return. Significant announcement effects were found using daily returns (Glascok, 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

The mean adjusted model 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 as determined using the mean adjusted model.

The AR_{it} is calculated for each of the days in the event window period, i.e. from day -5 through day +5.

Aggregation and averaging of abnormal returns across sample ratings and periods

The AR_{it} for each of the days in the event window period from day -5 through day +5 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.

$$AR_{Nt} = (1/N) \sum_{i=1}^N AR_{it}$$

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 from day -5 through day +5 to arrive at the cumulative abnormal return or CAR using the following formula.

$$CAR_{Nn} = \sum_{t=T1}^{T2} AR_{Nt}$$

Where,

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

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

$T1$ means the first period in which the AR_{Nt} is accumulated, i.e. day -5

$T2$ means the last period of which the AR_{Nt} is accumulated, i.e. day +5.

The CAR_{Nn} is then divided by n (event window period from day -5 through day +5) a period of 11 days to arrive at $CAAR_{Nn}$ 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 $CAAR_{Nn}$ is as follows.

$$CAAR_{n,t} = (1/n) \sum_{t=t1}^{t2} AR_{Nt}$$

Where,

$CAAR_{n,t}$ means cumulative average abnormal returns for a period of length n , the event window period (day -5 through day +5) for the sample or sub-sample.

n means the number of days in the event window period from day -5 through day +5, a period of 11 days.

$t1$ means the first day of the event window period, i.e. day -5

$t2$ means the last day of the event window period, i.e. day +5

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

Statistical test of significance

The above computed variables will be used to carry out the statistical test on the hypothesis drawn in Chapter 3. The acceptance or rejection of the hypothesis is depends on the results produced by the test.

Among many statistical tools used in event studies, student t-test is the most commonly accepted by researchers. For the purpose of the study, 2 tail t-test will be conducted to test the significance of each specified hypothesis. The test will be 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 (from day -5 till day + 5). This t-test is used for testing hypothesis H1. 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

$$\sigma_1 = \sqrt{\frac{\sum_{t=+6}^{+106} (R_{it} - R_{i*})^2}{T}}$$

Where,

σ_i means the standard deviation on security i of each rating

$T1$ means the first day of the estimation period (day +6) from which the differences between R_{iT} and R_i^* are to be accumulated

$T2$ 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 σ_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 σ_i in the complex version is generally close to one (Paterson, 1989).

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

$$\mathbf{t\ statistic} = \frac{AR_{it}}{\sigma_i}$$

Where,

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

σ_i means standard deviation on security i of each rating related security calculated under Step 1 above

If the abnormal returns AR_{it} 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 hypothesis H1 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 KLSE.

The next level of the t-test of significance is undertaken in testing hypothesis H2 through hypothesis H5. At this cross-sectional level 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 (σ_N)

The variances of all individual rating related companies, σ_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, σ_N , is then done using the following formula.

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

Where,

σ_N means the composite standard deviation of the sample or sub-sample concerned

σ_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.

$$\mathbf{t\ statistic} = \frac{CAAR_{Nn}}{\sigma_N}$$

Where,

CAAR_{Nn} means the cumulative average abnormal return for the event window period (day-5 through day +5)

σ_N means composite standard deviation of the sample concerned used in testing the particular hypothesis.

Hypothesis H2 till hypothesis H5 involve the information usefulness study which attempts to determine the degree of impact of the rating announcement by RAM throughout the event window period of 11 days (day –5 through day +5). 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 spells out the procedures taken place 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. However, only one agency has been 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.

RAM’s library was approached to gather a list of ratings announced from 1996 through 2001 with the announcement dates. The initial list consists around 1478 ratings (excluding aborted issues). Out of 1478 ratings, there only 776 ratings selected for further analysis because the rest are not listed in KLSE. As this study concentrates solely on bond issues (listed and OTC bonds), 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 579 ratings as the sample frame.

If the rating announcement is made more than once for a single company at the same period by RAM, this will be excluded because the study focus only on one event which is rating. 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.

The selected 537 ratings, will be classified to the types of the ratings as below:

<i>Initial Assignment</i>	:	72
<i>Reaffirmations</i>	:	299
<i>Downgrades</i>	:	96
<i>Upgrades</i>	:	70
<i>Total</i>	:	<u>537</u>

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 ratings grade 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 precedent. 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.

<i>Initial Assignment</i>	:	31
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<i>Reaffirmation</i>	:	50
<i>Upgrades</i>	:	21
<i>Downgrades</i>	:	42
<i>Total</i>	:	<u>144</u>

The finalised list of 142 ratings will be used to determine the estimated event window and estimation periods in terms of calendar dates using the announcement date as the focal date. Announcement day will be taken as day 0 (event day). The announcement days will be checked thoroughly and if it 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. The ratings will be excluded if the security concern is suspended during the period where announcement is made or the relevant days for the computation of AR is fall in this window.

As for the initial data collection, the share price of a particular security is collected for the period of one month prior to and five months after the announcement day. 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 this days on which a particular security is suspended are also excluded.

4.4 Data Collection Procedure

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 4.2 above.

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

Daily closing share prices

Daily closing KLCI

Daily closing share prices

Hydra, a software application, available at University of Malaya Library, will be used to obtain the daily closing share prices and daily closing KLCI for the ratings selected in Section 4.2. Hydra contains a host of current and past market information on share prices and KLCI. The system provides adjusted for bonus issues, rights issues & etc and unadjusted share prices. However, the later is more appropriate for the study and it would be downloaded for further action. The data will be saved in Excel format.

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 (day -5 through day +5) and the estimation period (day +6 through day +106) 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 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 (day -5 through day +5). 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 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.

Daily closing KLCI

Hydra, as explained earlier is again used to gather the daily closing KLCI for the estimated event window period (day -5 through day +5) and the estimation period (day +6 through day +106). 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 (day -5 through day +5) and the estimation period (day +6 through day +106). However the KLCI data is not much use in the analysis except for the above-mentioned purpose.

4.5 Data Analysis Techniques

This section explains the steps and techniques involved in analysis. Below steps involved in converting raw data into variable used in analysis:

Coding the samples and sub-samples

The samples are classified into investment grade, speculative grade and summary groups for all the four classes of ratings.

Standardize the date fields for all the ratings

The rating for each of the securities is taken place at the different time frame. The date field must be standardized in order to proceeding with the further computation. The announcement date will be referred as day 0, the days before announcement as -1, -2...-5 whereas the days after announcement as +1, +2+106

Computing daily share returns (R_{it}) and market returns (R_{mt})

The return will be computed by using the below formula for the window period -5 up to +5 and the estimation period +6 to +106

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

Computing normal returns (R_{it}^*) using mean adjusted models for each of the rating related security as per explained in 4.1.

Computing the abnormal returns, AR_{it} for each rating related security

Abnormal return is the difference between normal return and the daily share returns

($AR_{it} = R_{it} - R_{it}^*$). The , AR_{it} will be computed for day -5 to +5 for each ratings.

Computing the average abnormal returns, AR_{Nt} across samples and sub-samples.

The AR for sub-samples will be computed by dividing the cumulative abnormal return with the number of days between -5 to +5. The AR across the sample will be derived by dividing the total return of the samples returns for particular day with the number of ratings in sample.

Computing cumulative abnormal returns across periods, CAR_{Nn}

CAR_{Nn} will be obtained by aggregating the AR for each day in window period

Computing CAAR or cumulative average abnormal return across periods, $CAAR_{Nn}$.

$CAAR_{Nn}$ is the value derived by dividing the value in 7 by the number of days in window period across the subsample

Computing the t-test statistic values using AR_{it} and $CAAR_{Nn}$

Computing observed t-values for each of the ratings and samples/sub-samples involve 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 from day -5 through day +5, AR_{it} , is tested for significance level. Here, the AR_{it} value is divided by the standard deviation or σ_i to arrive at the t-statistic value for each of the 11 days of the event window period (from day -5 through day +5)

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 σ_N , the standard deviation of the sample or sub-sample, to arrive at the observed t-statistic value.

The t-statistic values are then used to accept or reject the hypotheses formulated under Section 4.1 entitled 'Research Hypotheses'.

4.6 Preparation of charts and tables for analysis.

Results of the computation and the test will be summarized and presented in table format. On top of this some of the result will be produced in line chart form to observe the trend.