Chapter 3: DATA AND METHODOLOGY

3.1 Data

3.1.1 Selection of Data

This study utilizes monthly data for Kuala Lumpur Composite Index (KLCI), CPO futures prices and RAM Quantshop Malaysian Government Securities (MGS) All Bond Index. Since the RAM Quantshop MGS All Bond Index (BOND) was only formed in January 1994, this study covers a period of 7 years, starting from January 1994 through February 2001, as well as two non-overlapping sub-periods (Feb 1994 - July 1997 and August 1997 – February 2001). The 7-year period of this study is chosen to cover the 84-month period of monthly returns, in which half of it (42 months) covers the first sub-period and the other equal half is for the second sub-period. These two sub-periods are chosen to cover the periods of pre- and post-financial crisis suffered by Malaysia. Apart from that, the monthly data for the month of September 1998 is dropped as KLSE was temporarily closed because KLCI dropped below the 200 mark. This step is taken to avoid any distortion that could affect the result of this study.

This study uses the KLCI as the proxy for the market portfolio index and as a diversified portfolio of stocks. KLCI is a portfolio of selected 100 companies stocks trading on the KLSE. KLCI uses market capitalisation to determine the weights of each selected stock and arithmetic mean to average the selected stocks. As for the bond portfolio, this study uses BOND data that is drawn from the Rating Agency Malaysia (RAM) Bond Newsletter. This index includes all securities with maturities greater than 1 year. Furthermore, this index contains straight, semi-annual coupon securities. The minimum size for the individual securities is RM200 million on issue. This index is calculated bi-monthly and market weighted. Besides that, the discount rate of the 3-month Malaysian

Government Treasury Bill is used to represent the risk-free rate of return. Furthermore, this study uses the CPO futures average monthly settlement prices for CPO spot month contract for its return calculation since there are some CPO futures spot month contracts that are not traded on the market on certain dates of a month.

3.1.2 Sources of Data

The data used in this study are obtained from the following sources:

i. The KLSE's website;
ii. Bank Negara's website;
iii. RAM Bond Newsletter;
iv. MDEX's website; and
v. Bank Negara Monthly and Quarterly Reports.

3.2 Computation of Returns, Risks and Correlation

The monthly return of the data are computed using the following formula:

$$R_{it} = \ln (P_{it} / P_{it-1}) \quad (1)$$

where,

R_{it} = monthly return for index i during month t;

$\ln P_{it}$ = natural log for index i during month t; and

$\ln P_{it-1}$ = natural log for index i during month t-1.

Natural logarithms of the monthly index are used to improve the normality of the price changes (Klemkosky and Martin, 1975). Besides that, cash dividends are excluded from returns computation for the KLCI.

Variance of the monthly returns of all the data is computed as a measure of risk using the following formula:

$$Var(Ri) = \sum_{j=1} (Ri - \overline{Ri})^2 / (m-1) \qquad (2)$$

where,

$Var(Ri)$ = variance of the monthly return of asset i;

Ri = monthly return of asset i;

$\overline{Ri}$ = mean of monthly return of asset i; and

m = number of variables in the sample.

The alternative measure of dispersion, i.e. risk, is standard deviation which is a square root of variance. The standard deviation is used frequently in this study than the variance.

According to Greer (1997), an asset class is classified as a set of assets that shares some fundamental economic similarities to each other and has different characteristics from other assets, which are not part of that class. Thus, CPO futures whose price derives from the price of the underlying CPO commodity can be considered as an asset class. Based on this statement, it is important that in this study CPO futures' movement is measured in relation to the movement of stocks and bonds. To this end, the covariance of the returns of the assets is calculated. Then, in order to standardize the covariance to fall within the range of -1 to +1, this study utilizes a measure known as correlation coefficient computed using the following formula:

$$\rho ik = \sigma ik / \sigma i \, \sigma k \qquad (3)$$

where,

ρ_{ik}	=	correlation between asset i and asset k;
σ_{ik}	=	covariance of assets i and k;
σ_i	=	standard deviation of asset i; and
σ_k	=	standard deviation of asset k.

3.3 Portfolio Formation

This study utilizes a method quite similar to the method used by Schneeweis and Spurgin (1999) in which they constructed four portfolios and then measured the portfolio performance in terms of each portfolio average annual returns and standard deviations as well as its Sharpe Index. However, this study differs in terms of the way the weights of assets in a portfolio is determined. Unlike in Schneeweis and Spurgin (1999) where weights in a portfolio is determined by allocating certain percentage randomly, this study will attempt to determine the optimal weights of each asset in a portfolio by using a computer software, which is known as S-plus version 6.0.

In order to compare the risks and returns between assets, monthly mean returns of each asset (KLCI, BOND and CPO futures) are computed for the entire sample period. Then, the average monthly returns are calculated for the whole period as well as two sub-periods. As for the risks of each asset, average standard deviations for the whole sample period and two sub-periods are computed.

Subsequently, this study examines the benefits of CPO futures as a part of a fully diversified portfolio. Thus, four portfolios are formed, Portfolio I to Portfolio IV. Portfolio I consist of KLCI and BOND, Portfolio II consist of KLCI and CPO futures, Portfolio III contain BOND and CPO futures, and Portfolio IV contain KLCI, BOND and CPO futures. The weights of assets in each of the above portfolios are computed in a way that each portfolio is optimally constructed.

3.3.1 Optimal Portfolio Construction

This study utilizes the S-Plus version 6.0 to find the optimal portfolios as mentioned above. The assumptions employed are short sales are not allowed but riskless lending and borrowing exist and the minimum weight of asset in each portfolio should at least be 0 per cent of the total asset in the portfolio, while the maximum weight should not be more than 100 per cent. The software is using the mean-variance model to determine the optimal portfolio. It will generate optimal portfolios subject to some predetermined criteria. The criteria that are used:

Minimise: $$\sum_{i,j \in Asset} Q_{ij} w_i w_j;$$

Subject to : $$\sum_{j \in Asset} w_j = 1;$$

$$\sum_{j \in Asset} \bar{r}_j w_j \geq r_{min}; \text{ and}$$

$$w_{j\,min} = 0 \leq w_j \leq w_{j\,max} = 100, \qquad j \in Asset$$

where w_j equals to an unknown allocation for asset j (variable), $\bar{r}_j$ is the observed mean return of asset j, r_{min} is the minimum accepted mean return, and $w_{j\,min}$ and $w_{j\,max}$ are the minimum and maximum allowable weights. Q_{ij} is the ij –th element of the covariance matrix of returns.

3.4 Portfolio Measures

In order to evaluate the performance of the experimental portfolios, this study examines the risk and returns of each portfolio. Below are the formulas for calculating portfolio retums and risk:

$$R_{pj} = \sum_{i=1}^{n} X_i R_{ij} \qquad (4)$$

where,

R_{pj} = monthly return of portfolio j;

X_i = percentage of investment invested in the asset i; and

R_{ij} = monthly return of asset i in the portfolio j.

As for risk,

$$\sigma^2_p = \sum_{j=1}^{N} X^2_j \sigma^2_j + \sum_{j=1}^{N} \sum_{\substack{k=1 \\ k \neq j}}^{N} X_j X_k \sigma_{jk} \qquad (5)$$

where,

X^2_j = square of the percentage of investment invested in asset j;

σ^2_j = variance of asset j;

$X_j X_k$ = percentage invested in asset j and asset k; and

σ_{jk} = covariance of asset j and k.

In addition, this study uses three measures. They are as follows:

$$\text{Sharpe Index} = \frac{R_p - R_f}{s_p} \qquad (6)$$

$$\text{Treynor Index} = \frac{R_p - R_f}{B_p} \qquad (7)$$

$$\text{Adjusted Jensen Alpha Index} = \frac{(R_p - R_f) - B_p (R_m - R_f)}{B_p} \qquad (8)$$

where,

R_p = average annual return on portfolio over the sample period;

R_f = average annual risk-free rate of return (the 3-month Treasury bill rate);

s_p = standard deviation of portfolio annual return;

B_p = beta of the portfolio; and

R_m = average annual return of market portfolio.

Sharpe Index measures the portfolios on a risk-adjusted basis. It determines the performance of the portfolios indicated by the size of excess return (R_p - R_f) per unit of total risk (s_p) (Sharpe, 1966). A high Sharpe Index indicates that such portfolio shows superior performance. Treynor Index developed by Treynor (1965) is an index that measures an excess return per unit of systematic risk. Therefore, a high Treynor Index indicates that the portfolio has a good performance. Meanwhile, Jensen (1969) developed an ex-post measure of a portfolio known as Jensen Alpha Index. It measures the size of excess return achieved by a portfolio. However, this index needs to be adjusted as different portfolios have different levels of systematic risks. Thus, the Adjusted Jensen Alpha Index is introduced as shown in (8). A portfolio with a positive Adjusted Jensen Alpha Index is regarded as having a good performance.

Furthermore, this study uses the market model to estimate the beta of the portfolio:

$$R_{it} = \alpha_i + \beta_i R_{mt} + e_{it} \qquad (9)$$

where,

R_{it} = monthly return of portfolio i in month t;

α_i = a constant term;

β_i = beta coefficient of portfolio i;

R_{mt} = monthly return of market portfolio in month t;and

e_{it} = error term, where $e_{it} \sim IN(0, \sigma^2)$.

3.5 Pre- and Post-Crisis Performance

To determine the performance of each experimental portfolio before and after the East Asian financial crisis, this study calculates the average risks and return of each portfolio for the two sub-periods. This is because to examine the performance of each portfolio in periods of traditional assets, i.e. stocks and bonds, decline. Furthermore, this step indicates whether investment in CPO futures could bring some benefits during these slump periods. This study conducts a hypothesis test using standard two-sample t-Test as follows:

H_0 : $\mu_{i1} = \mu_{i2}$

H_1 : $\mu_{i1} > \mu_{i2}$

where,

μ_{i1} = mean return of portfolio i in pre-crisis

μ_{i2} = mean return of portfolio i in post crisis

Rejection of the null hypothesis leads to the evidence of the existence of substantial effect of the financial crisis on the returns outlay of the constructed portfolios.