CHAPTER 3 : DATA AND METHODOLOGY

3.1 Sources Of Data

This study uses the weekly closing prices of the 31 Second Board Stocks of the KLSE Composite Index, for which sufficient data are available for the computation of betas, over the four periods; period 1(January 1992 to December 1992), period 2 (January 1993 to December 1993), period 3 (January 1994 to December 1994) and period 4 (January 1995 to September 1995). The major sources of data were the Daily Diary, the Investors Digest and Companies Handbook. Weekly price data were extracted from January 1992 till September 1995 and adjusted for any bonus issues, rights issues, share splits, etc. Weekly market returns and securities returns were obtained over all successive, non overlapping one-year periods from January 1992 through September 1995. The widely followed KLSE Composite Index was used to represent the market. The weekly returns are computed using the following definitions :

$$R_i = \frac{P_t - P_{t-1}}{P_{t-1}} \qquad R_m = \frac{I_t - I_{t-1}}{I_{t-1}}$$

where R_i = return on security i

P_t = price of the security i at the end of week t

P_{t-1} = price of the security i at the end of week t-1

R_m = return on market index

I_t = market index at the end of week t

I_{t-1} = market index at the end of week t-1

The 31 securities and their respective computed beta values in each of the four periods are presented in the Appendix A. The list of bonus issues, rights issues, share splits, dividends, etc., of the 31 securities is given in Appendix B. The market capitalisation of these securities is also given in Appendix C.

3.2 Computation Of Beta

For the purpose of this research paper, three different techniques of beta forecasting were examined. They are Ordinary Least Squares (OLS) method, Blume's method and Vasicek's method. Both simple and multiple regression techniques were employed to calculate the three different measures of beta coefficient. Betas were computed by regressing the weekly returns for a particular security in a certain period with the weekly market returns in the corresponding period. Betas computed in a period were used to predict betas for the subsequent period.

3.2.1 Ordinary Least Squares (OLS) Method

The simplest and most common approach in beta estimation is the OLS method. OLS method involves a simple linear regression between stock returns against the rates of return on the stock market index. Since the CAPM is not observable, the *ex post* model can be utilized :

$R_{it} = R_{ft} + \beta_i (R_{mt} - R_{ft}) + U_{it}$

where R_{it} = return on security i in period t

R_{ft} = risk-free return in period t

β_i = measure of systematic risk

R_{mt} = return of the market portfolio in period t

U_{it} = error term

However, Miller and Scholes (1972) found that if the risk -free rate of return is not stable over time, using time-series data to estimate the market model in equation will produce biased beta estimate. A better procedure is to utilize the relationship between a stock excess return and the market excess return :

$[R_{it} - R_{ft}] = \alpha_i + \beta_i [R_{mt} - R_{ft}] + U_{it}$

where R_{it} = return on security i in period t

R_{ft} = risk-free return in period t

α_i = independent return of security i

β_i = measure of systematic risk

R_{mt} = return of the market portfolio in period t

U_{it} = error term

The OLS method is the primary technique in this study. More specifically, the OLS estimated beta coefficients are used to calculate the Blume's adjusted beta and Vasicek's adjusted beta.

3.2.2 Blume's Method

Blume's (1975) technique for obtaining the estimated security betas involves first regressing the betas of securities in period 2 on the corresponding betas of securities in period 1 to obtain the simple linear regression equation :

$y = a + bx$

where a and b are the least squares regression coefficients. Using this regression equation, Blume's estimated betas of securities for period 3 are the y values when x is replaced by each of the betas of securities in period 2. Essentially, two sets of OLS estimated betas are required in Blume's beta adjusting technique, i.e. betas from non-overlapping time period t-1 and t. The betas in time period t are then regressed on the corresponding betas in time period t-1.

$$\beta_{i,t} = a + b\,\beta_{i,t-1} + \varepsilon$$

where $\beta_{i,t}$ = beta of security i from time period t

$\beta_{i,t-1}$ = beta of security from time period t-1

ε = error term

The regression coefficients a and b are then utilized to adjust *ex post* betas in the time period t and used as proxies for *ex ante* betas in time period t+1.

$\beta_{i,t+1} = a + b\,\beta_{i,t} + \varepsilon$

The Blume's estimated betas are also given in the Appendix A.

3.2.3 Vasicek's Method

The Vasicek's (1973) Bayesian technique for obtaining the estimated security betas makes use of the prior of historical distribution of beta coefficients. Specifically, Vasicek's estimated beta β_v of security i for period 2 is obtained as follows :

$$\beta_v = \frac{\beta s_1^2 + \beta_i S_\beta^2}{S_i^2 + S_\beta^2}$$

where β_i = the computed beta of security i for period 1

β = the mean of the cross sectional distribution of security betas for period 1

S_i^2 = the variance of β_i

S_β^2 = the variance of cross sectional betas in period 1.

This procedure adjusts beta in proportion to the size of the sampling error in beta estimation. The more uncertain the estimate of beta, the lower the weight placed on it. For example, if a particular security exhibited a stable beta (low standard error in its OLS regression) in the previous time period, this beta would not be adjusted as much as an unstable (high standard error) beta. In general, However, high betas have higher standard errors than low betas. Thus, high betas will be adjusted by a larger proportion than low betas. For this reason, after adjusting, the average of the adjusted betas will tend to be less than one.

3.3 Mean Square Error

The above three methods of predicting security betas are compared by using the statistical measure of mean square error (MSE) as a measure of forecast error. This procedure is also used by Klemkosky and Martin (1975). MSE measures the degree the predicted betas depart from the "true" betas. True betas are not known. Therefore, proxies are used. The OLS estimated betas are assumed to be the best representation of the true betas. True betas in time period t are predicted by :

(a) OLS estimated betas from time period t-1

(b) Blume's adjusted betas for time period t

(c) Vasicek's adjusted betas for time period t

MSE can be defined as follows :

$$MSE = \frac{1}{m} \sum_{i=1}^{m} (A_i - P_i)^2$$

where m = the number of securities for which beta forecasts are made

P_i = the prediction of the beta coefficient of security i

A_i = the estimated beta coefficient of security i

For example, P_i may be the computed beta or Vasicek's estimated beta of security i for period 1 used as the predictor of beta for period 2 and A_i is the corresponding computed beta for period 2.

The MSE can be easily partitioned into three components of forecast error as done by Hawawini, Michel and Corhay (1985) and Eubank and Eumwalt (1979) :

$$MSE = (A-P)^2 + (1 - \beta_1)^2 S_P^{\,2} + (1 - r_{A\,P}^{\,2}) S_A^{\,2} \tag{2}$$

where A = the mean of the computed betas

P = the mean of the predicted betas

β_1 = the slope coefficient of the linear regression of A on P

$S_P^{\,2}$ = sample variance in P

$S_A^{\,2}$ = sample variance in A

$r_{A\,P}^{\,2}$ = the coefficient of determination for P and A

The first term on the right hand side of the equation (2) represents bias, the second term inefficiency, and the last term random disturbance component of MSE.