CHAPTER 1 : INTRODUCTION

1.1 Capital Asset Pricing Model (CAPM)

Under the CAPM, the total risk of a security can be separated into market risk (systematic risk) and non-market risk (unique risk). Market risk is due to factors which influence all the securities in the market, and therefore constitute the only relevant risk for each security. It is a risk that arises from the return of a security and the market return. Hence, market risk is related to the risk of the market portfolio. Beta is commonly used as a measure of the market risk of a security. It originated from Markowitz's two parameter model (Markowitz 1952). Securities with higher betas will have higher market risk.

The non-market risk is attributed to factors which are specific to the security and it can be eliminated through diversification. Non-market risk is not related to beta. Thus, there is no reason why securities with larger amounts of non-market risks should have larger expected returns. Therefore, investors are rewarded for bearing market risk but not for bearing non-market risk.

To see how assets are priced, a model must be constructed. One of the model linking the market risk and return that has been used widely in security portfolio analysis is the CAPM which was developed by Sharpe (1964) and Lintner (1965). Their work was based on the earlier works of Markowitz (1952) and Tobin (1958).

Modeling requires simplification in that the model-builder must abstract from the full complexity of the situation and focus only on the most important elements. The way this is achieved is by making certain assumptions about the environment. These assumptions need to be simplistic in order to provide the degree of abstraction that allows for some success in building the model. The reasonableness of the assumptions (or lack thereof) is of its ability to help one understand and predict the process being modeled. (Milton Friedman 1953).

Some of the assumptions behind the CAPM are as follows :

1. Investors evaluate portfolios by looking at the expected returns and standard deviations of the portfolios over a one-period horizon.
2. Investors are never satiated, so when given a choice between two otherwise identical portfolios, they will choose the one with the higher expected returns.
3. Investors are risk-averse, so when given a choice between two otherwise identical portfolios, they will choose the one with the lower standard deviation.
4. Individual assets are indefinitely divisible, meaning that an investor can buy a fraction of a share if he or she desires.
5. There is a riskfree rate at which an investor may either lend (that is, invest) money or borrow money.
6. taxes and transaction costs are irrelevant.

To these assumptions the following ones are added :

7. All investors have the same one-period horizon.

8. The riskfree rate is the same for all investors.

9. Information is freely and instantly available to all investors.

10. Investors have homogeneous expectations, meaning that they have the same perceptions in regard to the expected returns, standard deviations, and covariance of securities.

Under the condition of market equilibrium, the CAPM relates the return on a security i to the return on the market m in the following manner :-

$E(R_i) - R_F = \beta_i [E(R_m) - R_F]$

where $E(R_i)$ = the expected return on security i

R_F = the riskfree rate

$E(R_m)$ = the expected return of the market

β_i = beta coefficient of security i

However, it has been argued that the CAPM is virtually impossible to test because

(a) the only testable hypothesis of the CAPM is that the "true" market portfolio lies on the efficient set.

(b) the "true" market portfolio cannot be meaningfully measured (Roll 1977).

Hence, despite its widespread application, the market portfolio is surprisingly ill defined. In theory, the composition of the market portfolio is simple: All assets are weighted in proportion to their respective market values. In reality, actually identifying the true market portfolio (or even a close approximation) is beyond the capability of any individual or organization. The difficulties involved in determining the composition and value of the true market portfolio have led to the use of market portfolio proxies. In dealing with common stocks, for instance, most researchers and practitioners arbitrarily define the market portfolio to be a broad stock market index, such as the S & P 500 or the KLSE Composite Index. What are the ramifications of not knowing the market portfolio's true composition? From a theoretical perspective, the potential problems are significant. In two controversial articles, Roll (1977,1978) argued that the ambiguity of the market portfolio leaves the CAPM untestable. He contended that only if one knows the true market portfolio can one test whether it actually lies on the efficient set. Considering that the CAPM linear relationship between expected return and beta depends on the efficiency of the market portfolio, Roll's argument should not be taken lightly. Furthermore, Roll argues that the practice of using proxies for the market portfolio is loaded with problems. Different proxies, even if their returns are highly correlated, could lead to different beta estimates for the same security. From the results of the recent studies, some researchers have concluded that the CAPM is no longer relevant based on the results that show that the relationship between beta and average stock returns is flat (Fama & French :1992, Fama & French :1993).

However, these test methods have been challenged by the results of other studies that show that average returns and betas have a positive linear relationship when the market portfolio includes human capital and betas are allowed to vary over the business cycle (Jagannathan & Wang, 1993).

1.2 Beta

If we want to know the contribution of an individual security to the risk of a well-diversified portfolio, it is no good thinking about how risky that security is if held in isolation - we need to measure its market risk, and that boils down to measuring how sensitive it is to market movements. This sensitivity is called beta.

Stocks with a beta of 1.00 means that, on average the stocks tend to rise and fall in price roughly by the same percentage that the market index rises or falls. Stocks with betas greater than 1.00 tend to amplify the overall movements of the market, but not as far. Stocks with negative betas would tend to move against the market, but such stocks are rare.

Note that, from an economic viewpoint, the market return does not cause the security return (Rosenberg and Guy, 1976). Instead, both are caused by economic events. This point has created some confusion among analyst who interpret beta, which is a regression coefficient, as necessarily stating the causal relationship between market returns and the security returns : That is, if beta is two, a market return of 10 percent causes a security return of 20 percent. The correct wording of this statement is that, as a consequence of the dependence of both market return and security return upon economic events, if a market return of 10 percent is observed, then the most likely value for the associated security return is 20 percent.

1.2.1 <u>Estimating Betas</u>

Betas are generally estimated from the stock's characteristic line by running a linear regression between past returns on the stock in question and the past returns on some market index. Betas developed in this manner are called historical betas.

For individual securities, past risk is often not a good predictor of future risk, and historical betas of individual firms are usually not stable. As a result of this, researchers have sought ways to improve them. This has led to the development of two different types of betas :-

1.) adjusted betas, and
2.) fundamental betas

Adjusted betas grew largely out of the work of Marshall E. Blume, who showed that true betas tend to move toward 1.00 over time (Blume 1975). Therefore, one can begin with a firm's pure historical statistical beta, make an adjustment for the expected future movement toward 1.00, and produce an adjusted beta which will, on average, be a better predictor of the future beta than would the unadjusted historical beta.

Other researchers have extended the adjustment process to include such fundamental risk variables as financial leverage, sales volatility, and the like. The end product here is a fundamental beta (Rosenberg and Guy, 1976). These betas are constantly adjusted to reflect changes in a firm's operations and capital structure, whereas with historical betas (including adjusted ones) such changes might not be reflected until several years after the company's "true" beta had changed.

The bottom line of all this is that one can calculate betas in many different ways and, depending on the method used, different values of betas will result. Where does this leave financial managers regarding the proper beta? Some managers calculate their own betas, using whichever procedure seems most appropriate under the circumstances. The choice is a matter of judgment and data availability, for there is no " right" beta.

1.2.2 Uses Of Beta

It is important to examine the uses of beta because the criteria for prediction and estimation probably arise from the requirements of usage. In other words, in each application, that estimator or predictor should be used that will function best in that application. If different applications impose different requirements, then different estimators should be used.

Performance Evaluation

The most widely recognized use of beta is in the evaluation of past investment performance. For this purpose, the portfolio as a whole is the appropriate entity : One is interested in the degree of portfolio risk (the beta of the portfolio).There is only a derivative interest in the risks of the individual securities, to the degree that knowledge of these can be helpful in assessing risk for the overall portfolio.

It should be noted that several different sets of data can be used to calculate historical betas, and the different data sets produce different results. Here are some points to note :

1. Betas can be based on historical periods of different lengths. For example, data for the past one, two, three, and so on, years may be used. Most people who calculate betas today use five years of data, but this choice is arbitrary, and different lengths of time usually alter significantly the calculated beta for a given stock.
2. Returns may be calculated on holding periods of different lengths - a day, a week, a month, a quarter, a year and so on. In statistical analysis, it is generally better to have more rather than fewer observations, because using more observations generally leads to greater statistical confidence. This suggests the use of weekly returns and say, five years of data for a sample size of 260, or even daily returns for a still larger sample size. However, the shorter the holding period, the more likely the data are to exhibit random "noise", and the greater the number of years of data, the more likely it is that the company's basic risk position will have changed. Thus, the choice of both the number of years of data and the length of the holding period for calculating rates of return involves tradeoffs between desire to have many observations versus a desire to have recent and consequently more relevant data.
3. The index used to represent "the market" is also an important consideration, as the index used can have a significant effect on the calculated beta. In theory, the broader the index, the better the beta : indeed, the index should really include returns on all stocks, bonds, leases, private business, real estate, and even "human capital".

Investment Strategy

Because the value of beta measures the expected response to market returns and because the vast majority of returns in diversified portfolios can be explained by their response to the market, an accurate prediction of beta is the most important single element in predicting the future behaviour of a portfolio. To the degree that one believes that one can forecast the future direction of market movement. a forecast beta, by predicting the degree of response to that movement, provides a prediction of the resultant portfolio return. To the degree that one is uncertain about the future movement of the market, the forecast of beta, by determining one's exposure to that uncertainty, provides a prediction of portfolio risk.

Thus, there is little doubt that, if one could make an accurate prediction of future beta for the portfolio, it would be an important ingredient in his investment decision making. For instance, if the manager decides to increase the portfolio beta, then he will seek to exchange current holdings with low beta for new purchases with high beta, and the success of this exchange will depend on his ability to forecast the difference in beta.

Valuation

Finally, a third class of uses applies to the valuation of convertible assets. Consider any asset, such as convertible bonds, convertible preferred stock, warrants and options, that provides the opportunity to exercise a conversion into the underlying security. The higher the underlying risk, the more likely that the security price will change significantly. Since one profits (loses) if the security price goes in one direction and is unaffected if the security goes in the other, the greater the expected risk, the greater the expected profit (loss). Knowledge of the beta permits prediction of one important element of risk.

1.3 Literature Review

Beta is gaining recognition and its application for the purpose of investment analysis and portfolio selection strategy will be extensive in the forthcoming years. In view of this, betas have been widely discussed and studied by academicians, practitioners and researchers. For example, Blume (1971) examined the empirical behaviour of the risk measures for the portfolio composed of NYSE-listed stocks during the period between 1933 and 1968. He found that the correlation coefficients between betas of the same portfolios of ten securities or more in two adjacent periods were over 90%. Besides, he also discovered that there was a tendency for a portfolio with a high or low beta in one period to have a less extreme beta in the next period. In a later study, Blume(1975) reported beta statistics for portfolios of 100 securities on both adjusted and unadjusted bases and compared them with betas of subsequent periods. The figures again show a close correlation between betas of adjacent periods. The results reinforced his earlier findings.

Vasicek (1973) found that the widely used method, Ordinary Least Squares (OLS), in estimation of beta forecasts can only minimize the squared sampling error but fails to minimize squared estimation error. Consequently, the OLS predicted betas do not satisfactorily reflect the desired properties of a beta estimator. A major source of estimation error in beta forecasts is due to the normal distribution assumption. This assumption is necessary so as to enable the inference of the distribution of the true beta (which is not known) using the historically estimated beta. To correct such error, he suggested the utilization of prior knowledge of the cross-sectional distribution of historically estimated betas as basis of adjustment to simple extrapolated beta forecasts. The end result is that these adjusted betas will satisfy the minimum expected loss criterion.

Thinness of the market and discontinuity in trading can lead to biased beta estimates. As a result, they are likely to embody high measurement error and thus seriously affect the stability of beta forecast. To correct for such biases, Dimson (1979) proposed a new specification of market model which incorporates a time series of lags and leads and aggregating the resulting beta coefficients to obtain the appropriate value of beta. The number of lags and leads required in Dimson's model is determined by the convergence of the aggregated betas to the expected value of 1.00. Fowler and Rorke (1983) argued that beta statistics in Dimson's procedure should be corrected by weighting the betas with the serial correlation in the market returns. it is shown that the resultant beta statistics are consistent and unbiased. Beta statistic derived through this method is called the Dimson-Fowler-Rorke's beta.

There is a number of empirical research done on the various estimation of beta. Various methods such as Ordinary Least Squares (OLS), Blume's, Vasicek's, Dimson-Fowler-Rorke's, etc., were critically examined to search for the "ideal" method in beta forecasting. The first study was by Klemkosky and Martin (1975). They investigated the source of forecast errors of extrapolated beta coefficients and three adjustment techniques that practitioners used to improve beta forecasts. The three adjustment techniques tested by them were Bayesian (or Vasicek's) method, Blume's method and MLPFS's method (developed by Merrill Lynch, Pierce, Fenner & Smith Inc.) Beta coefficients were computed using monthly returns over five year periods from July 1947 through June 1972. The four types of beta forecasts were evaluated using Mean Square Error criterion and then comparisons were made among the methods. They found that beta adjustment techniques, particularly Bayesian method, are useful for improving the accuracy of simple extrapolated beta forecasts. Beta adjustment techniques are also useful in reducing the forecast error for portfolio of securities than for individual securities.

Lam, Mok and Cheung (1990) tested the predictability and stationarity of beta coefficients of Hong Kong securities. Bi-yearly beta coefficients of 37 "blue chips" stocks in Hong Kong were computed based on weekly returns from 1 January 1980 to 31 May 1989. They presented five methods of predicting future beta values, i.e., OLS, Blume's. Modified Blume's, Vasicek's and Modified Vasicek's. Of these techniques, Modifies Vasicek's was found to have the least mean square error. On the local front, Kok (1994) did a similar study on the stability of beta forecast. Beta coefficients of 75 component stocks of the KLSE Composite Index were computed based on weekly returns over three periods, January 1983 to June 1986, July 1986 to December 1989 and January 1990 to December 1991. Three types of beta forecasting techniques were examined. They are OLS, Blume's and Vasicek's. Vasicek's method was found to yield the best predictors of future beta values.

1.4 OBJECTIVE OF THE STUDY

The objective of this study is to identify the most accurate method of predicting the future beta coefficients of individual securities which are listed on the Second Board of the Kuala Lumpur Stock Exchange (KLSE). This is important as by forecasting the future values of beta coefficients to determine the predictability of the future market risks of securities, investors will be able to make rational and prudent investment decisions with regards to the construction and management of a well-diversified portfolio in which the unique or unsystematic risk is significantly reduced.

Up until now, most of the studies on the predictability of beta coefficients were conducted on the securities listed on the Main Board of the KLSE (Kok ,1992 and 1994), which are widely regarded as less volatile as compared to those listed on the Second Board. Therefore, this study is conducted with the hope of providing some useful insight into the nature and characteristics of the beta coefficients of companies listed on the Second Board, and by doing so, create an awareness regarding the inherent problems of beta forecast.

The approach of this study is essentially similar to Kok's (1994). The three methods used in this study are Ordinary Least Squares method, Blume's method and Vasicek's method.