Risk and return nexus in Malaysian stock market: Empirical evidence from CAPM

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Abstract
This paper examines the applicability of CAPM in explaining the risk-return relation in the Malaysian stock market for the period of January 1995 to December 2006. The test, using linear regression method, was carried out on four models: the standard CAPM model with constant beta (Model I), the standard CAPM model with time-varying beta (Model II), the CAPM model conditional on segregating positive and negative market risk premiums with constant beta (Model III), as well as the CAPM model conditional on segregating positive and negative market risk premiums with time varying beta (Model IV). Empirical results indicate that both the standard CAPM models (Model I and Model II) are statistically insignificant. However, the CAPM models conditional on segregating positive and negative market risk premiums (Model III and Model IV) are statistically significant. In addition, this study also discovers that time varying beta provides better explanatory power.

Keywords: Stock market, CAPM, time-varying beta

JEL Classification: G10, G12, C20

1. Introduction

Stock market plays an important role in stimulating economic growth of a country. It helps to channel fund from individuals or firms without investment opportunities to firms who have them and thus improves the country's economic efficiency. It is the lifeblood of the economy of a nation that concerns individuals, firms as well as government. However, stock market is a volatile financial market, in which various factors can affect the return that investors can gain from investing in stocks. The uncertainty of reward from stock market is translated into risks that investors have to bear for investing in stocks. Broadly, risks exist in the stock market can be categorized into unsystematic risk which is firm specific as a result of company specific factors and systematic risk which is market related risk in consequence of market related factors. According to Markowitz Portfolio Theory (Markowitz, 1959), unsystematic risk can be diversified away through diversification of portfolio and thus the capital markets will not reward investors for bearing this type of risk. Instead, the capital markets will only reward investors for bearing systematic risk that cannot be eliminated through diversification.

Since the return from investment in stock market is uncertain, knowing the risk and return nexus in the stock market will be crucial for investors to maximize their return and minimize their risk, and thus ensuring the attractiveness of investing in stock market. Various theories relating risk and return have been developed about 60 years ago. In 1952, Markowitz developed the portfolio theory showing investors how to create portfolios of individual investments to optimally trade off risk versus return. Sharpe (1964) and Lintner (1965) marked the birth of asset pricing theory linking the expected return of an asset to its market risk using the Capital Asset Pricing Model (CAPM). Ross (1976) formulated Arbitrage Pricing Model (APM) as an alternative to CAPM. APM relates expected return of an asset to unidentified risk factors, which can be more than one. The unidentified risk factors could be anything but realistically it is most likely to be macroeconomic variables such as interest rate, inflation rate and so on. There are many other theories developed thereafter, some of them are modification of CAPM and APM. All these theories claim the possibility to estimate return of an investment. However, according to Bruner *et al*. (1998) and Graham and Harvey (2001), CAPM was found to be the most favored model of practitioners and academics. Dhankar and Singh (2005) also stated that CAPM is widely accepted as an appropriate technique for evaluating financial asset.

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CAPM developed by Sharpe (1964) links the investor's expected return on a stock to the market risk that the investor has to bear. According to CAPM, the expected return on an asset *i* is given by:

$$E(r_i) = r_f + \beta_i (E(r_m) - r_f) \tag{1}$$

where $E(r_i)$ is expected the return on asset *i*, r_f is the risk free return, $E(r_m)$ is the expected return on the market portfolio, $\beta_i = Cov(r_i, r_m)/\sigma_m^2$ is the systematic or market risk of asset *i* relative to the market portfolio, σ_m^2 is the variance of the return on the market portfolio and $Cov(r_i, r_m)$ is the covariance of r_i and r_m. The market portfolio, which consists of all the assets in the market, is not observable so it is necessary to use proxy and normally certain indexes will be chosen as the proxy. The following are the main assumptions of the CAPM [see Ariff and Johnson (1990, pp. 170) for the details]:

a) Investors are risk averse and seek to maximize expected utility of wealth at the end of a one period investment horizon.
b) Investors choose between objects of investments on the basis of their means, μ, and variance, σ^2, of expected return distribution.
c) The market for the securities is frictionless with trivial transaction and information costs and there are no taxes as well as no restrictions on trading.
d) Investment plan consists of an investor's consumption investment trade-off, which is made at the beginning of the investment horizons. Investors have a common horizon and identical expectations about the return distribution.
e) There exists a risk-free security guaranteed by the government (Treasury Securities) where all investors can borrow or lend.

These assumptions represent a highly simplified and idealized world, but are needed to obtain the CAPM in its basic form which link the investor's expected return on a stock to the market risk that the investor has to bear. In carrying out an empirical study on CAPM, some of these assumptions are very difficult to fulfill, leading to variation in findings from the theoretical expectation.

This study aims to investigate the risk and return relation of the Trading and Services sector, the biggest sector in term of market capitalization, in the Malaysian stock market namely Bursa Malaysia. Generally, we hope to establish a ground for investors to use CAPM model in managing risk and return while investing in Malaysian stock market. In particular, we intend to empirically examine whether constant or time varying systematic risk beta should be utilized in the context of Malaysia. Under the traditional CAPM model, the systematic risk of a firm is assumed to be constant over the life of the firm. However, there exists considerable evidence that the assumption of beta stability is invalid. It is highlighted by studies conducted by Kim (1993), Bos and Newbold (1984), Cheng (1997) and Kok (1992, 1994).

2. Literature Review

There had been extensive theoretical and empirical studies on asset pricing model, which trying to establish factors that contribute to the expected return of capital asset. These studies contributed towards the development and improvement of the models to explain pricing of capital asset under an equilibrium market. Sharpe (1964) and Lintner (1965) developed the earliest model trying to estimate the expected return of capital assets in the 1960's, which is the extension of the one period mean-variance model of Tobin (1958) and Markowitz (1959). The Sharpe-Lintner model links return to risk. It uses beta, the risk free rate, and the market return to estimate the expected return.

Early studies were largely supportive of the Sharpe-Lintner CAPM, that is, the unconditional model stating a linear relationship between return and market risk, beta which is a constant. For example, Fama and MacBeth (1973) found that on average there is a positive tradeoff between risk and return for New York Stock Exchange (NYSE) common stocks using monthly average data from 1926-1968. They found no measure of risk, other than beta, systematically affecting the average return. Ball *et al*. (1976) revealed that there is evidence that the cross sectional relationship between beta risk and the average return is linear in the Australian Industrial equity market over the period of 1958-1970. Ariff and Johnson (1990) also reported that the Singapore stock market was in favor of the linear and positive return to risk relation during 1973-1988. In addition, Chen (2003) found evidence supporting the use of CAPM in Taiwan stock market. The relationship between stock returns and beta is significant and the coefficient of determination of the regression is high for all the sectors under study.

On the other hand, Jagannathan and Wang (1996) examined the CAPM under condition where the firms' betas vary through time in the NYSE. They found that the conditional CAPM (CCAPM) where betas are allowed to vary over time performed well as compared to the standard CAPM where the firms' betas were assumed to be constant. Durack *et al*. (2004) who conducted the same test in Australian Stock Market also concluded that CCAPM could provide a better result for the relationship between expected return and beta as compared to the standard CAPM. Soydemir (2005) revealed that International CAPM (ICAPM) with time varying betas prices market risk in the Asian stock markets but not ICAPM with constant beta. Elsas *et al*. (2003) analyzed the beta and returns of the German stock market using both the standard CAPM and CCAPM on testing positive and negative market risk premiums separately. They documented that the CCPM is superior to the standard CAPM in estimating the stocks return. Tang and Shum (2004) stated that even though beta is significantly related to returns in Singapore stock market, the explanatory power is low. However, a conditional framework based on up and down markets significantly improved the explanatory power where there is a significant positive (negative) relation between beta and returns when the market excess return are positive (negative).

The validity of CAPM has been subjected to argument since some empirical tests have not been supportive of the model and have identified a number of factors that tend to better explain the cross-section of average returns in addition to market risk. For instance, Banz (1981) showed that the size of a firm in terms of their market value has an effect on the expected return. Small size firm tends to have a higher average return as compared to the return estimated by CAPM, vice versa. Besides, Bhandari (1988) found that the expected stock returns are positively related to the ratio of debt to equity in the NYSE. Leverage of a firm seems to have an effect on its return. Moreover, Chan *et al*. (1991) recorded that there is a significant relationship between expected return of stock in Tokyo Stock Exchange and the underlying behavior of four variables including earnings yield, size, book-to-market ratio and cash flow yield, for the period of 1971-1988.

Fama and French (1993) drew attention to the effect of three factors: market risk, size and ratio of book-to-market value of equity, on the expected return, and found that return is more precisely estimated by model consisting of the three factors. Rahman *et al*. (1998) examined the performance of three asset-pricing models: the CAPM, the APT and the unified between CAPM and APT (UAPT) in NYSE and AMEX using data from 1970-1985. They found that UAPT using macroeconomic factors is the best performing model, followed by the APT and CAPM. Gonzalez (2001) argued there is no significant evidence that CAPM can be used to predict stocks return in Caracas Stock Exchange from 1992-1998. Drew *et al*. (2004) employed the standard CAPM and a multifactor model to analyze stocks return in the Shanghai Stock Exchange. It was found that the multifactor model performs better and that firm size and idiosyncratic volatilities notably affect stocks return.

Theriou (2005) explored the ability of beta as well as firm specific factors to explain the expected return in the Athens Stock Exchange during 1993-2001. The findings indicate there is no significance relationship between beta and the expected return. However, the firm size effect on the average stock returns is more significance. Bartholdy and Peare (2005) found that CAPM and Fama and French (1993) three factors model performed badly in predicting the expected stock return from 1970-1996 in NYSE where the CAPM model only explain on average 3% of difference in returns whereas the Fama and French three factors model explained only 5%. Dhankar and Singh (2005) showed that APT with multiple factors provides a better indication of asset risk and estimates of required return than CAPM, which uses beta as the single measure of risk in the principal component analysis of the Indian stock market for the period of 1992-2002.

From the literature reviewed, it can be concluded that there is no one model that can claim to have the absolute ability to predict the expected stock return. While some researchers are questioning CAPM and in favor of Fama and French (1993) three factors model, there are studies that supported the performance of the CAPM model. There are also researchers that question the use of either model for estimation of individual expected stock returns such as Bartholdy and Peare (2005). On the other hand, some studies provide support on the use of CCAPM such as Jagannathan and Wang (1996), Durack *et al*. (2004), and some through analyzing separately positive market risk premium and negative market risk premium as in Elsas *et al*. (2003) and Tang and Shum (2004).

3. Data and Methodology

This study concerns stocks traded in the Malaysian stock market classified under the sector Trading and Services of the main board during the period of January 1995-December 2006. In term of market capitalization, the Trading and Services sector is the largest sector of the main board. As at 31st December 2006, the market capitalization of this sector is approximately RM326 billion which was about 40% of the main board total market capitalization of RM818 billion, and thus its contribution to Malaysian economic growth would be significance. As at 31st December 2006, a total of 150 stocks are listed in this sector. According to Bartholdy and Peare (2005), estimation for thinly traded stocks requires a different procedure that involves much more complexities. Thus, only frequently traded stocks will be considered in the study that totaled to 60 stocks. Following Bartholdy and Peare (2005), the frequently traded stocks refer to stocks that are traded on more than 95% of the days in the estimation period.

The market portfolio refers to under the CAPM is the market portfolio where by definition consists of all assets in the market (Sharpe, 1964). Since it is not observable, we proxy it with the Kuala Lumpur Composite Index (KLCI), which indicates the performance of the overall Malaysian stock market. The Trading and Services Index (TSI) will be used to indicate that performance of the Trading and Services sector. In this study, three types of data are required: the individual stock prices, the KLCI and TSI values and the 3-month Treasury bill rate (TBR) that represents the risk-free rate. The data for the individual stock and the two indexes were downloaded from the KLSE daily trading using software package Meta Stock. The TBR was compiled from various issues of the Monthly Statistical Bulletin published by Bank Negara Malaysia (BNM).

The test is to be carried out on four models including the standard CAPM model with constant beta (Model I), standard CAPM model with time-varying beta (Model II), CAPM model conditional on segregating positive and negative market risk premiums with constant beta (Model III), as well as CAPM model conditional on segregating positive and negative market risk premiums with time varying beta (Model IV). According to Elsas *et al*. (2003) and Bartholdy and Peare (2005), for any of the models to be of use, it is important for the model to produce a significant market risk premium.

Following Elsas *et al*. (2003) and Bartholdy and Peare (2005), testing the significant of each of the models involves three stages: firstly, the estimation of the systematic risk beta (β) of each of the stock in the sample in relation to each of the proxy market; secondly, the estimation of market risk premium of each of the model with regards to each of the proxy market; and lastly, to test whether the model can explain the relationship between individual stock return and systematic risk, beta.

3.1 Estimation of Systematic Risk, Beta

Generally the larger the number of observation, the better is the estimate. However, Bartholdy and Peare (2005) pointed out that a long estimation period for beta may cause the true beta to change over the period and the resulting estimate for beta will therefore be biased. They tested the performance of monthly data for 5 years, weekly data for 2 years and daily data for 1 year in estimating beta. Even though they recommend the use of monthly data for 5 years, the difference between weekly data for 2 years and monthly data for 5 years is not significant.

For this study, the estimation of beta for each stock will be based on weekly data for 2 years due to limited period of available data. Firstly, weekly return will be calculated base on the weekly closing price. To eliminate the weekend effect, one week will be taken as from Thursday to Wednesday of the following week. The periodic returns for KLCI, TSI and all the individual stock in the sample will be calculated using Equation (2) as follow:

$$r_t = \frac{(p_t - p_{t-1})}{p_{t-1}} X100\% \tag{2}$$

where r_t is the return of period t, p_t is the closing price/value of period t and p_{t-1} is the closing price/value of period t-1. For each of the stocks in the sample, an estimate of beta, can be obtained by running an Ordinary Least Square regression (OLS) using either one of the following time series regressions:

$$r_{it} = \alpha_i + \beta_{ik} r_{kt} + \varepsilon_{it} \tag{3}$$

$$r_{it} - r_{ft} = \alpha_i + \beta_{ik}\left(r_{kt} - r_{ft}\right) + \varepsilon_{it} \qquad (4)$$

where r_{it} is the periodic return of asset *i* at period *t*, r_{kt} is the periodic return at period *t* on the Index *k* which is used as a proxy for the market portfolio, β_{ik} is the systematic risk of asset *i* relative to the Index *k*, r_{ft} is the annual risk free rate, ε_{it} is an error term and α_i is a constant specific to asset *i*. Equation (3) is based on raw return of the stock whereas Equation (4) is based on the excess return. Bartholdy and Peare (2005) showed that the results obtained using the two equations are not significantly different. Since the data for weekly risk free rate is not available, we will utilize Equation (3) in our estimation.

For estimating the constant beta, the estimation period is from January 1995 to December 1996. The beta obtained for each of the individual stock will be used for testing the annual return for each year from 1997 to 2006. For estimating time varying beta, the estimation strategy is as depicted in Table 1.

3.2 Estimation of Market Risk Premium of the Models

The market risk premium of each of the models will be estimated by running a cross-section regression related to each of the models where the excess return of each of the stocks is the dependent variable and its beta is the independent variable. The coefficient of the regression will be the market risk premium. The market risk premium, $\gamma_{kt,}$ at each of the time period will be averaged to obtain the average estimated market risk premium, $\gamma_{k,}$ of the model. However, for models conditioned on market risk premium being positive or negative, period having positive market risk premium were averaged separately from the period having negative market risk premium. The cross-section regression for each of the models and the relevant beta estimation are as follow:

a) **Model I: Standard CAPM model with constant beta**

The beta for this model is constant as estimated in Equation (3) and the cross-section regression in accordance with Bartholdy and Peare (2005) is as in Equation (5):

$$r_{it+1} - r_{ft+1} = \gamma_{0t+1} + \gamma_{kt+1}\beta_{ikt} + \varepsilon_{kt+1} \qquad (5)$$

where r_{it+1} is the return of stock *i* for year *t*+1, r_{ft+1} is the annual risk free rate, $r_{it+1} - r_{ft+1}$ is the excess return of stock *i* for year *t*+1 and β_{ikt} is the estimated beta for stocks *i* at year *t* used to explain return at year *t*+1 for Index *k* and γ_{kt+1} is the risk premium for Index *k* for year *t*+1.

b) **Model II: Standard CAPM Model with time varying beta**

This model will be using the cross-section regression as in Equation (5). However, the beta for this model is allowed to vary over time.

c) **Model III: CAPM model conditional on segregating positive and negative market risk premiums with constant beta**

Elsas *et al*. (2003) found that the positive and negative market risk premiums combined together is having a neutralizing effect on the result and will affect the finding of CAPM. To circumvent this problem, they analyzed the positive and negative market risk premiums separately by augmenting the cross-section regression as in Equation (5) with a dummy variable D, which takes on the value 1 (0) if the market risk premium of the testing period is positive (negative). The cross-section regression is as in Equation (6):

$$r_{it+1} - r_{ft+1} = \gamma_{0t+1} + \gamma_{1kt+1}D_{t+1}\beta_{ikt} + \gamma_{2kt+1}(1 - D_{t+1})\beta_{ikt} + \varepsilon_{kt+1} \qquad (6)$$

where γ_1 and γ_2 are the expected values of the market risk premiums, conditional on them being positive or negative, respectively. In this study, γ_1 (γ_2) is estimated by averaging the market risk premium of all the period having a positive (negative) market risk premium.

d) **Model IV: CAPM model conditional on segregating positive and negative market risk premiums with time varying beta**

This model will be using the cross-section regression as in Equation (6). However the beta for this model is allowed to vary over time.

The data frequency of excess individual stock return on the left hand side of Equations (5) and (6) is annual data, independent of the data frequency used for estimation of beta. Bartholdy and Peare (2005, pp.413) stated that this reflects the general application of the model by practitioners, where historical data are used to obtain an estimate of expected returns for the next year. The annual return of each of the stock, $r_{it,}$ is calculated using Equation (2) whereas the annual risk free rate, $r_{ft,}$ is obtained by annualizing the average interest rate of the 3-month TBR over the year.

3.3 Testing the Significant of the Models

According to Elsas *et al*. (2003) and Bartholdy and Peare (2005), for any of the models to be of use, the model should produce a market risk premium that is significantly different from zero. The coefficient of determinant, estimated as the mean R^2, will determine the percentage of the excess return of the individual stock dependent upon beta for each of the models. To test the estimated market risk premium, to be significantly difference from zero, we employ the one-sample *t*-test. For Model I and Model II, the null hypothesis that the mean of market risk premium is equal to zero will be tested against alternative hypothesis that it is significantly difference from zero whereas for Model III and Model IV, the null hypothesis that the mean of positive (negative) market risk premium is equal to zero will be tested against alternative hypothesis that it is significantly larger (smaller) than zero.

4. Empirical Results and Discussions

The results of the four models are summarized in Table 2. For Model 1, the mean risk premium for the period of 1997-2006 is 0.017 or 1.7% per annum. This value is statistically insignificant, indicating the null hypothesis that the mean of the market risk premium is equal to zero cannot be rejected. Similar result was obtained using TSI as the proxy. Thus, in Model I, the excess return of the stock is not dependent on the systematic market risk, beta. Moreover, the average R^2 in the cross-section regression is 3.9% with KLCI as proxy and 3.6% when TSI is the proxy, showing a poor explanatory power of beta for the excess return.

For Model II using CAPM with time varying beta, the mean risk premiums are slightly larger than that in the Model I, with 4.6% (with KLCI as proxy) and 8.9% (with TSI as proxy) per annum, respectively. However, these values are statistically insignificant at 5% level of significance. Similar to Model I, the obtained average R^2 in the two cross-section regressions are quite small (0.068), demonstrating beta is unable to explain for the changes in excess return. Therefore, the excess return of the stock in Model II also is not dependent on the systematic market risk, beta.

The estimation results for Model III using CAPM conditional on segregating positive and negative market risk premiums with constant beta show that the mean of the positive market risk premium is 13.6% (with KLCI as proxy) per annum. This means high-beta stocks receive a larger positive risk premium than low-beta stocks in the up market. In contrast, the negative market risk premium has an average value of -16.2%, showing high-beta stocks incur higher loses than low beta stock in the down market. Both the estimated values are statistically significant as shown in Table 2. The average R^2 is 0.039 which indicates explanatory power of beta for the excess return is about 3.9%. On the other hand, with TSI as proxy, the mean of the positive (negative) market risk premium is 8.5% (-19.7) per annum. The average R^2 of 0.036 implies that beta can only account for 3.6% of the variations in excess return of the stocks. Hence, even though beta and excess return of the stock has a significant relationship in Model III, the explanatory power is rather low.

Like Model III, the empirical findings for Model IV when time varying beta is used in CAPM conditional on segregating positive and negative market risk premiums indicate that the mean of positive and negative market risk premiums are statistically significant when both KLCI and TSI are used proxy. The average R^2 in the cross-section regression is 0.068 for both models using different proxies. Thus, compared to Model III, the beta in Model IV has slightly better explanatory power in explaining the movements in the excess return of the stocks.

In a nutshell, both Model I and Model II are statistically insignificant, indicating that systematic market risk cannot be used to explain the excess return of the stock. For Model III and IV, a statistically significant relationship between beta and excess return has been identified. Thus, CAPM model conditional on segregating positive and negative market risk premiums is the model that can be used to justify the relationship between excess return and beta but not the standard CAPM model. The slightly higher explanatory power of Model IV as compared to Model III suggesting that time varying beta is better able to predict the excess return of stock. Therefore, Model IV is the best model among the four models to be used to predict excess return of stocks in this study.

5. Conclusion

Since the birth of CAPM in the 1960's as a model that allows investors to predict the expected return from investing in the stock market, numerous empirical studies had been carried out to analyze the applicability of CAPM in different stock markets. Some empirical findings supported the model conditionally or unconditionally, among others, Fama and MacBeth (1973), Jagannathan and Wang (1996), Chen (2003), Tang and Shum (2005) and Soydemir (2005). However, there are also abundant empirical evidences that against CAPM, claiming there are other factors affecting return in the stock market rather than systematic market risk. Some of these studies include Banz (1981), Fama and French (1992), Gonzalex (2001) and Dhankar and Singh (2005). To date, there is no one model that can claim to have the absolute ability to predict the expected stock return. As such, it is the intention of this study to empirically examine the applicability of CAPM in the Malaysian stock market.

This study is concerned with the individual stock return of 60 frequently traded stocks of the Trading and Services sector in the KLSE. We discovered that CAPM conditional on segregating positive and negative market risk premiums is the model that can be used to justify the relationship between excess return and beta. This result corresponds to the findings of Elsas *et al*. (2003) and Tang and Shum (2004). In addition, we found that time varying beta is better able to predict the excess return of the stock than a constant beta as suggested by Jagannathan and Wang (1996) and Durack *et al*. (2004). The results are consistent with the two different market (KLCI and TSI) proxies, providing stronger support that in applying CAPM in the Malaysian stock market, positive risk premium's market should be analyzed separately from the negative risk premium's market and beta should be allowed to vary over time in accordance with changes in the market conditions.

To conclude, the finding indicates that high-beta stock receives a larger positive risk premium than low-beta stock in the up market, vice versa. In view of that, when the market is expected to be up market, investors can choose stock having higher beta. This will allow investors to have a bigger chance of getting a higher return. In contrast, when it is expected to be a down market, investors should choose stock having a lower beta so that if the market is really going down the risk can be minimized. The government/relevant authorities should try to make the beta information from all the listed companies publicly available to investors so that they can use it as a guide while investing in Malaysian stock market. Nevertheless, the investors should interpret the information provided by the beta cautiously and not to make the investment decision merely based on beta seeing that other factors (such as firm size, company's financial ratios, local and global economy conditions) might affect the return of the stock.

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Table 1: Estimation Strategy for Time Varying Beta

Estimation Period	**Testing Period**
1995 and 1996	1997
1996 and 1997	1998
1997 and 1998	1999
:	:
2004 and 2005	2006

Table 2: Summary of the Results for the Four Models

Model	CI			TS		
	Risk Premium (mean)	p-value	R^2	Risk Premium (mean)	p-value	R^2
I	0.017	0.394	0.039	0.001	0.499	0.036
II	0.046	0.280	0.068	0.089	0.127	0.068
III	+0.136	0.018	0.039	+0.085	0.030	0.036
	-0.162	0.056		-0.197	0.050	
IV	+0.222	0.037	0.068	+0.215	0.034	0.068
	-0.131	0.017		-0.159	0.009	