

Capital Asset Pricing Model in Forecasting the Expected Return: Theory and Evidence

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Abstract

This paper is made to investigate the theories and evidences related to the evolution of the Capital Asset Pricing Model (CAPM). The previous studies examined the single factor model, CAPM and Theory of Arbitrage, conditional CAPM on positive and negative market premium, CAPM with higher skewness and kurtosis, and also CAPM with higher size. This paper finds that there're so many previous researchers investigated the robustness of the Capital Asset Pricing Model. The return expectation from investor cannot be explained by the single factor, namely systematic risk (beta). Hence, there're various models that have been developed and investigated to project the return expectation in capital market.

Keywords: beta, capital asset pricing model, return

Introduction

Capital market helps the buyers and sellers to maximize the return with certain risks. Investors need to manage the risk, since that risk refers to the occurrence of losses relative to the expected return on any particular investment. There are two types of risk that the investors have to deal with. The first is unsystematic or diversifiable risk, is the part of the risk that can be diversified by using portfolio. The next risk is the undiversifiable or systematic risk, is related to the overall movements in the market which cannot be eliminated by diversifying the investments.

Markowitz (1952) proposed the model to measure the risk. He suggested the volatility to measure the risk by calculating the deviation of its return. The model of portfolio selection was proposed by Markowitz (1952), how the investors can construct portfolios to maximize the return. By constructing the efficient frontier of optimal portfolios, investors would receive the maximum return expectation.

However, the calculation of risk as discovered by Markowitz (1952) was quite complex. Therefore, Sharpe (1964) developed the single index model. Sharpe (1964) proposed that the security return was correlated to the market movements, either stable, up or down market. The variation of security returns of the single index model can be explained by the index, hence the name single index model. The risk that related to the market movements is called systematic risk, beta.

The Capital Asset Pricing Model was found by Sharpe (1964), measuring the systematic risk of the security. Sharpe (1964) discovered that only single factor that can explain the return of stocks, namely beta (systematic risk measurement). Because Sharpe's invention, there are so many researchers that investigated this Capital Asset Pricing Model (Mollik and Bepari, 2010; Verma, 2011; Das and Barai, 2013; and Messis and Zapranis, 2016).

Mollik and Bepari (2010) investigated about the instability of beta in a small emerging market. The instability of beta increases both in inter-period and intra-period period. Verma (2011) found that there was no significant effect between beta when excess return of market was positive and negative with next period stock return and the same when excess return of market was negative. Das and Barai (2013) found the existence of dynamic beta that sensitive to the economic circumstances.

Messis and Zapranis (2016) investigated the ability of betas in predicting the market return. They found the differences for the accuration of the prediction for all of the samples. By doing the examination of parameters, there was significant variations between two groups of stock. Large differences on diagnostic tests were founded.

Consequently, the previous researchers discovered that the variation in return could not be expressed by the single factor. Therefore, the various models have been discovered to predict the expected stock of returns.

The Capital Asset Pricing Model Theory

There's the risk that can't be reduced even by diversifying the number of securities, that's the systematic risk with beta measurement. The Security Market Line expresses the security expected return as a function of non-diversifiable risks. The SML can be formulated as (Sharpe, 1964):

$$E(R_i) = R_f + \beta_{im} \{E(R_m) - R_f\}$$

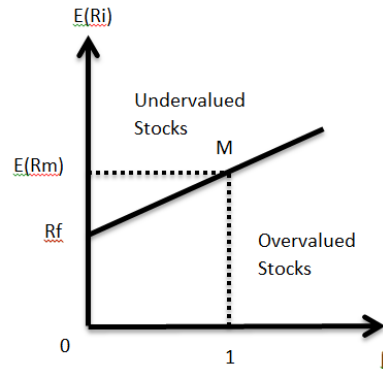
where:

$$\beta_{im} = \frac{\text{Cov}(R_i, R_m)}{\text{Var}(R_m)}$$

The β_{im} is the amount of systematic risk or non-diversifiable risk. R_i is the return of security and R_m is market return. In testing the fair prices of securities, the portfolio can be analyzed by using SML.

An undervalued (overvalued) stock here is priced too low and too high based on the theory of Capital Asset Pricing Model. The assets above the SML are undervalued because for a given amount of beta, they have a higher return. The assets below the security market line are overvalued because for a given amount of beta, as the measurement of systematic risk, they have a lower expected return. Security Market Line as discovered by Sharpe (1964) can be shown in figure 1.

Figure 1.
Security Market Line



The Empirical Studies

The empirical studies related to Capital Asset Pricing Model are explained under five circumstances:

1. Single Factor Model

The capital asset pricing model concerns about the correlation between beta and return. Academics and practitioners are used the CAPM in determining the price of the securities, can be formulated as:

$$R_{it} - R_{ft} = R_f + b_{im} \{E(R_m) - R_f\}$$

where

R_f is return of risk free and b_{im} is an estimate of β_{im} . The estimated β_{im} is the explanatory variable for the following equation:

$$R_{it} = Y_0 + Y_1 b_{im} + u_{it}$$

Y_0 is return expectation of zero beta, projected to be the same as the expected return of risk free. Y_1 is the market risk premium. It is positive value and different from zero.

Sharpe (1964), Lintner (1965) and Black (1972) were the pioneers to investigate the CAPM, primarily based on return of individual securities. Systematic risk was the risk measurement for investment and there was a trade-off between systematic risk and return expectation, and that trade-off would be positive. Furthermore, Fama and MacBeth (1973) has proven that there's the linear relationship but only limited to the data that covered long time period. Canegrati (2008) also confirmed the validity of the Capital Asset Pricing Model. The CAPM has been proven and the intercepts of regressions are equal to zero.

2. Capital Asset Pricing Model and Arbitrage Pricing Theory

There're so many studies found that the return of an asset cannot be described by the single factor. Ross (1976) explained about Arbitrage Pricing Theory model, more than one measure of risk in determining the factors that could explain the asset return. There's the procedure to test this model: First, a factor analysis procedure to find out the factors or variables. Second, the estimated factor loadings to explain the estimated expected return variations. Follow that research, Chen (1983) compared the APT and the CAPM and found that APT performed well rather than CAPM. The expected returns depend on estimated factor loadings.

Groenewold and Fraser (1997) found APT model was a valid model in explaining the variation in return of an asset. Messis, Iatridis and Blanas (2006) tested the three models for a five year period. They discovered that the APT performed better than the other models. During down markets, total risk has negative relationship to returns, while in up markets, this relationship was positive but not significant. Iqbal, Khattak and Khattak (2012) also has proved the validity of APT. APT was efficient enough to predict the future stock returns and more reliable measuring the risk premium.

3. Conditional CAPM on market premium

The further testing of CAPM is by considering the circumstances of the market, either bull or bear markets. Fabozzi and Francis (1977) were the pioneer to testing beta for bear and bull markets. Investors tended to receive positive premium for down market. Kim and Zumwalt (1979) analysed the return variations both in up markets and down markets. They discovered that downside risk more appropriate to measure the risk than beta itself.

Bhardwaj and Brooks (1993) investigated beta in bull and bear markets. They found the systematic risks statistically different between in bull and bear markets. The differentiator of market was based on either the return of market beyond the median of return of market or not.

Pettengill et al. (1995) found the inconsistent results of the correlation between return and systematic risk due to the conditional market. They investigated stocks in America for the period 1926 until 1990. For the total sample and across sub-sample periods, they discovered the conditional relationship between beta and return. There's a positive effect between beta and return during up market and negative effect between beta and return during down market.

Crombez and Vander Vennet (2000) also analysed the effect between return and beta conditional on the Brussel market, period 1990 until 1996. They also discovered the existence of different market conditions to test the beta. They found that beta was a strong indicator bull and bear markets.

Galagedera and Silvapulle (2003) examined the extended CAPM for the higher order co-moments. They investigated the relationship between returns and higher order systematic co-moments for up and down markets. They found the existence of skewness. The expected of excess return was related to beta and systematic coskewness.

Galagedera and Fuff (2005) examined whether the risk and return depending on changing of market volatility and condition of markets. They created three beta related to three volatility regimes and also two different markets. They discovered that risk premium in the three market volatility regimes was priced.

Canegrati (2008) found that beta was the measurement of risk and capture the expected excess returns variation. The existence of different market in finding the relationship between returns and betas was detected. Furthermore, Theriou, Angelidis and Maditinos (2010) investigated the return

and beta without differentiating the market excess returns. The significant evidence support the positive effect in up market and negative effect in down market.

4. CAPM with higher skewness and kurtosis

The literatures have noted the importance of higher moments (skewness and kurtosis). There're some findings discovered the unconditional return distribution was not normal (Ane and Geman, 2000; Chung et al., 2001). Skewness and kurtosis cannot be eliminated even by increasing the number of portfolios. The compensastion of investors for high risk measured by using the high systematic variance and systematic kurtosis (Arditti, 1971).

Many studies examined the CAPM of higher skewness and kurtosis, and also the effect on price of the assets. Researchers have mixed results in extending the CAPM to incorporate kurtosis and skewness in asset valuation models, there were Harvey and Siddique (2000), Christie-David and Chaudhry (2001), Messism Iatridis and Blanas (2007), Ajibola, Kunle and C. Prince (2015), Arewa and Ogbulu (2015) and Lal, Mubeen, Hussain and Zubair (2016).

Harvey and Siddique (2000) investigated CAPM with the conditional skewness. Harvey and Siddique (2000) found that conditional skewness reflected the return and even based on book to market values and size.

Christie-David and Chaudhry (2001) investigated the future market and found that the kurtosis and skewness could explain the return. They found that the explanatory power increases as terms for coskewness and cokurtosis were included.

Messis, Iatridis and Blanas (2007) found the significant evidences that the higher moment CAPM is more efficient than the lower moment CAPM. Portfolio of the investors may have the selection for the positive skewness. Unfortunately, the skewness and kurtosis cannot be eliminated by increasing the portfolio size. Thus, investors focused not only for variance, but also for kurtosis. As the time when the skewness of the portfolio was positive, they wanted to get the lower return, vice versa.

In Nigeria, Ajibola, Kunle and C. Prince (2015) found the validity of the CAPM by using unconditional and conditional information with higher order co-moments. The only relevant risk premium in explaining return variation was the systematic coskewness risk by using the unconditional CAPM. The investors in Nigeria were willing for taking specific market risk only in up market. The covariance and cokurtosis risks were dominant risk premium that have the impact on the determination of asset returns significantly.

Arewa and Ogbulu (2015) discovered that the CAPM risk factor was not significantly priced. The factors in the pricing assets by using the CAPM with higher order co-moment were not significant. The covariance risk and co-skewness risk premia have the inverse relationship with return, but unfortunately co-kurtosis risk did not. Furthermore, Lal, Mubeen, Hussain and Zubair (2016) found that the significant intercept term, high skewness and kurtosis. The adjusted R square was increased when higher moment was inserted in to the model.

5. Capital Asset Pricing Model with higher size

Before and during the recession, Rowe and Kim (2010) found that the size has significant positive impact on systematic risk. Asset turnover was the significant variable before the recession. The liabilities was significant during the recession. Hooy and Lee (2010) found size and operating efficiency have significant effect to systematic risk.

The higher the company size, the higher the beta value (Al-Qaisi, 2011). Financial leverage has the opposite relationship with beta. Government deficit and inflation has a positive relationship

with beta (Al-Qaisi, 2011). Before, during, and after the crisis, firm size constantly affected beta (Liu and Lin, 2015). That effect was significant. The same with the previous findings, the bigger the firm size, the higher the systematic risk before, during and after the crisis.

Nawaz et. al. (2017) found that size of the industry, efficiency of operating activities, and profitability were significant affect to systematic risk. The leverage and liquidity were not significant to systematic risk. This research will made the companies to finding out the strategic approach to make the organization more valuable.

Conclusion

This paper has explored the theories and evidences related to the evolution of the Capital Asset Pricing Model under five circumstances. There are the single factor model, CAPM and Theory of Arbitrage, conditional CAPM on positive and negative market premium, CAPM with higher skewness and kurtosis, and CAPM with higher size. The paper finds that there're so many previous studies testing the robustness of CAPM. The CAPM is valid to forecast the return both in individual stock and portfolio.

Nevertheless, the other studies also found that expected returns cannot be described by the single factor. Hence, there're various models that have been developed to predict the expected returns.

Since the robustness of CAPM is still debatable until now, there're so many literatures to improve that asset pricing model, and this makes multifactor models arised. Beta cannot be the only factor that can affects the expectation of the returns. The multifactor models incorporate so many variables such as factor analysis, factor loadings, skewness, kurtosis and size. The author also finds so many investors that concerned about the sensitivity of the markets.

However, the investigations about asset pricing model are unclear and unfinished. There's no firm model that could explain the variation of expected returns and there's no suitable measurement of risk. So the quest for robustness of modeling the asset pricing continues. This research has the limitations regarding to the circumstances in exploring the Capital Asset Pricing Model. The further research should explore more than this research did.

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