Research Journal of Finance and Accounting
ISSN 2222-1697 (Paper) ISSN 2222-2847 (Online)
Vol.5, No.21, 2014

Capital Asset Pricing Model (CAPM) Testability and its Validity in Stock Market: Evidence from Previous Literatures

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Abstract
Stocks such as bonds, treasurers and common stocks have been used in many companies to raise capital and improve investment for the benefit of the company or individual. Many companies has been raising or buying stocks for the investment benefit. Manager's decisions about stock pricing, stocks rising, stocks purchasing, investment valuation, etc have depended on market situation of such period in particular. As we know that managers or individuals cannot expect to succeed without understand how market forces shape the firm's ability to earn profit. Therefore, risk and return which associated with stocks have been given attention with companies and individuals, which was the cause of establishment of many models for these evaluations. One of the modal is Capital Asset Pricing Model(CAPM) which has became useful for assessment of cost of capital, portfolio performance, and portfolio diversification, valuing investments, choosing portfolio strategy among others and relationship between risk and return in market portfolio. The aim of this paper is to identify the validity of CAPM by thoroughly reviewing the literature and seeing whether its assumptions which used to guide its usage are holding true. Methodology used; CAPM is discussed under four categories which are the CAPM as a single factor model, supportive evidence of the CAPM evidence against it through various literatures. Findings showed that the CAPM remains a very useful item in the investment management toolkit. And investors trust it to evaluate the profitability of projects.
Keywords: Risk, Return, Portfolio, Asset, Validity, market, CAPM'

1. Introduction

Investors has been facing two kinds of risks, namely, diversifiable (unsystematic) and non diversifiable (systematic) risk. Unsystematic risk is the component of the portfolio risk that can be eliminated by increasing the portfolio size, the reason being that risks that are specific to an individual security such as business or financial risk can be eliminated by constructing a well-diversified portfolio. Systematic risk is associated with overall movements in the general market and therefore is often referred to as the market risk. The market risk is the component of the total risk that cannot be eliminated through portfolio diversification. The CAPM developed by Sharpe (1964) and Lintner (1965) relates the expected rate of return of an individual security to a measure of its systematic risk. The Capital Asset Pricing Model (CAPM) has become an important tool for managerial decision for assessment of cost of capital, portfolio performance, and portfolio diversification, valuing investments, choosing portfolio strategy among others and stocks' risk and return prediction. Fama and French (1992 and 1993), however, argued that market beta alone is not sufficient to explain expected return, and they developed their own model by adding two extra factors (size and book-to-market equity ratio) to CAPM. This model is known as the Fama and French three-factor (FF, hereafter) model and the financial community gradually adopted the model for practical and academic purposes. Elton (1999) and Fama and French (1997) later further examined the two traditional asset pricing models (CAPM and FF model) and concluded that estimates of the expected return computed using the two models are not reliable. The last half-century has witnessed the proliferation of empirical studies testing on the validity of the CAPM. A growing number of studies found that the cross-asset variation in expected returns could not be explained by the systematic risk alone. Therefore, a variety of models have been developed to predict asset returns. The aim of this paper is to identify the validity of CAPM by thoroughly reviewing the literature and seeing whether its assumptions which used to guide its usage are holding true. In a way the paper shall come with conclusion which shall be based on whether it's valid measuring risk and return in all aspects.

2.0. Literature review

2.1. Valid history behind the model

During the last few years considerable attention has been paid by most of the investors and financial researchers on the modern Capital theory. One of the most important development is the Capital Asset Pricing Model developed by Sharpe (1964), Lintner (1965).The foundations of the development of the model were laid down by Markowitz (1952) and Tobin (1958).Original theories suggested that the return volatility can be measured by

the standard deviation of the return, thus the higher the standard deviation of the returns the higher is the risk. The general idea behind CAPM is that investors need to be compensated in two ways: time value of money and risk. The time value of money is represented by the risk-free (rf) rate in the formula and compensates the investors for placing money in any investment over a period of time. The other half of the formula represents risk and calculates the amount of compensation the investor needs for taking on additional risk. This is calculated by taking a risk measure (beta) that compares the returns of the asset to the market over a period of time and to the market premium (Rm-rf).

Black, Jensen, and Scholes (1972) came up with a clever strategy that creates portfolios with very different betas for use in empirical tests. They estimate betas based on history (by regressing historical returns on a proxy for the market portfolio), sort assets based on historical betas, group assets into portfolios with increasing historical betas, hold the portfolios for a selected number of years, and change the portfolio composition periodically. As long as historical betas contain information about population betas, this procedure will create portfolios with sufficient dispersion in betas across assets.

Another classic observation through empirical study of the CAPM is by Fama and MacBeth (1973). They examine whether there is a positive linear relation between average return and beta and whether the squared value of beta and the volatility of the return on an asset can explain the residual variation in average returns across assets that is not explained by beta alone. Using return data for the period from 1926 to1968, for stocks traded on the NYSE, Fama and MacBeth find that the data generally support the CAPM.

2.2 Short Introduction of CAPM

CAPM explains systematic risk as a dual function of the return on common equity risk and growth risk. Thus risk is further broken into firm-owned risk and market risk, (Markowitz 1952). Therefore to use CAPM we need three inputs, which are the riskless asset which is asset for which the investor knows the expected return with certainty for the time horizon of the analysis. The risk premium which is the premium demanded by investors for investing in the market portfolio, which includes all risky assets in the market, and finally the beta which is the covariance of the asset divided by the variance of market portfolio measures the risk added on by an investment to the market portfolio. Investors face two kinds of risks, namely, diversifiable (unsystematic) and non-diversifiable (systematic). The market risk is the component of the total risk that cannot be eliminated through portfolio diversification (Don U.A Galagedera 2007). The CAPM developed by Sharpe (1964) and Lintner (1965) relates the expected rate of return of an individual security to a measure of its systematic risk.

3. The CAPITAL ASSET PRICING MODEL

The CAPM model has three testable implications: (C1) the relationship between expected return on a security and its risk is linear, (C2) beta is a complete measure of a risk of a security (C3) in a market of a risk averse investors, high risk should be compensated by higher expected market return. To test the linearity of relationship between the expected return of the security and risk need to make the assumption that the capital market is perfect hence no information or transaction cost incurred by investors. According to CAPM the expected return is the outcome of the two parameter model of risk and return relationship which can be written as:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) \quad (1)$$

Where $E(R_i)$ is the expected return on security i, $E(R_m)$ is the expected return of the market portfolio, R_f is the risk-free rate and β_i is a measure of risk for security i. The CAPM conveys the notion that securities are priced so that the expected returns will compensate investors for the expected risks. Therefore there are two fundamental relationships: The capital Market Line (CML) and Security Market Line (SML).

3.1. Capital Market Line (CML)

A line used in the capital asset pricing model to illustrate the rates of return for efficient portfolios depending on the risk-free rate of return and the level of risk (standard deviation) for a particular portfolio which can be written as:

$$E(R_p) = R_f + \sigma_p \left[\frac{E(R_m) - R_f}{\sigma_m} \right] \quad (2)$$

where R_p is portfolio return, σ_p standard deviation of portfolio returns and σ_m is standard deviation of market portfolio returns. The CML is valid only for efficient portfolios and expresses investors' behavior regarding the market portfolio and their own investment portfolios

3.2. Security Market Line (SML)

The SML express the return an individual investor can expect in terms of risk-free rate and the relative risk of a security or portfolio. The SML with respect i can be written as:

$$E(R_i) = R_f + \beta_{im}(E(R_m) - R_f) \quad (3)$$

$$\text{Where } B_{im} = \frac{\sigma_i r_{im}}{\sigma_m} = \frac{\text{Cov}(R_i, R_m)}{\sigma^2_m} \quad (4)$$

and r_{im} the correlation between security return, R_i, and market portfolio return. The β_{im} can be expressed as the amount of non-diversifiable risk inherent in the security relative to the risk of market portfolio. Equation 3 is the Sharpe-Linter version of the CAPM. The SML has capability of test whether securities are fairly priced or not.

4. Empirical of the Model

4.1. CAPM as a single factor

To test the CAPM validity of the CAPM researchers have been testing the SML given in (3) above. The CAPM has been known as single-period ex-ante model. However since the ex-ante returns are unobservable, researchers rely on realized returns. Therefore the empirical question is; Do the past security returns be in line with or comply with the CAPM? The beta in such an investigation is obtaining by estimating the security characteristic line (SCL) that relates the excess return on security i to the excess return on some efficient market index at the time t. Therefore the ex-post SCL can be written as:

$$R_{it} - R_{ft} = \eta_i + b_{im}(R_{mt} - R_{ft}) + \varepsilon_{it} \quad (5)$$

Where η_i is the constant return earned in each period and ε_{it} is noise disturbance term and b_{im} is an estimate of β_{im} in the SML(Jensen,1968). Then the estimated β_{im} is then used as the explanatory variable in the following cross-sectional equation:

$$R_{it} = Y0 + Y1 b_{im} + U_{it} \quad (6)$$

The coefficient Y0 is the expected return of a zero beta portfolio, expected to be the same as the risk-free-rate, and Y1is the market price of risk (market risk premium), which is significantly different from zero and positive in order to support the validity of the CAPM. To test the CAPM using (5) and (6) we are actually testing the following:(a) b_{im} is true estimates of historical β_{im}'s, (b) the market portfolio used in empirical studies is the appropriate proxy for the efficient market portfolio for measuring historical risk premium and (c) the CAPM specification is correct (Radcliffe,1987).

The last half-century has witnessed the proliferation of empirical studies testing on the validity of the CAPM. A growing number of studies found that the cross-asset variation in expected returns could not be explained by the systematic risk alone. Therefore, a variety of models have been developed to predict asset returns. Beta has been used as a key parameter in the CAPM. Sharpe (1964), Lintner (1965), and Black (1972) made significant contributions in this field by developing the capital asset pricing model (CAPM, hereafter) that explains the expected return by a market beta.

CAPM has been being in use with different kind of assumptions as follows:

(i) It assumes that all investors have homogeneous expectation of returns, which can be defined as their best predictions of the future returns within a specified time period and which are based on all the available information at all time.

(ii) It assumes there are no taxes no transaction costs involved when buying or selling security. But in reality most investments are subject to paying capital gain or loss taxes as well as transaction cost.

(iii) It assumes that when evaluating investment through this model, the capital markets are in equilibrium and that all investment are properly priced in line with their risk levels, thus there is no arbitrage opportunities for investors.(Note that arbitrage opportunities can appear when an investor can obtain different prices for one asset in two or more markets, thus profiting from the asset's pricing imbalances in different markets)

(iv) CAPM model depends on an assumption that markets are perfectly efficient.

4.2. The Function and Importance of CAPM

Valuing investments

In the managerial, corporate finance and economic literature it is given for granted that the CAPM, originated as an equilibrium model, may be unambiguously and safely used as a tool for valuing projects and making decisions, provided that the assumptions of the model are met. The procedure for valuing projects and take decisions is very simple and has been presented and proved in several papers, all of which assume that the CAPM assumptions are met.

A survey by Graham and Harvey (2001) finds that three out of four CFOs use the CAPM as the primary tool to assess cost of capital. As a tool for valuing and selecting projects, the use of CAPM is considered theoretically correct, once its assumptions are met in the relevant security market (Brealey and Myers, 2000):

5. Methodology

Different literatures are used to taste the model's validity, its usage in different type of investment and if the assumptions regarding to model itself to show its usage are holding true. Therefore there are supportive evidence, challenges about its usage and challengers of those challenges about the model from different literatures which used as the methodology in this paper.

6. Analysis and Findings

N0.	LITERATURE	TEST	FACTORS	CLASSICAL OBSERVATIONS
1.	Black,Jensen & Scholes	beta based on history.	Using regressing historical returns on a proxy for the market portfolio	Its valid
2.	Fama& MacBeth	Positive linear relation between average return and beta	Return data for the period from 1962 to 1968	Support CAPM
3.	Fama and French	Developed a new model	Adding two factors.(size & book to market ratio)	Failed to test return with two models
4.	Black et al	Study NYSE study over 34 yrs period	Developed a zero beta version of the CAPM	There is linear relationship between average excess portfolio return and beta
5.	Downs and Ingram	Illustrate the outlier	Negativity and positivity	Average return is positive with beta
6.	Bos and Newbold	Timely beta	Beta Validity	Beta is unstable overtime
7.	Roll and Ross	Single factor of model	As a Single factor of model	Market proxy is inefficiency
8.	Kan and Zhang	time-varying risk premium		Broader market portfolio affects results.

Table 1: Showing different test result on CAPM using different aspects.

6.1. Supportive Evidence of CAPM

One of the earliest empirical studies of the CAPM is that of Black, Jensen, and Scholes (1972). They find that the data are consistent with the predictions of the CAPM, given the fact that the CAPM is an approximation to reality just like any other model.

Another classic empirical study of the CAPM is by Fama and MacBeth (1973). They examine whether there is a positive linear relation between average return and beta and whether the squared value of beta and the volatility of the return on an asset can explain the residual variation in average returns across assets that is not explained by beta alone. Using return data for the period from 1926 to 1968, for stocks traded on the NYSE, Fama and MacBeth find that the data generally support the CAPM.

Fama and French attribute the different conclusions to the different sample periods used in the two studies. Recall that Fama and MacBeth (1973) use stock returns for 1926– 68, whereas Fama and French (1992) use stock returns for 1963–90. When Fama and French rerun their regressions for 1941–65, they find a positive relationship between average return and beta.

Black et al. (1972), in their study of all the stocks of the New York Stock Exchange over the period 1931-1965, formed portfolios and reported a linear relationship between the average excess portfolio return and the beta, and for beta >1 (<1) the intercept tends to be negative (positive). Therefore, they developed a zero-beta version of the CAPM model where the intercept term is allowed to change in each period.

6.2. Evidence against the Validity of CAPM

Past studies (Linter 1965; Douglas, 1969) on CAPM were primary based on individual security returns. Their empirical results were discouraging. Miller and Scholes (1972) highlighted some statistical problems encountered when using individual securities in testing the validity of the CAPM. Most studies subsequently overcame this problem by using portfolio returns.

However, there are literatures provide weak empirical evidence on these relationships (see, for example, He and Ng, 1994; Davis, 1994; Miles and Timmermann, 1996). The following are confusion results on empirical findings on the return-beta relationship prompted a number of responses:

- Beta is definitely unstable over time (see, for example, Bos and Newbold, 1984); Faff et al., 1992; Brooks et al., 1994; Faff and Brooks, 1998).
- The single-factor CAPM is rejected when the portfolio used as a market proxy is inefficient (See [2], for example, Roll, 1977; Ross, 1977). Even very small deviations from efficiency can produce an insignificant relationship between risk and expected returns (Roll and Ross, 1994; Kandel and Stambaugh, 1995).
- There are several model specification issues: For example, (i) Kan and Zhang (1999) focused on a time-varying risk premium, (ii) Jagannathan and Wang (1996) showed that specifying a broader market portfolio can affect the results and (iii) Clare et al. (1998) argued that failing to take into account possible correlations between idiosyncratic returns may have an impact on the results. (iv) Kim (1995) and Amihud et al. (1993) argued that errors-in-the-variables problem impact on the empirical research.
- Cenk Yurtsever and Tarib Zahor(2007) in their test of relationship between the expected return on a security and its risk on linearity and come up with the result that there is no linear relationship between them for individual securities. They have also checked whether high risk is associated with higher return and risk aversion and came up with results that this is applicable to securities and not to portfolio.

6.3. Evidence that Challenge those Challenges.

The Fama and French (1992) study has itself been challenged. The study's claims most attacked are these: that beta has no role for explaining cross-sectional variation in returns, that size has an important role and that the book to- market equity ratio has an important role. The studies responding to the Fama and French challenge generally take a closer look at the data used in that study. The general reaction to the Fama and French (1992) findings, despite these challenges, has been to focus on alternative asset pricing models (for example, the interesting one in Fama and French 1993). Jagannathan and Wang (1993) think that may not be necessary. Instead they show that the lack of empirical support for the CAPM may be due to the inappropriateness of some assumptions made to facilitate the empirical analysis of the model. Such an analysis must include a measure of the return on the aggregate wealth portfolio of all agents in the economy, and Jagannathan and Wang say most CAPM studies do not do that.

Kothari, Shanken, and Sloan (1995) argue that Fama and French's (1992) findings depend critically on how one interprets their statistical tests. Kothari, Shanken, and Sloan focus on Fama and French's estimates for the coefficient on beta, which have high standard errors and therefore imply that a wide range of economically plausible risk premiums cannot be rejected statistically. Black (1993) suggests that the size effect noted by Banz (1981) could simply be a sample period effect: the size effect is observed in some periods and not in others. That is, size does not appear to have any power to explain cross-sectional variation in average returns for the period after the Banz (1981) paper was published.

7. Discussion

Different results raised in the literatures are seems to confuse and bring extra thinking of whether investors' attitude to risk is changing periodically. On the other hand according to market fluctuation can be one of the reason of unexpected, market risk which gives investor hard time to make investment decision. Regarding this model, many literatures seems to overlook by not taking into account model's assumptions, but there are more number of supportive evidence than challengers, which show a model's great capability of assessment of cost of capital, portfolio performance, and portfolio diversification, valuing investments, choosing portfolio strategy among others and relationship between risk and return in market portfolio.

8. Results and Concluding Remarks

Research has shown the CAPM to stand up well to criticism, although attacks against it have been increasing in recent years. Until something better presents itself, however, the CAPM remains a very useful item in the financial management toolkit. Despite the doubts existing in empirical literature the CAPM generally is still the best in the first place in understanding what type of risk requires a premium and hence what is the excess return one should expect from various assets, and still is used in evaluating the profitability of a project which is very important to the economy as a whole. Therefore, researchers should proceed with caution when using any abstract measure of performance equilibrium models. Due to that they should extract meaning from the theoretical implications of the measure. However all theoretical models are abstract representations of reality and thus will have some slight imperfection or deviations from reality.

REFERENCES

Sharpe, W.F. (1964), "Capital asset prices: a theory of market equilibrium under conditions of risk", Journal of Finance, Vol.19, No. 3, pp 425-42

Lintner, J. (1965), "The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets", Review of Economics and Statistics, Vol.47, No. 1, pp 13-37

Fama, E.F., French, K.R. (1992), "The cross-section of expected stock returns", Journal of Finance, Vol.47, No. 2, pp 427-65

Elton, E. (1999), "Expected return, realized return, and asset pricing tests", Journal of Finance, Vol.54, No. 4, pp 1199-220

Fama, E.F., French, K.R. (1997), "Industry costs of equity", Journal of Financial Economics, Vol.43, No. 2, pp 153-93

Markowitz, H (1952), " Portfolio Selection" The journal of finance, Volume7,pp 77-91

Tobin, J. (1958), "Liquidity preference as behavior toward risk", Review of Economic studies, Vol.26,pp.65-86

Black, F, Jensen Scholes, M(1972), The capital asset pricing model:pp.307-27

Fama and Macbeth,JD. (1973) "Risk, return and equilibrium: empirical tests" The journal of Political Economy, Vol.81,pp 607-36

Don U.A. Galagedera, managerial finance.Vol No 10 2007, pp 321-832

Radcliffe, R.C. (1987), investment, 2nd ed, Scott, Foresman and company London

Black, F. (1972), "Capital market equilibrium with restricted borrowing", Journal of Business, Vol.45, No. 3, pp 444-55

He, J. and Ng, L.K. (1994), ''Economic forces, fundamental variables and equity returns'', Journal of Business, Vol. 67, pp. 599-639.

Davis, J. (1994), ''the cross-section of realized stock returns: the pre-COMPUSTAT evidence'', Journal of Finance, Vol. 49, pp. 1579-93.

Miles, D. and Timmermann, A. (1996), ''Variation in expected stock returns: evidence on the pricing of equities from a cross-section of UK companies'', Economica, Vol. 63, pp. 369-82.

Bos, T. and Newbold, P. (1984), ''An empirical investigation of the possibility of stochastic systematic risk in the market model'', Journal of Business, Vol. 57, pp. 35-41.

Faff, R., Lee, J. and Fry, T. (1992), ''Time stationarity of systematic risk: some Australian evidence'', Journal of Business Finance and Accounting, Vol. 19, pp. 253-70.

Brooks, R., Faff, R. and Lee, J. (1994), ''Beta stability and portfolio formation'', Pacific-Basin Finance Journal, Vol. 2, pp. 463-79.

Roll, R. (1977), ''A critique of the asset pricing theory's tests; part I: on past and potential testability of the theory'', Journal of Financial Economics, Vol. 4, pp. 129-76.

Ross, S.A. (1977), ''Return, risk and arbitage'', in Friend, I. and Bicksler, J.I. (Eds), Risk and Returnin Finance, Ballinger, Cambridge, MA, pp. 189-218.

Kan, R. and Zhang, C. (1999), ''Two-pass tests of asset pricing models with useless factors'',

Journal of Finance, Vol. 54, pp. 203-35.
Jagannathan, R. and Wang, Z. (1996), ‘‘The conditional CAPM and the cross-section of expected returns’’, Journal of Finance, Vol. 51, pp. 3-53.
Clare, A.D., Priestley, R. and Thomas, S.H. (1998), ‘‘Reports of beta’s death are premature: Evidence from the UK’’, Journal of Banking and Finance, Vol. 22, pp. 1207-29.
Kim, D. (1995), ‘‘The errors in the variables problem in the cross-section of expected stock returns’’, Journal of Finance, Vol. 50, pp. 1605-34.
Amihud, Y., Christensen, B.J. and Mendelson, H. (1993), ‘‘Further evidence on the risk-return relationship’’, working paper, New York University, New York, NY.
Kothari, S.P., Shanken, J. and Sloan, R.G. (1995), ‘‘Another look at the cross-section of expected stock returns’’, Journal of Finance, Vol. 50, pp. 185-224.
Banz, R.W. (1981), ‘‘The relationship between return and market value of common stocks’’, Journal of Financial Economics, Vol. 9, pp. 3-18.
Jagannathan, Ravi, and Wang, Zhenyu. 1993. The CAPM is alive and well. Research Department Staff Report 165. Federal Reserve Bank of Minneapolis.