A Conceptual Study of Asset Pricing Models in India

ISBN: 978-1-943295-05-0

Balaji S
T. Manjunatha
Visvesvaraya Technological University
(balaji.setty82@gmail.com)
(tmmanju87@gmail.com)

Capital Asset Pricing Model is one of the widely used model in finance for pricing of risky securities. It is a model that describes the relationship between systematic risk and expected return of the asset. The systematic risk is termed as beta, measure of volatility. Beta is affected by various factors. In the recent years there is lot of arguments regarding this model validity. Since early 70's various researchers have questions validity of this model. Afterwards many asset pricing model have been developed. This paper studies conceptual framework and discusses standard form of various asset pricing model.

Keywords*:* Expected Returns, Market Returns, Risk Free Rate of Returns, Beta, Alpha.

1. Introduction

The Capital Asset Pricing Models (CAPM) has created benchmark of various asset pricing models. Nearly for four decades researchers are trying to relax the assumptions of CAPM. The empirical testing of asset pricing models is been in the continuous process. There are many factors which are interrelated among these models. As a researcher, understanding the crux of various asset pricing models would help us to conduct an empirical test successfully in Indian Context.

The original CAPM of Sharpe (1964), Lintner (1965) and Mossin (1966) has been developed in a hypothetical world, where there are various assumptions about investors and the opportunity set: (1) Investors are risk-averse individuals who tries to maximize their wealth with minimal risk. (2) Investors have homogeneous expectations about asset returns. (3) Investors borrow or lend at risk-free rate. (4) All assets are marketable and perfectly divisible. (5) Assumes that information is available to all investors simultaneously. (6) There are no taxes, transaction cost, short sell etc.

In the last four decades, the CAPM has become the benchmark of asset pricing models and most of empirical studies. Dybvig and Ross (2003) believe that CAPM is the most important and it provides us most of our basic intuitions about the risk-return trade-off. In this paper we try to cover the evolution of Various Asset Pricing Models and make an attempt to know the differences between various asset pricing models. In the research flow of the static CAPM, Brennan (1970) proposes the extension of the single period CAPM model, which considers taxation of dividend over capital gains. Litzenberger and Ramaswamy (1979) extend Brennan (1970) model by considering the restriction on investor's borrowing. Black and Scholes (1974) also consider the effects of dividend yield and policy on the returns. Sasson and Kolodny (1976) tests the relationship between the CAPM and the dividend relevance. The argument is about once the security beta is calculated; the firm's dividend policy is of no use in assessing the returns. Further to the argument on dividend policy Lintzenberger and Ramaswamy (1982) conducts and empirical test to show the nonlinear relationship between stock returns and expected dividend yield. Hagiwara and Herce (1997) suggest that the dividend asset pricing models is better than consumption asset pricing model. Sharpe (1964), Lintner (1965), and Mossin (1966) further developed mean-variance analysis of portfolio selection developed my Markowitz (1959). The mean-variance model was criticized by many researchers. Jean (1971) extends the two parameter analysis to three or more parameters. The effect of higher moments on utility function, traditional asset pricing theorists assume that investors seek to maximize expected utility.

Levy et al. (2006) relaxes the assumptions of homogeneous CAPM which is one of the fundamental assumptions, considered to be more critical drawback of CAPM. Homogeneous beliefs assumption is that all the investors invest in the same mix of risky assets. The CAPM holds that simple relationship exists between risk and return is known as SML- security market line. Levy et al. (2006) examine the robustness of the CAPM to relax the assumption of homogeneous beliefs. In their study they prove that the heterogeneous-belief market with and infinite number of investors and an infinite number of risky assets, the CAPM risk-return relationship precisely holds good. Lee et al. (1990) examine the effect the heterogeneous investment horizons on the functional form of CAPM and proposed the trans log model for estimating the risk-return relationship. Their paper contends that some empirical findings that are inconsistent with the traditional CAPM result from misrepresentation of CAPM by ignoring the discrepancy between the observed data periods and the true investment horizons. Merton (1973) relaxes the single-period assumption to develop the intertemporal CAPM Model with stochastic investment opportunities. Breeden (1979) utilizes continuous-time economic framework and support the work of Merton.

After Breeden (1979) it is very important to concentrate on Fama and French (1988) context on inter- temporal models (predictability is not necessarily inconsistent). Balvers et al. (1990) therefore present a general equilibrium theory relating to returns on financial assets to macroeconomic fluctuations. Grinols (1984) extends Merton's intertemporal capital asset pricing model with multiple consumer to include a description of the supply of traded securities. Stulz (1981) provides and intertemporal model of international asset pricing, which admits differences in consumption opportunity sets across countries. Hart (1974) derives the properties of equilibrium prices, it is assumed that equilibrium does in fact exist.

besides, most of the empirical studies on the static CAPM assume that betas remain constant over time and the return on the value-weighted portfolio of all stock is a proxy for the return on aggregate wealth. Finally the consensus that static CAPM us unable to explain satisfactorily. Therefore Fama and French (1992, 1996) provide the three factor model to the cross-section of expected stock returns. From there the great debate goes on. Sharpe (1998) says, ''I'd be the last to argue that only one factor drives market correlation. There are not as many factors as some people think, but there's certainly more than one.''

2. The Static CAPM

First, how will CAPM change if investors cannot borrow and lending at the risk-free rate? Black et al. (1972) provide the minimum-variance zero-beta portfolio to solve the problem and the model is also called Black's zero-beta CAPM.

Brennan (1970) first proposes an extended form of the single period CAPM model that accounts for the differential taxation of dividends over capital gains. Litzenberger and Ramaswamy (1979) extend the model of Brennan (1970) considering the restrictions on investors' borrowing. Both these models assume that dividends and interest are taxed as ordinary income and capital gains

These models are two factors pricing models adjusted for differential taxation of dividends and interest relative to gains. After Black and Scholes (1974) Sasson and Kolodny (1976) examines relationship between dividend and CAPM. Morgan (1982) summarizes that dividends have negative effect on security prices. Miller and Modigliani (1961) and Miller and Scholes (1978) favours dividend and capital gains. Brennan (1970) and Litzenberger and Ramaswamy (1979) favours taxation on income and capital gains.

3. Equilibrium Model with Heterogeneity

Homogeneous beliefs and expected returns is one of the fundamental assumptions and the critical drawback of CAPM. Basak (2005) studies assets pricing implication of heterogeneous beliefs. Levy et al. (2006) relaxes the assumptions of homogeneous expectation of the investors.

Basak (2005) provides a continuous-time pure-exchange framework to study asset pricing implication of the present of heterogeneous beliefs, within a rational Bayesian setting. Equilibrium is determined in terms of a representative investor's utility function with stochastic weighting driven by the investor's disagreement about the aggregate growth. In addition, Levy et al. (2006) relax the homogeneous beliefs assumption of CAPM, whichcan be derived under various sets of assumptions. They employ mathematical analysis and numerical simulations to study the effect on the introduction of heterogeneity of beliefs on asset prices, they prove that in an infinite market when number of investors and assets approach to infinite, with unbiased heterogeneous beliefs and bounded variance, the CAPM linear risk-return relationship precisely holds. Constantinides and Duffie (1996) assume an economy in which heterogeneous investors have different consumption levels. Constantinides (1982) develops another heterogeneous investor's model. Under full consumptions assumption the heterogeneous consumer are able to equalize their marginal rate.

Yoel (2009) derives asset pricing model, in which low status investors hold a single high volatiltity asset in order to move up the status ladder. High status investors are concerned about losing their status, they prefer assets with high volatility and hedge against low status investors. The equilibrium asset pricing model derives two important dimensions. Firstly, it is not driven by single representative agents, but result of strategic interactions among heterogeneous investors. Secondly, the factor risk primiums arises due to the fact that ris-averse invesrots seek to limit their exposure to systematic risk factors.

Heterogeneous Investment Horizon

The main contribution of Lee (1976) is to prove the observed function form of CAPM can become nonlinear and to show that either the likelihood ratio method or the constant elasticity of substittion function methods can be employed to improve the explanatory power of CAPM. Levhari and Levy (1977) investigate the empirical implications of heterogeneous investment horizons. Lee et al. (1990) examine the effect of heterogeneous investment horizons on the functional form of capital asset pricing and suggest a translog model for estimating the relation between risk and return. They assume that the holding period returns of securities are serially independent and the return distributions are stationary. Considering these two assumptions the expected returns and variance is identical and the covariance of returns between both the period is zero.

4. Skewness Effect Models

Many of the investors argue about the mean variance analysis of various portfolio selection and subsume the effect of higher moments. Borch (1969) argues that the upward sloping mean-standard deviation IC curves are inconsistent and proven to be uncertain. Feldstein (1969) argue against Tobin (1958, 1965) is not correct in ascertaining the IC curves of risk –averse investors. Tsiang (1972) argues that even though mean standard deviation analysis is introduced by Tobin, the sense of investment demand for cash is actually quite incapcble of doing. Further he claims the skewness preference for major risk takers should be taken into consideration. Jean (1971) extends the two parameter analysis to more parameter. Ingersoll (1975) corrects the model proposed by Jean. Schweser (1978) correct both the work of Ingersoll's and Jean's apart. Many researchers give more attention to skewness effect, Lee(1977) employs the transformation technique. Sears and Wei(1988) estimates coefficient of co-sknewness discloses that marginal rate of substitutions between skewness is independent on the market risk premium. Harvey and Siddique (2000) formalizes the intuition of asset pricing model that incorporates conditional skewness.

The cross-sectional variation of expected returns across assets and is significant even when factors based on size and book to market are included.

Liquidity Based Models

Pastor and Stambaugh (2003) find that stocks whose prices decline when the market gets more illiquid receive compensation in expected returns. Dividing stocks into 10 portfolios based on liquidity betas (regression coefficients of stock returns on market liquidity with other factors as controls), the portfolio of high-beta stocks earned 9 % more than the portfolio of low-beta stocks, after accounting for market, size, and value-growth effects with the Fama–French three factor model. Almost this entire premium is accounted for by spread in liquidity betas and a factor risk premium estimated across 10 portfolios.

They examine four channels of the liquidity premium. Firstly, they have to pay a premium simply to compensate for its particular illiquidity or transactions cost. Secondly, the premium need to be paid when more illiquid in bad times i.e. when the market goes down. Thirdly, the prices might decline when whole markets become less liquid. Fourthly, the security could become more illiquid when the market becomes more illiquid.

The Dynamic CAPM

The static CAPM states that expected premium on any risky assets is proportional to the premium. It is criticized especially for homogenous expectations. An intertemporal model is concluded from multi period. Merton (1973) subsequently relaxes this assumption and shows that when the opportunity set fluctuates over time due to changes in the state of the economy, individual securities are also priced with respect to selected portfolios, providing a hedge against unanticipated fluctuations. He first develop the CAPM model with stochastic investment opportunities. Unfortunately, the assumption under constant investment opportunity set is not consistent. Merton (1973) derives the equilibrium market clearing conditions for the model of the stochastic opportunity set and the equilibrium relationship between the expected return on an individual asset and the expected return on the market. Finally, Merton (1973) shows the investment opportunities vary over time.

Consumption Based Models

Merton (1973) with stochastic investment opportunites states that the epected return on assets is derived from multi-beta version of the CAPM with number of betas being equal to one plus the number of state variables needed to describe the relevant characteristics of the investment opportunity set. Breeden (1979) utilizes the framework of Merton and shows that expected return on any asset is proportional to its beta with respect to aggregate consumption alone. He argues that single beta relative to a specific variable, given certain stationary assumptions on the joint distributions of rates of retun and aggregate consumption, maekt eh model easier. Breeden (1979) concentrates on the variation across assets from an optimizing intertemporal perspective under the assumption that if agents have time additive utility i.e. locally quadratic, then the expected return of assets are in linear with consumption. Breeden (1979) derives a single beta asset pricing model in a multi-good continuous time model with uncertain consumption goods price and uncertain investment opportunities. Balvers and Huang (2009) add money to the standard consumption-based CAPM of Breeden (1979).

Production Based Models

Fama and French (1988), and others note, that in the context of intertemporal models, predictability is not necessarily inconsistent with the concept of market efficiency. Balvers et al. (1990) argue that aggregate output is equal or proportionate to aggregate consumption and that one can evaluate the marginal utility of consumption at the observed level of output so that aggregate output growth becomes the key asset pricing factor. The advantage to this approach is that output growth is likely measured more accurately than consumption growth. Balvers et al. (1990) indicate that changes in aggregate output lead to attempts by agents to smooth consumption, which affect the required rate of return on financial assets.

Supply Side Effect Models

Black (1976) examines the effects of disequilibrating shocks on individual behavior in financial markets and the effects of such modified behavior on market outcomes. After Black (1976), Grinols (1984) extends Merton's intertemporal CAPM with multiple consumers to include a description of the supply of traded securities. Moreover, Lee et al. (2009) argue that Black's theoretically elegant model has never been empirically tested for its implications in dynamic asset pricing.

5. International CAPM

Stulz (1981a) provide an intertemporal model of international asset pricing, which admits differences in consumption opportunity sets across countries. Besides, Stulz (1981b) also presents a simple model in which it is costly for domestic investors to hold foreign assets. Finally, Stulz (1984) summarizes that how differences across countries of (1) inflation rate (2) consumption baskets of investors and (3) investment opportunity sets of investors matter when one applies capital asset pricing models in an international setting. In particular, the fact that countries differ is shown to affect the portfolio held by investors, the equilibrium expected returns of risky assets, and the financial policies of firms. In empirical studies, Chang and Hung (2000) employ a two-factor international equilibrium asset pricing model to examine pricing relationships among the world's five largest equity markets. Their paper suggests that the intertemporal asset pricing model proposed by Campbell (1993) can be used to explain the returns on the five largest stock market indices.

Existence of Equilibrium

Hart (1974) argues that in deriving the properties of equilibrium prices, it has been assumed that equilibrium does in fact exist. Surprisingly, no attempt appears to have been made to establish the existence of equilibrium in the basic Lintner-Sharpe model or in more general versions of the model. Nielsen (1989) presents simple conditions and a simple proof of the existence of equilibrium in asset markets where short-selling is allowed and satiation is possible. Unlike standard non-satiation assumptions, the one used here is weak enough to be reasonable in the mean–variance CAPM and in asset market models where investors maximize expected utility and where total returns to individual assets may be negative.

6. Behavioral Finance

Preference-based behavioral models often work with the prospect theory of Kahneman and Tversky (1979), according to which, people do not judge outcomes on an absolute scale but compare outcomes with an initial reference point. Tversky and Kahneman (1992) modify their prospect theory by using a cumulative distribution function for the domain of gains and a cumulative distribution function for the domain of losses rather than separate decisions called Cumulative Prospect Theory. The value function is a utility function defined over gains and losses.

7. Empirical Tests

Black et al. (1972) and Fama and MacBeth (1973) test the implication of CAPM and find empirical evidence to support the linear relationship between risk and return and efficient market; therefore, their empirical studies support the CAPM. Roll (1977), however, criticizes their empirical results by declaring that (a) no correct and unambiguous test of the theory has appeared in the literature, and (b) there is practically no possibility that such a test can be accomplished in the future. Besides, Cheng and Grauer (1980) also criticize the tests of Black et al. (1972) and Fama and Macbeth (1973) based only on the assumption of constant b and stationarity of the distribution of return; therefore, their paper argues that it makes no sense to attempt a test of the CAPM based on stationarity because the validity of the CAPM over time implies stationarity cannot hold in any but a very degenerate sense. Thus, they find the CAPM generally does poorly in their tests. Finally, Fama and French (1992) conclude that market capitalization (a measure of size) and the ratio of the book to the market value equity should replace beta altogether.

8. Conclusion

There are various asset pricing models have been developed in due course of time. There are various factors considered for testing of these asset pricing models. We are trying to understand various concepts of asset pricing models and test in them in Indian capital markets scenario. We would also try to concentrate on those models where it is not been tested.

9. References

1. Acharya VV, Pedersen LH (2005) Asset pricing with liquidity risk. J Financ Econ 77:375–410
2. Balvers RJ, Huang D (2007) Productivity-based asset pricing: theory and evidence. J Financ Econ 86:405–445
3. Balvers RJ, Huang D (2009) Money and the (C) CAPM: theory and evaluation. J Financial Quant Anal 44:337–368
4. Balvers RJ, Cosimano TF, McDonald B (1990) Predicting stock returns in an efficient market. J Finance 45:1109–1128
5. Barberis N, Huang M (2008) Stocks as lotteries: the implications of probability weighting for security prices. Am Econ Rev 98:2066–2100
6. Barberis N, Huang M, Santos T (2001) Prospect theory and asset prices. Q J Econ 116:1–53
7. Basak S (2005) Asset pricing with heterogeneous beliefs. J Bank Finance 29:2849–2881
8. Black SW (1976) rational response to shocks in a dynamic model of capital asset pricing. Am Econ Rev 66:767–779
9. Black F, Scholes M (1974) the effects of dividend yield and dividend policy on common stock prices and returns. J Financ Econ 1:1–22
10. Black F, Jensen M, Scholes M (1972) the capital asset pricing model: some empirical tests. In: Jensen M (ed). Studies in the theory of capital markets. Praeger, New York, NY, pp 79–121
11. Borch K (1969) a note on uncertainty and indifference curves. Rev Econ Stud 36:1–4
12. Box GEP, Cox DR (1964) an analysis of transformations. J R Stat Soc 26:211–243
13. Brav A, Constantinides GM, Geczy CC (2002) Asset pricing with heterogeneous consumers and limited participation: empirical evidence. J Political Econ 110:793–824
14. Breeden DT (1979) an intertemporal asset pricing model with stochastic consumption and investment opportunities. J Financ Econ 7:265–296
15. Brennan MJ (1970) Taxes, market valuation and corporate financial policy. Natl Tax J 23:417–427 Campbell JY (1993) intertemporal asset pricing without consumption data. Am Econ Rev 83:487–512 Campbell JY, Cochrane JH (1999) by force of habit: a consumption-based explanation of aggregate stock market behavior. J Political Econ 107:205–251
16. Cecchetti S, Lam PS, Mark N (1990) Mean reversion in equilibrium asset prices. Am Econ Rev 80:398–418
17. Chang JR, Hung MW (2000) an international asset pricing model with time-varying hedging risks. Rev Quant Finance Account 15:235–257
18. Cheng PL, Grauer RR (1980) an alternative test of the capital asset pricing model. Am Econ Rev 70:660–671

19. Cochrane JH (1991) Production-based asset pricing and the link between stock returns and economic fluctuations. J Finance 46:209–237
20. Cochrane JH (1996) A cross-sectional test of an investment-based asset pricing model. J Political Econ 104:572–621
21. Cochrane JH (2005) financial markets and the real economy. Working paper. (University of Chicago) Constantinides GM (1982) intertemporal asset pricing with heterogeneous consumers and without demand aggregation. J Bus 55:253–267
22. Constantinides GM, Duffie D (1996) Asset pricing with heterogeneous consumers. J Political Econ 104:219–240
23. Copeland TE, Weston JF, Shastri K (2005) financial theory and corporate policy. Pearson Addison Wesley, Boston
24. Dybvig PH, Ross SA (2003) Arbitrage, state prices and portfolio theory. In: Constantinides G, Harris M, Stulz R (Eds) Handbook of the economics of finance, Vol 1B. Elsevier Science, Amsterdam, pp 605–637
25. Epstein L, Zin S (1989) Substitution, risk aversion, and temporal behavior of consumption and asset returns: a theoretical framework. Econometrica 57:937–969
26. Epstein LG, Zin SE (1991) Substitution, risk aversion, and the temporal behavior of consumption and asset returns: an empirical analysis. J Polit Econ 99:263–286
27. Fama EF, French KR (1988) Permanent and temporary components of stock prices. J Political Econ 96:246–273
28. Fama EF, French KR (1992) the cross-section of expected stock returns. J Finance 47:427–465
29. Fama EF, French KR (1996) Multifactor explanations of asset pricing anomalies. J Econ Perspect 18:25–46
30. Fama EF, French KR (2004) the capital asset pricing model: theory and evidence. J Finance 51:55–84
31. Fama EF, MacBeth J (1973) Risk, return, and equilibrium: empirical tests. J Political Econ 81:607–636
32. Feldstein MS (1969) Mean-variance analysis in the theory of liquidity preference and portfolio selection. Rev Econ Stud 36:5–12
33. Grinols EL (1984) Production and risk leveling in the intertemporal capital asset pricing model. J Finance 39:1571–1595
34. Hagiwara M, Herce M (1997) Risk aversion and stock price sensitivity to dividends. Am Econ Rev 4:738–745
35. Hart OD (1974) on the existence of equilibrium in a securities model. J Econ Theory 9:293–311
36. Harvey CR, Siddique A (2000) Conditional skewness in asset pricing tests. J Finance 55:1263–1295
37. Holmstro ¨m B, Tirole J (2001) LAPM: a liquidity-based asset pricing model. J Finance 56:1837–1867
38. Ingersoll J (1975) Multidimensional security pricing. J Financial Quant Anal 10:785–798
39. Jagannathan R, Wang Z (1996) the conditional CAPM and the cross-section of expected returns. J Finance 51:3–53
40. Jean WH (1971) the extension of portfolio analysis to three or more parameters. J Financial Quant Anal 6:505–515
41. Kahneman D, Tversky A (1979) Prospect theory: an analysis of decision under risk. Econometrica 47:263–291
42. Krep D, Porteus E (1978) temporal resolution of uncertainty and dynamic choice theory. Econometrica 46:185–200
43. Yi-Cheng Shih • Sheng-Syan Chen • Cheng-Few Lee • Po-Jung Chen (2014) The evolution of capital asset pricing models Rev Quant Finan Acc (2014) 42:415–448