AN EMPIRICAL EVALUATION OF RISK RETURN RELATIONSHIP IN INDIAN STOCK MARKET

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Abstract

This article investigates the relationship between excess returns and different risk measures including beta which is a popular risk measurement variable in the Capital Asset Pricing Model (CAPM). Adopting an improved version of the Fama and MacBeth (1973) model, the present study made a new attempt to test, in relation to the Indian market, the validity and reliability of the model with residual, skewness, variance and standardised kutosis as independent variables. The return-risk relationship is analysed using the Newey and West (1987) process which addresses both multicollinearity and heteroskesticity issues in OLS. The study makes use of the weekly returns of 432 NSE listed Indian companies from January 1997 to December 2008. The results suggest that the beta alone does not measure the security returns. The other risk measures like residual, skewness, variance and kurtosis also have a significant role in explaining excess returns.

Key Words: CAPM – Beta - Multicollinearity and *Heteroskedasticity*

I. Introduction

Investment in the securities market requires a study of the relationship between risks and returns. Portfolio theory of Markowitz (1952) is a description of how rational investors should build efficient portfolios and the capital market theory tells us how assets should be priced in the efficient capital market. In security analysis we are concerned only with those assets whose prices can be estimated. The usual notion in economics is that the price of an asset is determined based on

the demand for and supply of the asset. The same notion is contained in a theory that explains how assets are priced in the securities market.[1]

This paper is concerned with assessing the adequacy of the Capital Asset Pricing Model (CAPM) in terms of the ability of beta to explain the risk-return relationship in an investment portfolio, along with other statistical parameters. In particular, our aim is to evaluate the risk return relationship using a modified version of standard CAPM. While early empirical tests had concluded in favour of the CAPM [Fama and MacBeth (1973)], subsequent studies have provided evidence that is less than conclusive. Recent examples using US data are Fama and French (1992). Davis (1994) had found that there was no statistically significant linear relationship between realised returns and beta'.[2]

II. Literature Review

Diwani (2010) found that CAPM is not quite applicable to the Indian market.[3]Lazar (2009) investigated the validity of CAPM in the Indian market. The analysis gave mixed results and conclusive evidence in support of CAPM could not be found in the Indian market.[4] Vaidyanathan (1994 a) analysed Sensex, ET index and Natex to find variations among the indices. The result of the study indicated that the performance of Reliance explained more than half of the variations in the indices during 1989 and 1990 while Hindustan Lever also figured up to a point. Now

1 T. Manjunatha* and T .Mallikarjunappa 'An Empirical Testing of Risk Factors in the Returns on Indian Capital Market

2 Patricia Fraser*, Foort Hamelink**, Martin Hoesli*** and Bryan MacGregorTime-varying betas and cross-sectional return-risk relation: evidence from the UK - University of Aberdeen, Centre for Property Research, Department of Land Economy, St Mary's, King's College,Old Aberdeen AB24 3UF, Scotland, UK.

3 Mazen Diwani' A study that investigates the validity of the CAPM in Bombay Stock Exchange SENSEX30-2010 – Lund University.

4 Abhilash S. Nair, Abhijit Sarkar , A. Ramanathan and A. Subramanyam " Anomalies in CAPM: A Panel Data Analysis Under Indian Conditions" International Research Journal of Finance and Economics Issue 33 (2009)

the two scrips together explain around 70% of the variations in Sensex and Natex.[5] .Gali (1994 b) tested the "weak form efficiency" of the stock market by using three tests - run, serial correlation and filter – for ten scrips at four different points during the period from 1980 to 1990. The evidence from all the three tests demonstrate a weak form of efficiency.[6] Jagannathan (1996) tested stocks listed in NYSE and AMEX during the period 1962-1990. Following Fama and French approach, 100 portfolios were put together after ranking the stocks on the basis of beta size. The research findings strongly supported conditional CAPM when betas and expected returns were allowed to vary over time by assuming that CAPM holds in each and every period.[7] Pettengill *et al*. (1995) studied conditional and unconditional relationship in the US market for the period from 1936 to 1990. The results of the traditional tests showed a significant relationship between beta and returns for the whole sample period, but not for the sub-periods. The results of conditional tests, on the other hand, showed a significant positive relationship between beta and risk premiums for periods with positive market risk premiums and an inverse relationship for periods with negative market risk premiums.[8]Fama and French (1992) studied the monthly returns of NYSE stocks and found an insignificant relationship between beta and average returns. They concluded that CAPM cannot describe the last 50 years of average stock returns and only market capitalization and the ratio of book value to market value have significant explanatory power for portfolio returns. Fama and French (1996b) also found that beta is not sufficient to explain returns and the average return anomalies of CAPM, concluding that the model is not a useful approximation.[9] Fama and MacBeth (1973) studied the relationship between beta and returns for two different periods. They included

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5 Vaidyanathan, R. and Kanti Kumar Gali, 1994a, Efficiency of the Indian Capital Market Indian Journal of Finance and Research Vol. V. No.2 July, 1994

6 Vaidyanathan, R. and Kanti Kumar Gali, 1994b, Market Indices, Working Paper of Center for Capital Market Research (CCMR) of llM, Bangalore.

7 Jagannathan, R. , & Wang. Z., "***The Conditional CAPM and the cross section of expected returns***", Journal of Finance, 51, pp 3-53, 1996

8 Pettengill, G.N., Sundaram, S. & Mathur, I. (1995), "The Conditional relation between beta and returns", Journal of Financial and Quantitative Analysis, 30, pp. 101-116

9 10. Fama, E., and K. French. (1992). The cross-section of expected stock returns. Journal of Finance, 47, 427-465.

all common stocks traded in NYSE from 1926 to 1968 in their analysis. The total study period was divided into three sub periods such as a four-year portfolio formation period, a five year beta estimation period and a 5-year testing period. Constructing 20 portfolios on the basis of ranked betas of individual securities during the first sub-period, they used a three-step approach. The test results showed a positive relationship between period t-1 betas and period t returns on average. Black, F., M. Jensen, and M. Scholes (1972) and Fama and MacBeth (1973) studies were later called traditional studies.[10]

III Objectives

The following are the objectives of the present study:

1. To test the adequacy of the standard Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) in the Indian capital market.
2. To test the empirical applicability of CAPM in the Indian capital market
3. To ascertain the predictive ability of capital asset pricing models.
4. To empirically investigate the risk and return relationship of individual stocks included in the National Stock Exchange (NSE) sample mentioned earlier.

IV Need for the Study

The validity of the Capital Asset Pricing Model cannot be determined by using only the earlier studies, because the model is designed to measure the volatility of the market in different scenarios. It is important to test the returns variability periodically because of the fluctuations occurring in the different time scenarios due to various reasons. It was with this in view that the study was initiated to test the validity of the model in the chosen time period and with reference to the

10 Fama, E.F. & MacBeth, J.D., "***Risk, return and equilibrium: empirical tests***", Journal of Political Economy, 81, pp.607-636.

sample of the stocks used. For another, the government policy on financial markets and recommendations of the Narasimham committee had brought about a radical reform of the Indian capital market. The companies now have to operate in a more dynamic and contemporary setting. Beta cannot probably be assumed to remain stable over a long period in the present situation, hence the need for conducting a more general test of CAPM in the Indian capital market on the lines followed by of Fama and Macbeth (1973).

V Statement of Problem

In the earlier studies in India and abroad, the risk return relationship had been tested using several variables and empirical models as stated in the literature review. Even though a few studies, incorporating statistical measures, have been conducted in the international market, no such study has been undertaken in the Indian market itself. So, in the present study the improved version of CAPM has been applied using statistical parameters addressing OLS limitations, along with adoption of the Newey and West HAC method.

VI Data description

The study used weekly stock returns and market returns from the Indian stock market. The data was collected from the Centre for Monitoring Indian Economy (CMIE). The sample includes 432 stocks from the NSE which have been quoted and traded at least 90% of the working days. In terms of the time frame, the first 36 months were for construction of portfolios and the second 36 months were required for estimation of portfolios' parameters. S&P Nifty and US Treasury bill rate were used as market proxy and risk free returns respectively.

VII Testing procedure

The 12-year period was divided into three consecutive non-overlapping sub-periods: the portfolio construction period (1997 to 2000), the parameter estimation period (2001 to 2003) and the model test period (1997 to 2008). In the construction

period, individual stocks' betas were estimated and 12 equally weighted portfolios were formed on the basis of the estimated betas that were ranked in a descending order. In the estimation period, betas and other statistical measures of each portfolios formed in the construction period were estimated. In the final stage, the relationship between different risk measures and excess returns was tested.

VIII Testable hypotheses

The equilibrium relation of CAPM is stated in terms of the expected returns. In order to test the model with historical data, we adopted the stochastic process for generation of the portfolios' returns as proposed by Fama and MacBeth (1973):

H_{oa} : The expected value of risk free return is not equal to zero

H_{1a} : The expected value of risk free return is equal to zero

H_{ob} : The standard CAPM is not quite applicable to the Indian security market.

H_{ob} : The standard CAPM is quite applicable to the Indian security market.

Using simple and multiple regressions the following unconditional predicting equations models were developed in this study:

$$\hat{R}_{jt} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t}\boldsymbol{\beta}_j + \hat{\mu}_{jt}$$

$$\hat{R}_{jt} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t}\boldsymbol{\beta}_j + \hat{\gamma}_{4t}\boldsymbol{S}_j + \hat{\mu}_{jt}$$

$$\hat{R}_{jt} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t}\boldsymbol{\beta}_j + \hat{\gamma}_{7t}\boldsymbol{SKW}_j + \hat{\mu}_{jt}$$

$$\hat{R}_{jt} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t}\boldsymbol{\beta}_j + \hat{\gamma}_{10t}\,\boldsymbol{\sigma}^2{}_j + \hat{\mu}_{jt}$$

$$\hat{R}_{jt} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t}\boldsymbol{\beta}_j + \hat{\gamma}_{13t}\boldsymbol{KUR}_j + \hat{\mu}_{jt}$$

IX. Empirical Results

Most of the earlier studies conducted in the Indian market had not considered the multicollinearity issues which affect the model validity and reliability to a great extent. In the present study that issue has been resolved by forming a correlation matrix. The results of the correlation matrix show that the multicollinearity is not found between the independent variables except for beta and variance (0.9535175) as shown in appendix.1. Though there is a higher correlation, the variable was not dropped from the model until the interpretation phase. The results of Newey – West HAC indicated that the adjusted coefficient of determination of all the models has less than 20% explanatory power except for skewness (see.Appendix.2). The calculated F score and ANOVA p-values are significant at 0.05 level which proves that the models are valid and having predictive ability as regards excess returns on securities in the Indian market. In the entire test period the intercept is not significantly different from zero. The p-values of beta coefficients are not significant at 0.05 levels except with skewness and variance. And the significance of beta with variance is ignored because of the existence of multicollinearity (see. Appendix.3).

X Limitations of the study:

1. The study period was restricted to twelve years from 1997 to 2008 due to non- availability of data till 2010.
2. Only 432 stocks were identified as qualified for the analysis and hence the researcher has worked on a restricted amount of data.
3. The proxy index used is S&P CNX Nifty, whereas other indices like the BSE30 could also have been used.
4. Due to want of stocks based on the parameter of data sufficiency, only 12 portfolios could be formed. More portfolios could be constructed, varying the number of securities in each, but there was a time constraint.

The researcher had to wait for the prices to evolve till December 2008. So the time available to complete the given task was limited, which constituted a major constraint for the study.

XI. Conclusions

Now the findings of the study indicate that the standard Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) does not adequately explain the excess returns on a sample stock of the Indian market during the test period. Hence, it is proved that the beta alone does not influence the stock returns. The other statistical measures, residual, variance and kurtosis, also make a great impact on the returns. The modified version of the model used in the study predicts the market returns but not adequately. It is to be supposed that the investors do not hold diversified portfolios in the Indian market since beta is not related to the returns on the stocks and it is not possible to eliminate firm specific risks. Besides, the skewness and kurtosis play a vital role in the returns.

In sum, the study provides a broad guidance to the investors that in the Indian market the investment should not be done only on the basis of systematic risk. Rather, diversified risk and variance are factors to be considered while formulating investment strategies.

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Appendix. 1

Table No 1 Portfolio Parameter Correlation Matrix (Portfolio Construction Method: Equally Weighted)

	Beta	Residual	Skewness	Variance	Kurtosis
Beta	1				
Residual	0.1144850	1			
Skewness	-0.7467669	0.1226000	1		
Variance	0.9535175	0.3832700	-0.5899043	1	
Kurtosis	-0.1884727	0.1855115	0.3201811	-0.0877520	1

Appendix. 2

Table No 2 Adjusted Coefficient of Determination and ANOVA P-Values

Newey West (1987)		
Parameters	**Adjusted R^2**	**ANOVA – P Value**
Beta	0.008743	0.004857
Beta and Unsystematic Risk	0.106467	0
Beta and Skewness	0.329784	0
Beta and Variance	0.186136	0
Beta and Kurtosis	0.026541	0.000009