AN EMPIRICAL ANALYSIS OF STATIONARITY OF BETA IN INDIAN STOCK MARKET

Dr. George Thomas[1] and Bainy George[2]

[1]Associate Professor in Commerce, St. John's College, Anchal (PO), Kerala
Email: joyseputhen@gmail.com
[2]Assistant Professor in Commerce, St. John's College, Anchal (PO), Kerala

ABSTRACT

In an efficient market no security would offer a return on sustained basis in excess of that warranted by its inherent risk factors. The expected return on a security is, in fact, in proportion to its risk content as perceived by the market. The yearly beta values are considered to measure the importance of risk by testing the stationarity of beta coefficients in the market. Evidences of the present study establish that security betas over the entire and sub-periods show stationarity. The standard deviation of beta coefficients over the period also shows that the range of deviation is less for those securities whose beta values are stationary over time.

Keywords: Beta, Stationarity, Market Return, Time Variable, Dummy Variable, Random

INTRODUCTION

Investors, while analyzing securities, are concerned with the return expected from holding a security and the corresponding risk associated with it. Risk is the outcome of the uncertainty in predicting the future events that are affected by external and internal factors. The external factors are termed as the sources of systematic risk, whereas internal factors are considered to be the sources of unsystematic risk. Introduction of the systematic risk coefficient or beta in Capital Market Theory is an important statistic in estimating the return on assets and consequently in the making of investment decisions. The importance of beta as a tool for making investment decisions has been increasingly recognized and investors use this information to make their investment worthy and safe. A stable and predictable beta estimate will also enhance the validity of the beta based investment performance measures[1]. The estimation of beta is important for understanding the risk-return relationship in a security market

Baesel[2], provides evidence that the stability of beta is dependent upon the estimation period length. However Theobald[3], demonstrates that beta stability does not increase indefinitely with the estimation period length, thereby implying an optimal estimation period. If beta value is stable and hence predictable, then investors can assess the future riskiness of their investment from past riskiness.

Investors buy securities based on their future prospects. Hence, they are generally more interested in future betas than in historical betas. Investors are not always calculating and analyzing the future betas. The most commonly used procedure for estimating future betas is to use security's historical beta as a starting point. Adjustments are then made to the historical betas based on the most recent changes in the fundamental characteristics of the company. If historical betas are stable over time, there would be reason to consider past betas to estimate future betas. Thus the relevance of beta as a measure of risk depends on the stationarity of beta over time.

Irala (2007)[4], examined the stationarity of betas in Indian security markets, using the monthly returns of 660 companies from BSE for a 12 year period from April 1994 to March 2006. The result exhibited that the market explained around 13% variation in security returns and betas for individual securities and smaller sized portfolios were not stable over time. Das (2008)[5], studied the stability of betas of individual stocks over a period of time, from February 1999 to September 2007, using econometric tests, relating to 39 stocks listed on the NSE Nifty. It was found that 85% of the stocks had a stable beta in one method (regression using time as variable) and 65% for the stocks had a stable beta when using the second method (regression using dummy variable). Sarma and Sarmah (2008)[6], examined the stability of beta in Indian stock market for the period from December 2001 to November 2006. It is tested by using Chow Test and the result showed that betas were unstable over time. Rohini Singh (2008)[7], examined 158 stocks of the BSE for the period 1991-2002, using two model of 'time' as a variable and 'a dummy variable' in regression model. It was found that there was considerable variation in the value of beta and its stationarity and stability dependes on the method used. Beta was not stable when the interval period was changed. Ray (2010)[8], examined the stability of beta for Indian market for a ten year period from 1999 to 2009. The monthly return data of 30 stocks from BSE100 index were considered in different market phases. The stability of beta was tested using three econometric models, using time as a variable, using dummy variable and Chow Tests. The results of the three models were mixed and inconclusive. Only nine stocks in all the three models reported similar signal of beta stability over different market phases.

STATEMENT OF THE PROBLEM

Estimating the required return on investment to be made in the stock market is a challenging job before an ordinary investor. Different market models and techniques are being used for taking suitable investment decisions. The past behavior of the price of a security and the share price index play a very important role in security analysis. So an analysis of the stability of beta in Indian stock market is relevant in explaining the parity between risk and return.

OBJECTIVES OF THE STUDY

The present study attempt to answer the following objective:

1. To identify whether market related risk, *Beta*, is an appropriate measure of risk by testing its stationarity over the period.
2. To examine the relation between systematic risk and average rate of return on equity shares in India.

METHODOLOGY

In this paper, an attempt is made to examine the stationarity of beta in the Indian stock market during the period from January 1996 to December 2009. In order to carry out the analysis, 60 scrips are selected, which form part of the S&P CNX500 index. These securities represent all major sectors of the industry. Adjusted closing prices for each security for each month are considered for computing the security return. As such 168 month end prices are included. The monthly return on each of the security is computed by using the following formula:

$$r_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}}$$

The monthly market return for the analysis is taken as BSE100 Index (NATEX) closing value. As such 168 index points are included. The monthly market return is found out by:

$$r_{mt} = \frac{B_t - B_{t-1}}{B_{t-1}}$$

The regression equation used to compute beta values for each of the 60 scrips for the period is:

$$R_{it} = \alpha + \beta R_{mt} + \upsilon_{it}$$

where,

R_{it} is the individual security return at time period‘t’

α constant term

β beta value of the security

R_{mt} is the market return at time period ‘t’

υ_{it} is the error term

The above equation model asserts that the return on security ‘i’ is a linear function of market return and independent factors unique to security ‘i’. The return due to independent factors can be eliminated through diversification. As such the investors will be compensated only for bearing risk arising out of market factors. Thus, beta is accepted as the measure of risk. Any scrip for which the estimated value of beta as given by the slope coefficient is greater than one is a volatile security.

The present study analyses the stationarity of beta in Indian stock market and is tested by two methods: (i) Use of time as a variable, and (ii) Use of dummy variable to measure the change in beta over time.

I. Use of Time as a variable

To test if beta is stationary over time, a variable ‘tR_{mt}’ is used as a separate explanatory variable in the above regression model, where the time variable ‘t’ takes a value of ‘t =1’ for

the first period, 't =2' for the second period and so on. The regression model after incorporating 'tR_{mt}' as a separate regressor, is –

$R_{it} = \alpha + \beta R_{mt} + CtR_{mt} + \varepsilon_{it}$ t =1,2,3.....14 ..... (1)

The statistical significance of the coefficient of the variable 'tR_{mt}' is tested using t-statistic. If the coefficient of 'tR_{mt}' is found significant at a given level of significance, it indicates that the beta values are non- stationary over time.

II. Use of Dummy variable to measure the changes of slope over time.

An alternative method to test the stationarity of beta is to use the dummy variable for the slope coefficients in the regression model, as explained below:

$R_{it} = \alpha + \beta_i R_{mt} + \gamma_1 D_1 R_{mt} + \gamma_2 D_2 R_{mt} + \gamma_3 D_3 R_{mt} + \ldots\ldots\ldots + \varepsilon_{it}$ t =1,2,3---14 ... (2)

where, D_1, D_2, D_3... represent the values of 1 in the relevant year and 0 for all other years. If the t- statistics for the coefficients of any of the variables 'DR_{mt}' is found to be significant, it is an indication of non-stationarity of beta over time.[18]

EMPIRICAL RESULTS AND DISCUSSIONS

Over the study period, Table 1, on average, 36% of the stocks showing a beta value of more than 1, represents when the return on the security is more than the return on the market and those securities are aggressive. But 58% of the securities under observation come under beta value between 0 and 1, that is, if the return on the security is less than the return on the market, those securities are defensive. 6% of the securities show a negative beta value.

Table 1. Number of Securities in Different Range of Beta during the Period 1996 To 2009

YEAR	β > 1	0< β< 1	β < 0
1996	29	31	---
1997	19	38	3
1998	25	35	---
1999	20	36	4
2000	8	41	11
2001	21	36	3
2002	23	31	6
2003	24	34	2
2004	29	29	2
2005	20	35	5
2006	26	30	4
2007	18	40	2
2008	27	33	--
2009	19	34	7

Source: Prepared from the results of the analysis

The empirical results of the study disclosed the following:

Test of beta stationarity during the period from 1996 to 2009-

Table 2. Regression Coefficients in Equation 1& 2 during 1996 to 2009

Equation	Significant	Non-Significant
1	13	47
2	23	37

Source: Prepared from the results of the analysis

Table 2 shows the results of the two equations (time and dummy) to test the stationarity of beta over the period. Out of the 60 regressions, the coefficients of 'tR_{mt}' are found significant in 13 cases (equation 1), of which 7 regressions are at 1 per cent level of significance and at 5 per cent level in 6 cases. In the remaining 47 regressions the coefficient is statistically insignificant. From the analysis, it is clear that, the significance of the coefficient of variable 'tR_{mt}' implies that the beta values over the time are stationary. In 23 out of 60 companies, at least one regression coefficient of 'D_iR_{mt}' is significant(equation 2) at either 1 % or 5 % level of significance. Of which, in 6 cases the regression coefficient is significant at 1 % level, in 10 cases significant at 5 % level and in 7 cases the regression coefficients are significant at both 1 % and 5 % level of significance. The analysis reveals that in 37 companies, all the regression coefficients are insignificant, which favor stationarity of beta coefficients.

There are 27 companies, which show non-stationarity when at least one test is applied, that is, they are significant either at 1 per cent or at 5 per cent level of significance.

Out of the 60 companies under study, majority of the companies' slope coefficients signal stationarity in explaining the return behavior in the Indian scenario, that is, in 33 cases the beta values are stationary when at least one test is applied, either at 1 per cent or at 5 per cent level of significance, during the period from 1996 to 2009.

Beta Stationarity in Different Sub-Periods

In making the inference on beta stationarity, the existing period of study is divided into three sub periods, viz, 1996-2000, 2001-2005 and 2006-2009. Beta estimation and its stationarity play a vital role in financial decision making. Both the tests (Equation 1 & 2) were applied during the period for finding the objective.

Table 3. Regression Coefficients in Equation 1& 2 during 1996 to 2000

Equation	Significant	Non-Significant
1	10	50
2	13	47

Source: Prepared from the results of the analysis

When using equation 1, where time is a variable, 'tR_{mt}' in regression equation, during the sub- period, 1996-2000, 10 out of 60 companies showed significant 't' values at 1 per cent and 5 percent level of significance, Table 3. The remaining 50 company's results show insignificant regression coefficients. 13 out of 60 coefficients, 'DR_{mt}' are significant at either 1 per cent or 5 per cent level of significance. In 3 cases the regression coefficients are significant at 1 % level, 7 companies at 5 % level and 3 companies are significant at both the

level of significance. The test results exhibit that 47 company's regression coefficients are insignificant. Hence the beta values are stationary during the first sub-period.

Table 4. Regression Coefficients in Equation 1& 2 during 2001 to 2005

Equation	Significant	Non-Significant
1	10	50
2	16	44

Source: Prepared from the results of the analysis

The second sub period selected for the test of beta stationarity is from 2001 to 2005. The result of the first test is given in Table 4. There are 10 companies out of 60 showing significant coefficients, 'tR_{mt}', either at 1 per cent or at 5 per cent level of significance**.** The remaining 50 companies regression coefficients are not significant, which shows stationarity in beta values**.** The coefficients of regression results obtained by using the second test during the sub-period 2001-2005 shows that 16 company's out of 60 are significant, 'DR_{mt}', either at 1 per cent or at 5 per cent level of significance, Table 6.12. Out of these, 3 company's regression coefficients are significant at 1% level, 10 companies at 5 % level and 3 companies at both the level of significance.

Table 5. Regression Coefficients in Equation 1& 2 during 2006 to 2009

Equation	Significant	Non-significant
1	4	56
2	11	49

Source: Prepared from the results of the analysis

The representative sample company's regression coefficients, 'tR_{mt}', when the equation 1 is applied during the above period, Table 5, show that there are only 4 companies which are significant either at 1 per cent or at 5 per cent level of significance. Remaining 56 companies regression coefficients are not significant, which shows stationarity over the period. The results of regression coefficients, 'DR_{mt}', when equation 2 is used during the sub-period 2006-2009, exhibit that 11 companies out of 60 are significant either at 1 per cent or at 5 per cent level of significance. Of which 3 companies' regression coefficients are significant at 1 % level and 5 companies' at 5 % level and 3 companies' at both the level of significance.

CONCLUSION

In order to examine the stationarity of beta, the study considered security beta over the entire period of 14 years and three sub-periods. The two tests worked out for the entire analysis has found that, in the case of 14 year period together, the number of companies representing non-stationarity comes to 27 out of 60. But, when assessing the stationarity during sub-periods, it is found that, there are 15 companies for the first sub- period (1996-2000), 17 companies for the second sub- period (2001-2005) and 11 companies for the third sub- period (2006-2009) displaying non-stationarity in beta coefficients.

It can be concluded that beta varies in accordance with the vagaries of time. The present analysis clearly indicates that beta coefficients are stationary where both the equations are used in the entire period and sub periods. For a sample of 60 securities traded on the Indian

stock market, the findings of the study indicate that the beta coefficients as a measure of systematic risk are relatively stationary over time.

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