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# DUAL BETA MODEL- EVIDENCE FROM INDIAN MARKET

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**ABSTRACT**

Beta is the most common and widely accepted measure of investment risk and volatility in modern portfolio theory. The traditional CAPM developed by the Sharpe, Lintner and Mossin assumes that beta, which is the measurement of market risk, is symmetric over bull and bear markets. This is based on the assumption that the utility function of an investor is quadratic and security returns are normally distributed. The empirical evidence in the asset pricing literature has really interrogated both the normality and symmetry of the stock returns. The concern with the stock beta is the assumption of symmetry, that it gives equal weightage to upside and downside variance and fails to differentiate the downside risk (risk of loss) from upside risk (gain).This raises the question, whether beta is symmetric over bull and bear markets. The main objective of this study is to assess whether beta is symmetric over bull and bear market in the twelve prominent sectors of the Indian Economy. These sectors are Auto, Banking, Fast Moving Consumer Goods (FMCG), Consumer Durables, Capital Goods, Oil & Gas, Information Technology (IT), Telecom, Realty, HealthCare, Metals and Power.The results of the study show that beta is symmetric in case of relatively aggressive business to consumer sectors such as Auto, Consumer Durables and Telecom. In case of mostly defensive business to consumer sectors such as FMCG, IT and Health-Care the beta coefficients over bear market has come out to be more than the beta coefficient over the bull market. Finally, in case of aggressive and mostly business to business or business to service sectors such as Banking, Capital Goods, Metal, Oil and Gas, Power and Realty sectors the beta coefficient over the bear market has come out to be less than the beta coefficient over the bull market.

## Introduction

The traditional Capital Asset Pricing Model developed by Sharpe (1964), Lintner (1965) and Mossin (1966) is one of the most important model in asset pricing to describe the relationship between expected return and risk. According to this model, beta, which is the measurement of systematic risk or market risk is the only determinant of expected return. The model does not take into account the unsystematic risk or the firm-specific risk while pricing risky assets as unsystematic risk can be eliminated through the diversification of the portfolio. The relationship between systematic risk and expected returns in the traditional CAPM model has been theoretically described on the assumption that the utility function of the investor is quadratic. The model further assumes that only the first two moments (mean and variance) are sufficient to describe this relationship between systematic risk and expected returns. Further, the traditional CAPM assumes that the security returns are normally distributed. The upside and downside risk are assumed to be identical in the capital asset pricing model. This means that positive returns to the right tail of the normal curve and equal negative returns (in terms of absolute value) are given equal worth. That is, the investor is indifferent between high chances of positive returns and high chances of equal negative returns (in terms of absolute value). However many empirical studies show that security returns do not follow normal distribution (Estrada, 2007).That is, the impact of decline in the market return on the security return may not be the same as the impact of equal increase in the market return

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on the security return. This study aims at analyzing the impact of bull market (up market) and bear market (down market) on the Bombay Stock Exchange (BSE) sectoral indices return of the Indian Economy. The main object of this study is to assess whether beta coefficient over bull and bear market are same or different (i.e. whether beta is symmetric over bull and bear market). All those months where excess market returns is negative is defined as bear market and all the months where excess market return is positive has been defined as bull market. The symmetry of beta in bull and bear market conditions have been tested for 12 sectoral indices of Bombay Stock Exchange. (BSE). These sectoral indices are Auto, Banking, Fast Moving Consumer Goods (FMCG), Consumer Durables, Capital Goods, Oil & Gas, Information Technology (IT), Telecom, Realty, Health-Care, Metals and Power. This study has an important contribution to make in the sense that whether the nature of the industry has any role in determining whether beta are symmetric over bull and bear market. The study may be of relevance to investors in deciding in which kind of sectors they should invest over bull and bear market. In general, the stocks which are more sensitive to upswings and less sensitive to downswings will be preferred by a rational investor.

The paper is organized as follows: Section 2 discuss the Literature Review. Section 3 explains the Data and Methodology used in the study. Section 4 presents the Results and Analysis and the final section Concludes.

**Literature Review**

There is a considerable research referring to the beta coefficient as conjecturers of return.The empirical evidence in the asset pricing literature has really interrogated both the normality and symmetry of the stock returns (Estrada, 2007). The concern with the stock beta is the assumption of symmetry, that it gives equal weightage to upside and downside variance and fails to differentiate the downside risk (risk of loss) from upside risk (gain). The upside and downside risk are assumed to be identical in the capital asset pricing model. This assumption has been cross-examined by many studies but the results are mixed and indecisive. Fabozzi and Francis (1977) in their study test the differential effect of beta for the two different market conditions i.e. the bull and bear market for 700 NYSE stocks. They formulated a modified single index market model, taking into consideration the dummy variable to test whether beta coefficient differs over bull and bear markets.In the model the dummy variable assumed the value of unity in bull markets and zero for the bear market. A significant coefficient on the binary variable reflects the existence of asymmetric beta in bull and bear market conditions. Using this model, they found the beta to be symmetric in bull and bear market conditions. In their study the few securities which had significant differential coefficient reflecting the dual beta were scrutinized to find the common cause. They mentioned the insignificant R2 for the single index model or association of securities with a particular industry as some of the reasons for significant coefficient on their binary variable, but no commonality could be found. The test was replicated using three alternative bull and bear market conditions and concluded with the same results for all these definitions. Woodward and Anderson (2003) applied an alternative model i.e. logistic smooth transition market model (LSTM) to examine the stability of beta for a sample of returns on Australian industry portfolios over the period 1979-2002. They found that 22 out of 24 industry portfolios had significant different betas in the bull and bear market conditions.Considerable research has been carried out in the developed economies regarding beta as a predictor of return. Some research has been done in the emerging economies also but that too with mixed results. Javid and Ahmad (2011) in their study for a sample of 50 stocks traded in Karachi Stock Exchange for Pakistani Stock Market found asymmetric response of beta to bullish and bearish market conditions by applying the dual beta CAPM. In the Indian context Bhaduri and Durai (2006) studied 78 highly liquid stocks in BSE 100 Index to test the stability of beta in bull and bear market conditions. The results showed symmetry in beta in both bull and bear market, in all competing definitions of market conditions. Deb and Misra (2011) in their study for 410 companies found some evidence of instability of betas. The cause of instability or variation in beta is still to be investigated.Taking a clue from Fabozzi and Francis (1977) to find out the common cause if asymmetric beta happens to be the case in Indian Market, this study takes the sectoral indices data to test the symmetry of beta in bull and bear market conditions.

The objective of the present study is to find out whether the sectoral returns respond differently to the up and down market conditions and whether the nature of the industry has any role in determining whether beta are symmetric over bull and bear market.

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**Data and Methodology**

There are two major stock exchanges in India, i.e. Bombay Stock Exchange (BSE) and National Stock Exchange(NSE). However, for the purpose of this study only BSE is taken as a representative of equity market of India. BSE is the oldest exchange in India which offers high speed trading. The sample period for this study is 108 months ranging from April 2006 to March 2015.The 12 sectors (namely, Auto, Banking, FMCG,Consumer Durables, Capital Goods, Oil and Gas, IT, Telecom, Realty, HealthCare, Metals and Power) constitute the total population of the study. The BSE 500 index, a value weighted index, is taken as a proxy for market portfolio. Monthly sectoral indices return are calculated as follow:

$$\hat{R}_{it} = \ln\left(\frac{P_{it}}{P_{i,t-1}}\right) \quad )$$

Where,

$R_{it}$ =Return on Sectoral Index i

$P_{it}$ = Value of the Sectoral Index iattheend of the montht

$P_{i,t}$=Value of the sectoral Index at the end of the month t-1

Similarly the monthly return for the market portfolio i.e. BSE500 Index is calculated as follows:

$$\hat{R}_{mt} = \ln\left(\frac{P_{mt}}{P_{m,t-1}}\right)$$

Where,

$R_{mt}$ = Monthly return on the market portfolio

$P_{mt}$ = Value of the S&P BSE 500 Index at the end of the month t.

$P_{mt-1}$= Value of the S&P BSE 500 Indexat the end of the month t-1.

The required data of all the sectoral indices and market index has been obtained from BSE website.

The 91 days Treasury bill rate has been taken as a proxy for the risk free rate of return. The data for the 91 days Treasury bill has been taken from the official website of Reserve Bank of India (RBI).

Firstly through time series regression estimate the sectoral indices returns are regressed against a market index, i.e. BSE 500 Index to find out slope i.e. beta of the various (above-mentioned) sectors and to see whether it is significant in explaining the returns of the sectoral indices.

To test the relationship of the beta and returns of the indices the following regression equation has been used

$$R_{it}=a_i+ß_{it}\,(R_{it})+\mu_t \quad (1)$$

Where R_it denotes themonthly excess returns for the i th sector in the t th month; R_mt represents the monthly excess return of BSE 500 Index; a_i is the regression intercept and ß_i is the slope i.e. the beta of the i th sector respectively.If ß_i coefficient comes out to be positive and significant it means that the sector which has high systematic risk has high returns. The regression model specified in equation (1) assumes that beta coefficient is symmetric over bull and bear market.

To test whether beta coefficient is symmetric over bull and bear market, the model suggested byFabozzi and Francis, 1977 has been used. The regression model incorporates both bull and bear market in the same model and testing the symmetry of beta over bull and bear market is given below in equation (2).

$$R_{it}=a\_i+ß_{1i}\,(R_{mt})+ß\_(2i)\,(R\_(mt))\,D+\mu_t \quad (2)$$

Where D is the dummy variable which assumes the value of 1 in bear market and 0 in the bull market. The coefficient $ß_{2i}$ measures the differential effect of the bear market condition over the bull marketfor the i th sector. As per equation (2) the beta of the i th sector over the bull market isequal to ß_1iand the beta of the i th sector over the bear market is equal to$ß_{1i}+ß_{2i}$.

If the $ß_{2i}$ will be significantly different than zero then beta for the i th sector is said to be different for bull and bear market. If the $ß_{(2i)}$ comes out to be positive and significant, it means that the impact of bear market on the sectoral return is higher than the impact of bull market. If the $ß_{(2i)}$ comes out to be negative and significant, it means that the impact of bull market on the sectoral return is higher than the impact of bear market.

There is no general accepted definition of bull and bear market. Months of non-negative excess market returns are classified as up months, while months of negative excess market returns are classified as down months. This is in consensus with one of the alternative definition of bull and bear market as proposed by Fabozzi and Francis (1977).

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**Results and Analysis**

The model specified in the Data and Methodology section have been tested for the twelve Sectoral Indices of Bombay Stock Exchange. The symmetry of beta over bull and bear market has been tested by including dummy variable in the traditional CAPM. The dummy variable has differentiated the bull and bear market in the same model. If after including the dummy variable to assess the differential impact of bull and bear market on the sectoral returns, the explanatory power of the model increases (i.e. the value of Adjusted R2 increases), it means that the beta coefficient are not symmetric over bull and bear markets. The estimated regression models mentioned in Data and Methodology section have been shown in Table (1) and (2). Table (1) shows the regression results of the traditional CAPM in which it has been assumed that beta coefficient is symmetric over bull and bear market. The results of Table (1) shows, that beta coefficient have come out to be significant in case of all the twelve sectors. The FMCG, IT and Health-Care sectors are the most defensive sectors (ß value much less than one) of the Indian Economy whereas the Realty sector followed by the Metal have come out to be the most aggressive sectors of the Indian Economy. The Auto, FMCG, Health-Care, IT, Oil and Gas and Telecom sectors have the risk less than average market risk (ß values less than one). On the other hand Banking, Capital Goods, Consumer Durables, Metal, Power and Realty have risk more than average market risk (ß values greater than one).

**Table 1**

Regression Analysis Results $R_{it} = \alpha_i + \beta_i(R_{mt}) + \mu_t$

| Sectors | α | β | Adjusted $R^2$ |
|---|---|---|---|
| BSE-Auto | 0.003826 (0.96797) | 0.916821 (18.19131)* | 0.7551 |
| BSE-Bankex | 0.004063 (0.954924) | 1.166852 (21.50799)* | 0.8118 |
| BSE-Capital Goods | -0.00193 (-0.43213) | 1.242618 (21.84298)* | 0.8165 |
| BSE-Consumer Durables | 0.002183 (0.436338) | 1.176859 (18.44958)* | 0.7603 |
| BSE-FMCG | 0.0048 (1.067698) | 0.404184 (7.051358)* | 0.3129 |
| BSE-Healthcare | 0.0066 (1.545254) | 0.588516 (10.80686)* | 0.5197 |
| BSE-IT | 0.002486 (0.386743) | 0.530305 (6.470913)* | 0.2764 |
| BSE-Metal | -0.00874 (-1.63504) | 1.439068 (21.10332)* | 0.8059 |
| BSE-Oil & Gas | -0.00227 (-0.59983) | 0.958399 (19.83743)* | 0.7858 |
| BSE-Power | -0.00791 (-2.0807) | 1.111445 (22.91699)* | 0.8305 |
| BSE-Realty | -0.01339 (-1.50042) | 1.872396 (16.4588)* | 0.7161 |
| BSE-Telecom | -0.00538 (-0.86981) | 0.864393 (10.95186)* | 0.5264 |

Note Figures in () indicate the value of t-statistics

*Significant at 1% level

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**Table 2**

Regression Analysis Results $R_{it} = \alpha_i + \beta_{1i}(R_{mt}) + \beta_{2i}(R_{mt})\,D + \mu_t$

| Sectors | α | $\beta_{1i}$ | $\beta_{2i}$ | Adjusted $R^2$ |
|---|---|---|---|---|
| BSE-Auto | 0.006866 (1.202926) | 0.85621 (8.895464)* | 0.108146 (0.739731) | 0.7541 |
| BSE-Bankex | -0.0082 (-1.38247) | 1.411372 (14.10989)* | -0.43629 (-2.87165)* | 0.8239 |
| BSE-Capital Goods | -0.00745 (-1.16095) | 1.352693 (12.50223)* | -0.1964 (-1.19512) | 0.8172 |
| BSE-Consumer Durables | 0.00523 (0.723358) | 1.116091 (9.152706)* | 0.108426 (0.585411) | 0.7588 |
| BSE-FMCG | 0.019007 (3.057395)* | 0.120893 (1.153111) | 0.505464 (3.174232)* | 0.3671 |
| BSE-Healthcare | 0.021661 (3.711509)* | 0.288179 (2.927868)* | 0.535879 (3.584536)* | 0.568 |
| BSE-IT | 0.012676 (1.377533) | 0.327114 (2.10794)* | 0.362544 (1.538142) | 0.2856 |
| BSE-Metal | -0.01658 (-2.16138)* | 1.595243 (12.33384)* | -0.27866 (-1.41846) | 0.8077 |
| BSE-Oil & Gas | -0.00664 (-1.21826) | 1.045553 (11.36877)* | -0.15551 (-1.11325) | 0.7863 |
| BSE-Power | -0.01352 (-2.47966)* | 1.2233 (13.30035)* | -0.19958 (-1.42862) | 0.8321 |
| BSE-Realty | -0.0348 (-2.76506)* | 2.299413 (10.83307)* | -0.76191 (-2.36328)* | 0.7279 |
| BSE-Telecom | -0.00713 (-0.79623) | 0.899263 (5.95245)* | -0.06222 (-0.27114) | 0.5222 |

Note Figures in () indicate the value of t-statistics

*Significant at 1% level

When the results of Table (2) are combined with the results of Table (1), it is observed that in case of all the sectors except Auto, Consumer Durable and Telecom the explanatory power of the model has increased (i.e. the Adjusted R2 has increased) after differentiation of the bull and bear market in the model. Thus, the results show that beta coefficient is not symmetric over bull and bear market in case of nine sectors out of twelve. The sectors on which beta coefficient is symmetric over bull and bear market are Auto, Consumer Durable and Telecom. These sectors belong to business to consumer and are relatively aggressive than the other sectors of business to consumers such as FMCG and Health-Care. The Beta coefficient over the bear market has come out to be significantly or

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moderately significantly more than the beta coefficient over the bull market in case of FMCG, Health Care and IT Sector. That means, these sectors are less sensitive to upswings and more sensitive to downswings in the market. These sectors are defensive sectors (having beta value less than one in the traditional CAPM) of the Indian Economy and mostly belongs to business to consumer sector. In case of Banking, Capital Goods, Metal, Oil and Gas, Power and Realty sectors the beta coefficients over bear market have come to be less than beta coefficient over the bull market. That means, the sectors are more sensitive to upswings and less sensitive to downswings in the market. All these sectors are mostly aggressive sector (having beta value greater than one in the traditional CAPM) and belong to business to business or business to service sector.

**Conclusion**

The traditional CAPM developed by the Sharpe, Lintner and Mossin assumes that beta, which is the measurement of market risk, is symmetric over bull and bear markets. This is based on the assumption that the utility function of an investor is quadratic and security returns are normally distributed. However many empirical studies show that security returns are not normally distributed. (Estrada, 2007). This raises the question, whether beta is symmetric over bull and bear markets. The main objective of this study is to assess whether beta is symmetric over bull and bear market in the twelve prominent sectors of the Indian Economy. These sectors are Auto, Banking, FMCG, Consumer Durables, Capital Goods, Oil and Gas, IT, Telecom, Realty, Health-Care, Metals and Power.

The results of the study show that beta is symmetric in case of relatively aggressive business to consumer sectors such as Auto, Consumer Durables and Telecom. In case of mostly defensive business to consumer sectors such as FMCG, IT and Health-Care beta coefficients over bear market has come out to be more than the beta coefficient over the bull market. Finally, in case of aggressive and mostly business to business or business to service sectors such as Banking, Capital Goods, Metal, Oil and Gas, Power and Realty sectors the beta coefficient over the bear market has come out to be less than the beta coefficient over the bull market. The study may be of relevance to the investors in deciding which kind of sectors they should invest over bull and bear market conditions of the economy.

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