International Recognized Double-Blind Peer Reviewed Multidisciplinary Research Journal
Indian Streams Research Journal
ISSN 2230-7850 **Impact Factor : 3.1560(UIF)**
Volume - 5 | Issue - 4 | May - 2015 **Available online at www.isrj.org**

ASSESSMENT OF LEAD LAG RELATIONSHIP BETWEEN BETA AND CORRELATION OF STOCKS WITH INDIAN STOCK INDICES

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Short Profile :

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ABSTRACT :

Rational investing requires studying the risk and return relationship prior to making any investment decision. In order to make profit through market timing, the investor needs to understand the movement of beta of a stock along with the correlation between stocks and market indices to construct the competent portfolio and to manage the risk efficiently. A general assumption in investing is that when there is high correlation between stocks and indices, the risk is assumed to be higher due to perceived high levels of beta. We use rolling window estimation approach on single index model to test whether the beta and correlation coefficients of stocks with indices form peaks and troughs at the same time. Contrary to our assumption of high (low) values of correlation coinciding with high (low) values of beta, we find that the relationship between beta and correlation coefficients changes for different combinations of high/low beta and correlation values. This relationship also depends on the Index used to calculate the beta and correlation coefficient of different stocks.

Keywords:

Beta, Correlation coefficient, Single Index Model, Rolling window estimation approach, Indian stock market

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1. INTRODUCTION

Ever since the origination of Modern Portfolio Theory (MPT) with Harry Markowitz's seminal paper on diversification benefits (Harry Markowitz, 1952) and subsequent asset pricing theories, there has been an effort across all investors to beat the market and generate positive abnormal returns. This has led to development and popularisation of many investing styles and practices. But one of the core concepts which form the foundation of smart investing is the co-movement of stock returns with the market benchmark and among themselves. This co-movement helps in generating superior risk adjusted returns. It helps in estimating returns of a particular security given the returns of another security or benchmark and the degree of its co-movement. There are different statistical ways of quantifying this co-movement among securities. Two of such popular measures are the correlation coefficient and beta coefficient. Both are used extensively in financial analysis. Both are standardised versions of covariance between two data series. But the technique of standardisation is different in each of these measures. Since both the measures are used widely, it may be interesting to know if both measures deliver similar results if applied to practical investing based on conditional bets given the direction and strength of movement of one data series with which the concerned security shares a statistical relationship. This forms the main objective of this research study.

2. THEORETICAL FRAMEWORK

To study the behaviour of variables in research, an analysis in linear dimensions is preferred as it is simple to work with and results are easily interpretable. Two measures of linear association used widely to study the relationship between variables i.e. correlation coefficient and beta coefficient are discussed below.

The Correlation Coefficient

In probability and statistics, covariance is a measure of how two random variables vary together. If the two variables move together in the same direction i.e. an increase in one variable is accompanied by an increase in the other, the covariance is positive. On the other hand, if an increase (decrease) in one variable is accompanied by a decrease (increase) in the other, the covariance is negative. One limitation of covariance is that it is difficult to interpret as it an unbounded quantity. Hence it is not intuitively appealing. The standardised form of the covariance, the correlation coefficient, is the solution to this problem. When covariance is divided by the product of the standard deviations of the two variables, we arrive at a much more meaningful and intuitive measure of linear association between two variables i.e. the correlation coefficient. It tells the strength and direction of the linear relationship between two variables. The correlation gives bounded measurement that can be interpreted independently of the scale of the two variables as it always lies between -1 and +1. The closer the estimated correlation coefficient is to -1, higher is the strength of negative linear

relationship between them (if correlation coefficient is -1, there is perfect negative correlation). Similarly, the closer the estimated correlation is to +1, higher is the strength of positive linear relationship between them (if correlation coefficient is +1, there is perfect positive correlation).

To summarise, we have

$$\text{Covariance between X and Y} = Cov(X,Y) = E\{(X-\bar{X})(Y-\bar{Y})\}$$

where X and Y are two random variables and E is the expectation operator

and

$$\text{Coefficient of Correlation} = r = \frac{Cov(X,Y)}{\sigma_X \sigma_Y}$$

The Beta Coefficient

The other measure of linear association as introduced above is the Beta coefficient. Beta coefficient is a measure of sensitivity of one random variable to movement in the other variable. For beta, the covariance between the two relevant variables is standardised by the variance of the variable against which the sensitivity of the first variable is being measured. For instance, in finance, Beta coefficient is calculated as covariance of a stock's return with market returns divided by variance of market return. This measures systematic risk which is the risk inherent in the whole financial system. Beta can be understood as a measure of the volatility, or systematic risk, of a security or a portfolio in comparison to the market as a whole. A beta of 1 indicates that the investment will move with the market. A beta of less than one means that the investment will be less volatile than the market. A stock with a beta of 1.5 implies that if market return changes by 1%, the stock return changes by 1.5%. Beta coefficient is an important input in capital asset pricing model (see Sharpe 1964) to calculate required rate of return on a stock (see Gardner, McGowan Jr., & Moeller, 2010). It is the slope of the security market line. Beta is an important measure of linear association because it measures the risk of an investment that cannot be reduced by diversification. It does not measure the risk of an investment held on a stand-alone basis, but the amount of risk the investment adds to an already-diversified portfolio.

$$\text{Beta of Returns of an Asset A} = \beta_A = \frac{Cov(R_A, R_m)}{\sigma^2_{R_m}}$$

Clearly, we can observe that the covariance between the two relevant variables i.e. return on asset A (R_A) and return on market benchmark (R_m) is standardised by the variance of the return on market i.e. (R_m). This is where the actual difference between beta coefficient and correlation coefficient lies.

Comparison between Beta Coefficient and Correlation Coefficient

When beta and correlation coefficients are compared as measures of linear association, we can note a few important differences between them. Firstly, correlation coefficient is bounded as it can take values between -1 and 1 only whereas beta coefficient has no such bounds. Secondly, correlation coefficient signifies degree of linear association between two variables whereas beta coefficient is a measure of sensitivity of one variable with another variable. Correlation coefficient cannot be treated as measure of risk whereas in finance, beta coefficient is a measure of systematic risk as a stock variability is linked to changes in the market benchmark (see Bilinski & Lyssimachou, 2014). Thirdly, beta coefficient represents the change in the expected value of one variable corresponding to a 1-unit increase in the other variable. Hence it can be used for estimation of stock returns (see (Swensen, 2015). The same is not true for correlation coefficient.

For the following regression equation,

$$Y_i=\alpha + \beta(X_i)+\varepsilon_i$$

where Y is the dependent variable and i represents the i^{th} observation

α is the intercept of the regression model

β is the beta coefficient which measures the change in of Y for a unit change in X

ε is the error term

For the above mentioned regression equation,

β can be expressed in the form of correlation coefficient as follows:

$$\beta = \frac{\sigma_Y}{\sigma_X} r_{X,Y}$$

where β is the beta coefficient of Y with respect to X

σ_Y is the standard deviation of Y

σ_X is the standard deviation of X

$r_{X,Y}$ is the coefficient of correlation between X and Y

Hence we can observe that beta coefficient and correlation coefficient shall be equal to each other only when σ_Y is equal to σ_X. This implies that if standard deviation of Y is equal to standard deviation of X, then beta coefficient and correlation coefficient will coincide by taking the same value and shall give same results

for any analysis. There will be a difference between beta coefficient and correlation coefficient only when standard deviation of Y is not equal to standard deviation of X. This study is aimed at studying whether beta coefficient and correlation coefficient move together and coincide with each other or is there a lead-lag relationship between them for predicting stock movements. This objective is equivalent to studying whether standard deviation of Y i.e. σ_Y is equal to standard deviation of X i.e. σ_X. Hence the null hypothesis of this study is the equality of standard deviation of Y and standard deviation of X i.e. $\sigma_Y = \sigma_X$.

3. METHODOLOGY

Data & Sample

The required sample data has been collected using Prowess database for stocks listed on Bombay Stock Exchange (BSE) and benchmark indices of BSE. For the purpose of this study weekly adjusted closing price from 3rd April 1999 to 3rd January 2015 was collected for stocks comprising BSE500 Index and four benchmark indices of BSE, which include Sensex, BSE100 Index, BSE200 Index and BSE500 Index.

Out of the 500 companies, stocks that did not have price data for all the observations, i.e., the weekly adjusted closing prices for 823 weeks were filtered out. After the aforementioned filtering condition, only 186 companies were included in the study for analysis.

The following naming conventions were used to represent the different data series:

Index(*i*)	*i* ranging from 1 to 4	representing Sensex, BSE100, BSE200 and BSE500 Indices respectively
Comp(*j*)	*j* ranging from 1 to 186	representing 186 companies with complete data set in alphabetical order

(Complete list of names and corresponding naming conventions have been mentioned in Appendix-I)

4. DATA ANALYSIS

Weekly log returns were calculated for all the 190 data series (186 companies and 4 indices) in the study as follows:

Ln(p1/p0) with p1 representing adjusted closing price of current day and p0 representing adjusted closing price of previous day

We used single index model along with the rolling window methodology to compute the beta and correlation coefficients for each of the combinations of individual stocks regressed on each index with a window size of 105 weeks. The following statements provide a description of the methodology used:

Equation 1 – For computation of beta coefficients:

$$\text{Comp}(j) = C + beta * \text{Index}(i)$$

where sample size was rolling 105 week window, where the window changes as follows:

1-105 weeks –sample 1

2-106 weeks –sample 2

<

<

<

<

718-822 weeks- sample 718

Equation 2 – For computing correlation coefficients

$$\text{Corr (comp(j), Index(i))}$$

where the correlation among the stocks and indices for each of the sample window was measured.

Eight separate matrices were created consisting of 718 rows and 186 columns, with one set of four matrices consisting of beta coefficients for each of the four indices and other set of four matrices consisting of correlation coefficients. After forming all the matrices, the largest five beta and largest five correlation coefficients along with their respective time periods were picked for each combination of stock and index, i.e., for combination comp(1)index(1): the time period in which the beta and correlation coefficients achieved their five highest values were picked up. Similarly smallest five beta and smallest five correlation for each index was measured. This was done to calculate whether the largest (smallest) five beta values occur at the same time as largest (smallest) five correlation values.

Using these two categories of Large and Small value time periods, four combinations were created for analyzing whether the time period in which largest five values of beta coefficients are achieved, coincide with the time period in which the largest or smallest five values of correlation coefficients were achieved. The four different combinations can be represented as follows:

Beta Large *Correlation* Large

Beta Small *Correlation* Small

Beta Large *Correlation* Small

Beta Small *Correlation* Large

The above process was repeated for lag in Beta (beta in greater condition) and Lead in Beta (beta in lower condition)

5. RESULTS

The following tables provide a description of the analysis:

Table 1: Time period of highest/ lowest values of beta coefficients coincides with highest/ lowest values of correlation coefficients

Equal	Index1	Index2	Index3	Index4
ConditionLL1	10	9	8	6
ConditionLL2	8	4	6	3
ConditionLL3	3	3	3	3
ConditionLL4	3	2	1	3
ConditionLL5	1	3	1	2
ConditionSS1	84	112	85	84
ConditionSS2	64	62	53	55
ConditionSS3	57	45	42	43
ConditionSS4	47	40	42	35
ConditionSS5	33	25	34	37
ConditionLS1	0	0	0	0
ConditionLS2	0	0	0	0
ConditionLS3	0	0	0	0
ConditionLS4	0	0	0	0

Table 2: Time period of highest/ lowest beta values lags correlation coefficient

Beta Lag	Index1	Index2	Index3	Index4
ConditionLL1	84	98	101	105
ConditionLL2	83	95	104	106
ConditionLL3	87	97	104	108
ConditionLL4	85	104	111	106
ConditionLL5	84	98	105	105
ConditionSS1	45	5	42	47
ConditionSS2	53	56	59	52
ConditionSS3	49	55	60	64
ConditionSS4	64	63	62	65
ConditionSS5	75	65	70	65
ConditionLS1	109	133	115	116
ConditionLS2	111	120	115	115
ConditionLS3	111	122	117	118
ConditionLS4	112	124	117	118

ConditionLS5	0	0	0	0		**ConditionLS5**	111	120	114	117
ConditionSL1	0	0	0	0		**ConditionSL1**	75	23	63	62
ConditionSL2	0	0	0	0		**ConditionSL2**	76	60	64	61
ConditionSL3	0	0	0	0		**ConditionSL3**	74	58	65	60
ConditionSL4	0	0	0	0		**ConditionSL4**	75	57	61	59
ConditionSL5	0	0	0	0		**ConditionSL5**	77	60	62	57

LL(n) represents combination of Large-Large values of beta and correlation coefficients

SS(n) represents combination of Small-Small values of beta and correlation coefficients

LS(n) represents combination of Large-Small values of beta and correlation coefficients

SL(n) represents combination of Small-Large values of beta and correlation coefficients

(n) represents the corresponding large or small values of beta and correlation coefficients

In table 1, there are very few stocks for which the largest five beta and correlation coefficient values coincide, however, the smallest five beta and correlation coefficient values occur at the same time for quite a few stocks. As expected, no combination of Largest(Smallest) beta values coincide with Smallest(Largest) correlation coefficient values for any of the stocks.

Table 2 provides a description of the conditions in which high/ low beta values lag the corresponding high/low correlation coefficient values, i.e., highest/lowest beta values occur in time periods that follow high/low correlation coefficient values. In table 2, we notice that for most of the stocks, large beta values occur after large correlation values have been recognized, however, not as many stocks have small beta values that lag small correlation coefficients.

Table 3: Time period of highest/ lowest beta values leads correlation coefficient

Beta Lead	**Index1**	**Index2**	**Index3**	**Index4**
ConditionLL1	92	79	77	75
ConditionLL2	95	87	76	77
ConditionLL3	96	86	79	75
ConditionLL4	98	80	74	77
ConditionLL5	101	85	80	79
ConditionSS1	57	69	59	55

Table 4: Relationship of beta with correlation coefficient

Beta	**Index1**	**Index2**	**Index3**	**Index4**
ConditionLL1	Lead	Lag	Lag	Lag
ConditionLL2	Lead	Lag	Lag	Lag
ConditionLL3	Lead	Lag	Lag	Lag
ConditionLL4	Lead	Lag	Lag	Lag
ConditionLL5	Lead	Lag	Lag	Lag
ConditionSS1	Lead	Lead	Lead	Lead

ConditionSS2	69	68	74	79		**ConditionSS2**	Lead	Lead	Lead	Lead
ConditionSS3	80	86	84	79		**ConditionSS3**	Lead	Lead	Lead	Lead
ConditionSS4	75	83	82	86		**ConditionSS4**	Lead	Lead	Lead	Lead
ConditionSS5	78	96	82	84		**ConditionSS5**	Lead	Lead	Lead	Lead
ConditionLS1	77	53	71	70		**ConditionLS1**	Lag	Lag	Lag	Lag
ConditionLS2	75	66	71	71		**ConditionLS2**	Lag	Lag	Lag	Lag
ConditionLS3	75	64	69	68		**ConditionLS3**	Lag	Lag	Lag	Lag
ConditionLS4	74	62	69	68		**ConditionLS4**	Lag	Lag	Lag	Lag
ConditionLS5	75	66	72	69		**ConditionLS5**	Lag	Lag	Lag	Lag
ConditionSL1	111	163	123	124		**ConditionSL1**	Lead	Lead	Lead	Lead
ConditionSL2	110	126	122	125		**ConditionSL2**	Lead	Lead	Lead	Lead
ConditionSL3	112	128	121	126		**ConditionSL3**	Lead	Lead	Lead	Lead
ConditionSL4	111	129	125	127		**ConditionSL4**	Lead	Lead	Lead	Lead
ConditionSL5	109	126	124	129		**ConditionSL5**	Lead	Lead	Lead	Lead

LL(n) represents combination of Large-Large values of beta and correlation coefficients

SS(n) represents combination of Small-Small values of beta and correlation coefficients

LS(n) represents combination of Large-Small values of beta and correlation coefficients

SL(n) represents combination of Small-Large values of beta and correlation coefficients

(n) represents the corresponding large or small values of beta and correlation coefficients

Table 3 provides a description of the conditions in which high/ low beta values lead the corresponding high/low correlation coefficient values, i.e., highest/lowest correlation values occur in time periods that follow high/low beta values. In table 3, we notice that for most of the stocks, correlation values occur after beta values have been recognized, irrespective of the magnitude (high/low) of the values considered.

Table 4 summarizes the results of tables 2 and 3. In table 4, we notice that for most of the stocks, largest beta values with Index1 lead the largest correlation values with Index1. However, Index2, Index3 and Index4, have a lagging highest beta values. In case of small values, beta leads correlation coefficients for most of the stocks.

Figure 1: Graphs of beta and correlation estimated through rolling window estimation for company with highest market capitalization under selected set of BSE500 companies

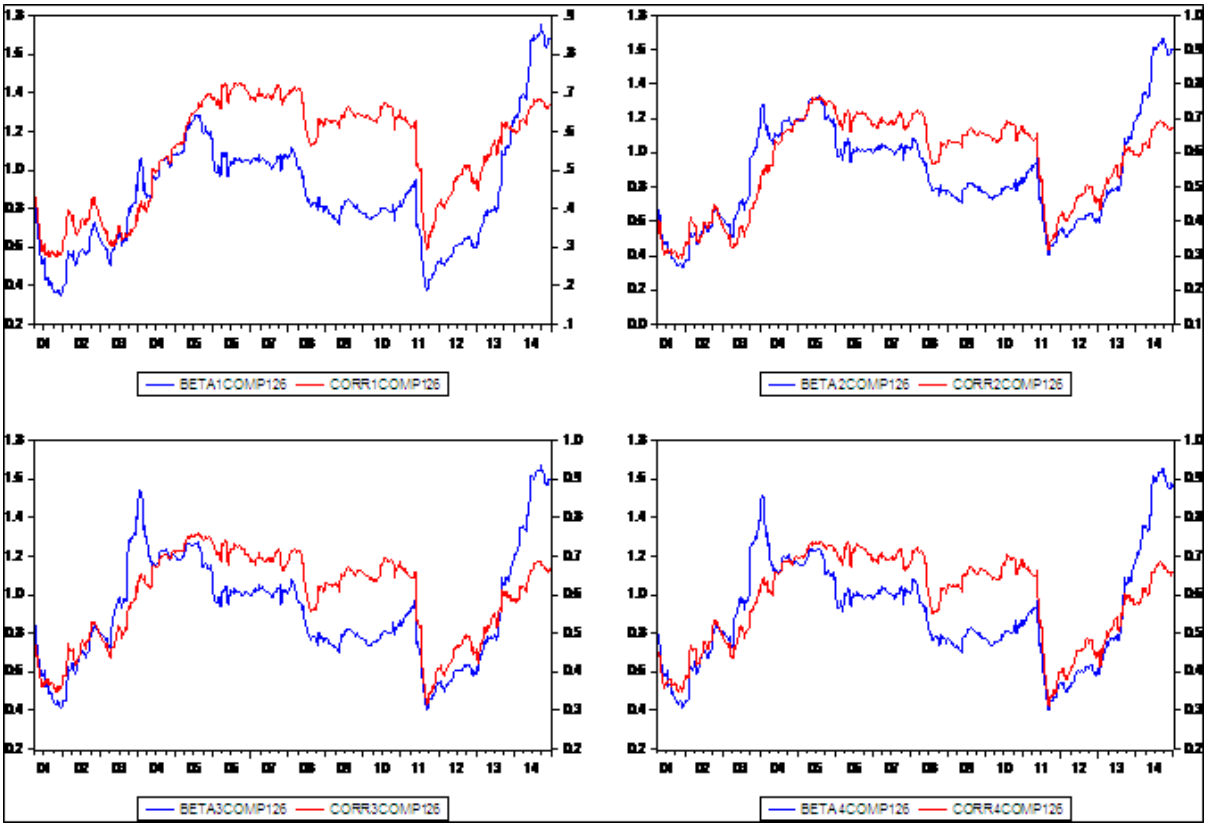

Figure 1 represents the beta and correlation values of company with highest market capitalization in the set of companies considered for analysis. Top left graph shows the relationship of beta and correlation over time for this company calculated with Index1. Top right graph represents the same relationship calculated on Index2. Bottom left graph represents the same relationship calculated on Index 3 and bottom right graph represents the same relationship calculated on Index 4.

Figure 2: Graphs of beta and correlation estimated through rolling window estimation for company with second highest market capitalization under selected set of BSE500 companies

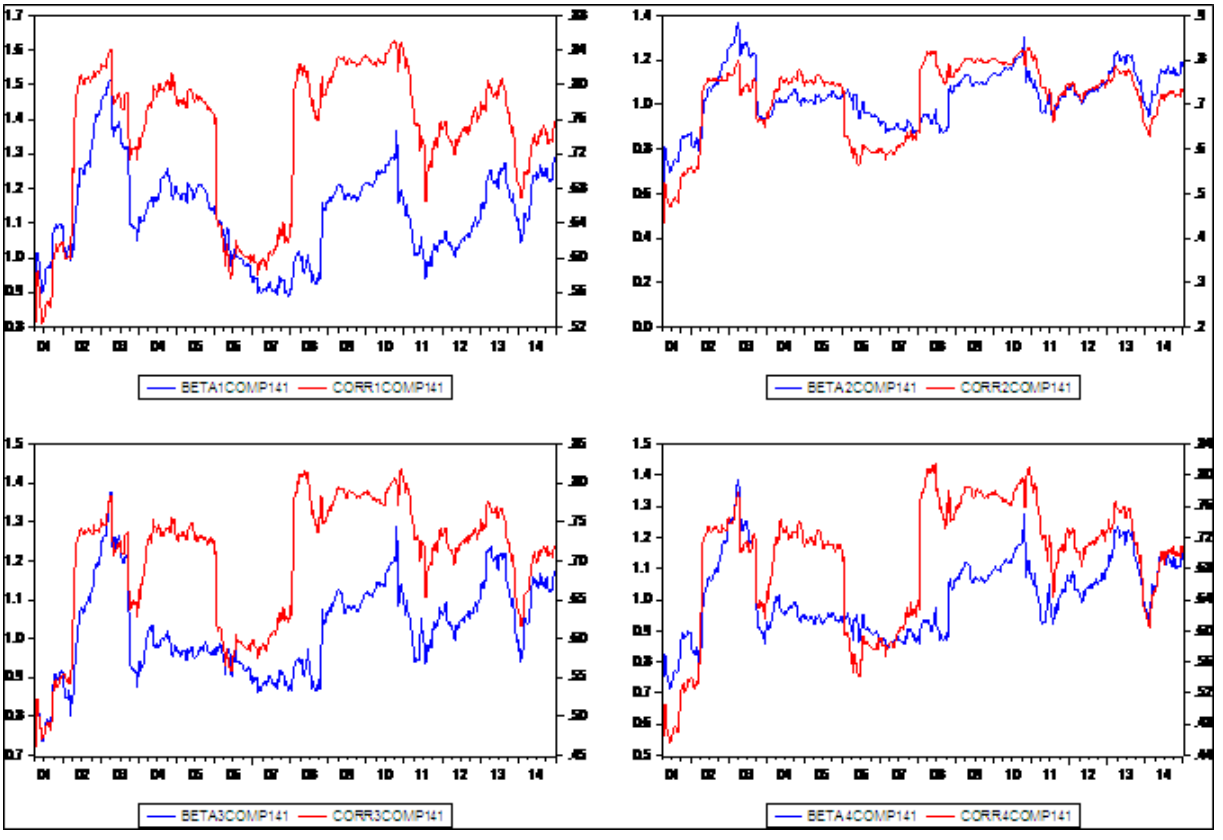

Figure 2 represents the beta and correlation values of company with second highest market capitalization in the set of companies considered for analysis. The four graphs within the figure follow the same pattern as mentioned for Figure 1.

Figure 3: Graphs of beta and correlation estimated through rolling window estimation for company with third highest market capitalization under selected set of BSE500 companies

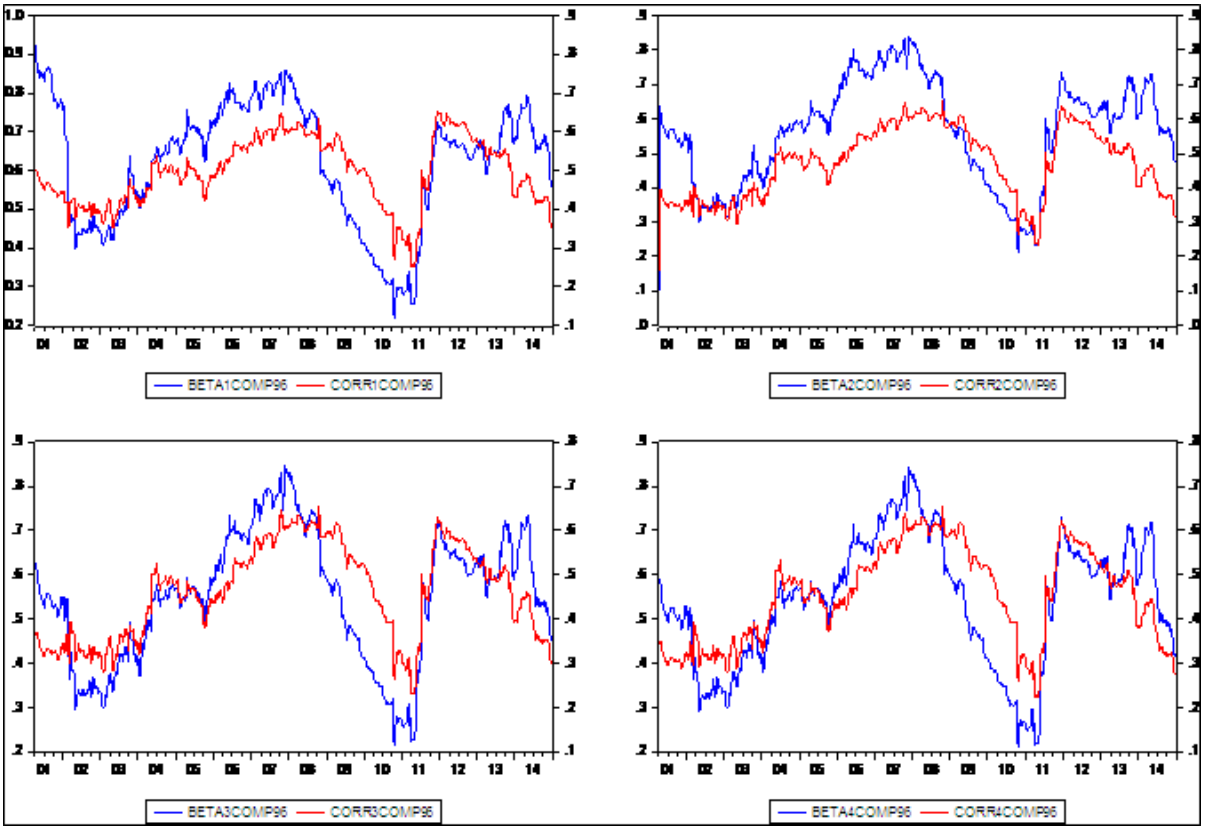

Figure 3 represents the beta and correlation values of company with third highest market capitalization in the set of companies considered for analysis. The four graphs within the figure follow the same pattern as mentioned for Figure 1.

Figure 4: Graphs of beta and correlation estimated through rolling window estimation for company with lowest market capitalization under selected set of BSE500 companies

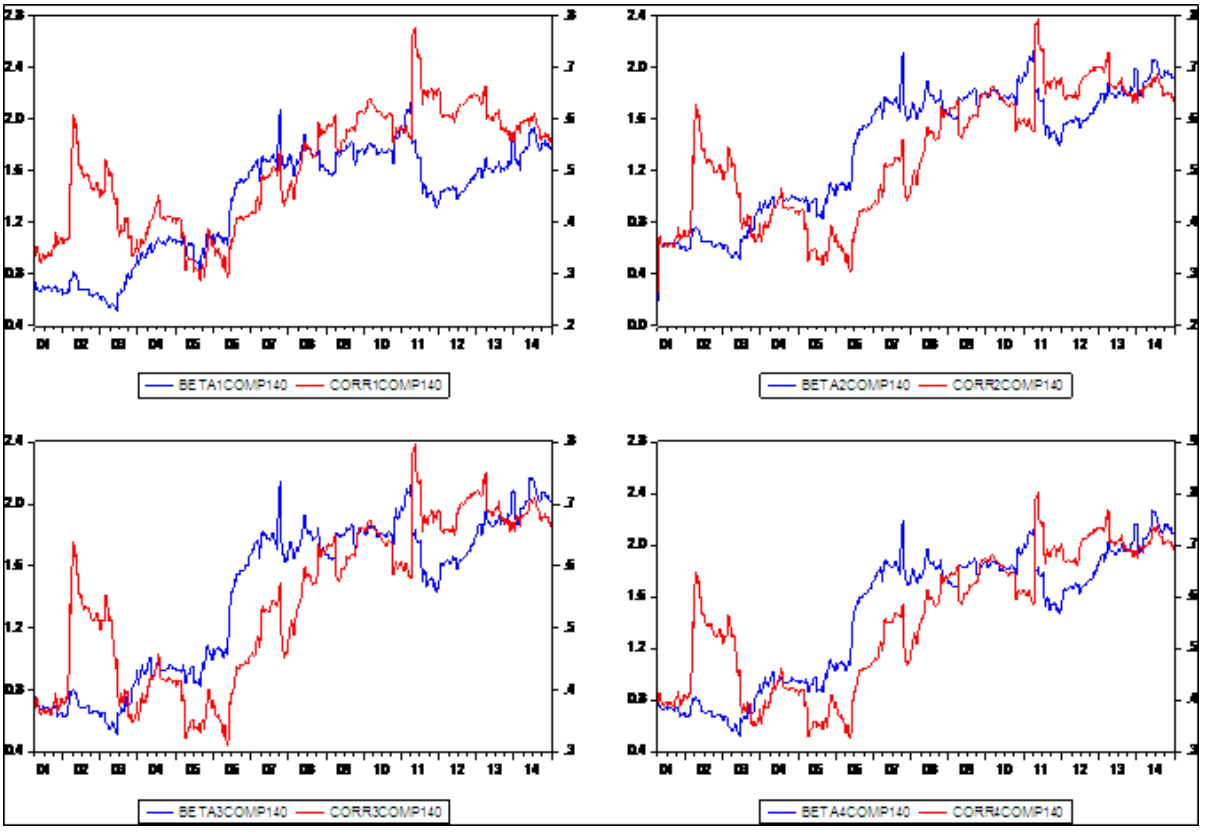

Figure 4 represents the beta and correlation values of company with lowest market capitalization in the set of companies considered for analysis. The four graphs within the figure follow the same pattern as mentioned for Figure 1.

Figure 5: Graphs of beta and correlation estimated through rolling window estimation for company with second lowest market capitalization under selected set of BSE500 companies

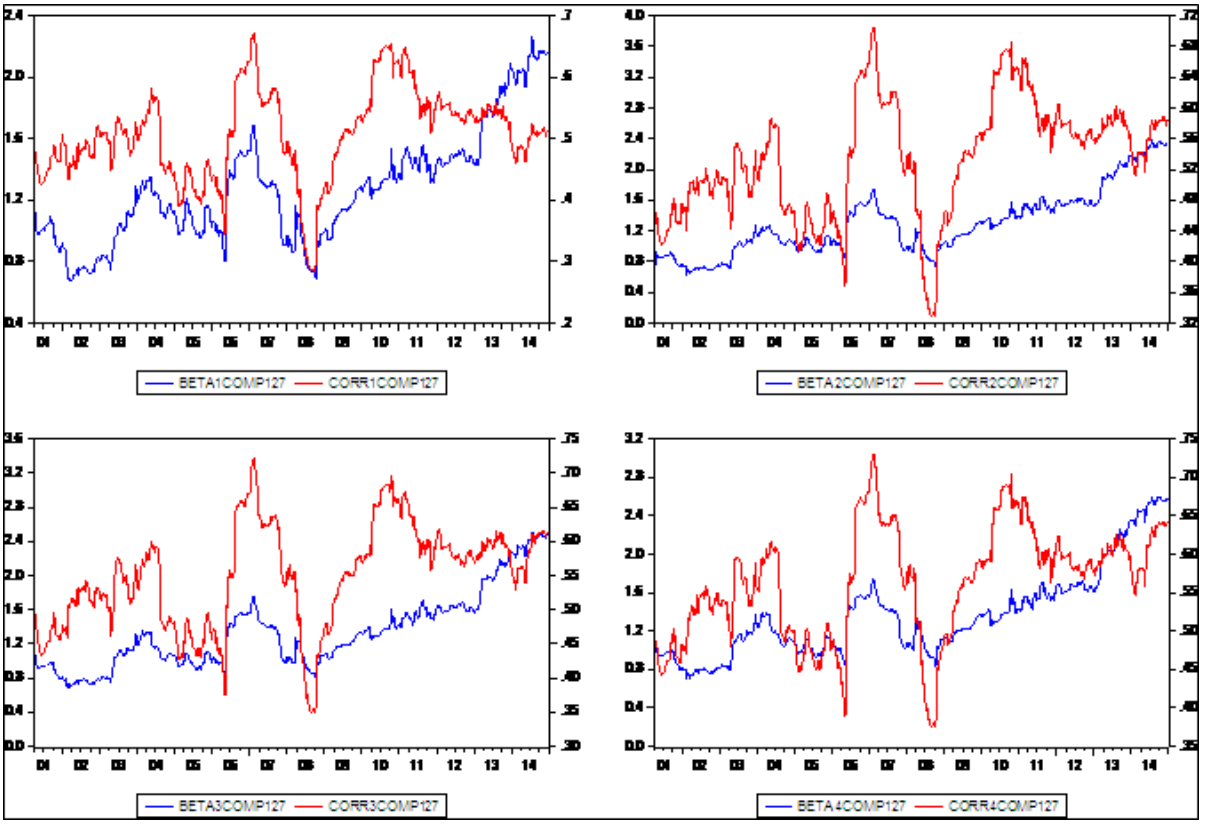

Figure 5 represents the beta and correlation values of company with second lowest market capitalization in the set of companies considered for analysis. The four graphs within the figure follow the same pattern as mentioned for Figure 1.

Figure 6: Graphs of beta and correlation estimated through rolling window estimation for company with third lowest market capitalization under selected set of BSE500 companies

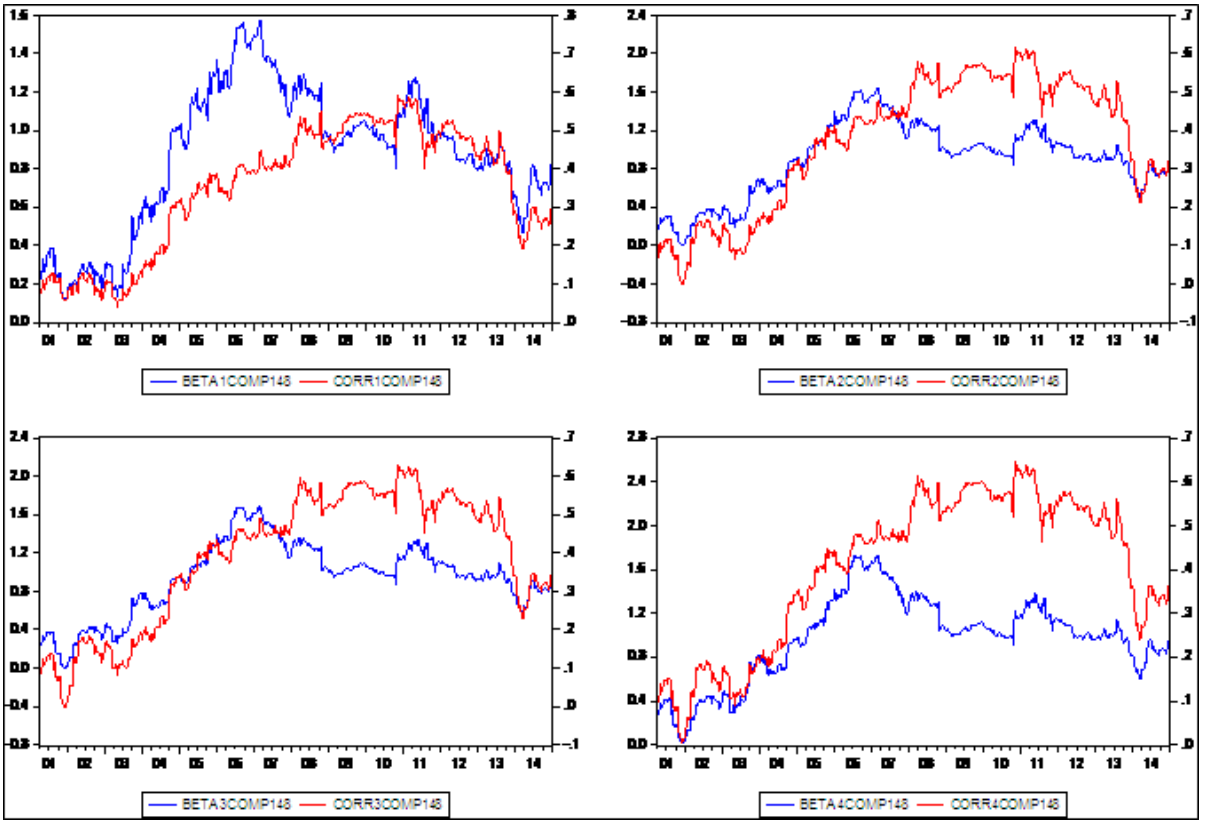

Figure 6 represents the beta and correlation values of company with third lowest market capitalization in the set of companies considered for analysis. The four graphs within the figure follow the same pattern as mentioned for Figure 1.

6. CONCLUSION

The analysis shows that out of the sample companies considered, largest beta and largest correlation coefficient values do not coincide, i.e. do not peak at the same time, while for some of the companies the smallest beta and smallest correlation coefficient values do coincide. The analysis also shows that the lead-lag relationship beta and correlation values depend on the Index which is used to calculate this value. But in general the largest beta values lag the largest correlation values for most of the stocks, while the smallest beta values lead the smallest correlation values for most of the stocks. The above analysis clarifies that an incorrect approximation of beta values through correlation coefficients or vice versa can provide misleading risk-return relationship. An investor should not use beta and correlation values as proxies of each other while calculating the risk-return trade-off while making an investment decision.

REFERENCES

1. Markowitz, Harry. "Portfolio Selection," The Journal of Finance, March 1952, pp. 77-91.
2. Sharpe, William F. (1964). *Capital asset prices: A theory of market equilibrium under conditions of risk*, Journal of Finance, 19 (3), 425–442
3. Gardner, J. C., McGowan Jr., C. B., & Moeller, S. E. (2010). Calculating The Beta Coefficient And Required Rate Of Return For Coca-Cola. Journal of Business Case Studies, 6(6), 103–109.
4. Bilinski, P., & Lyssimachou, D. (2014). Risk Interpretation of the CAPM's Beta: Evidence from a New Research Method. Abacus, 50(2), 203–226. http://doi.org/10.1111/abac.12028
5. Swensen, J. (2015). Investigating Use of Beta Coefficients for Stock Predictions Honors Research Paper Investigating Use of Beta Coefficients for Stock Predictions.

APPENDIX-I

Comp1	3M India Ltd.	Comp96	I T C Ltd.
Comp2	A B B India Ltd.	Comp97	India Cements Ltd.
Comp3	A C C Ltd.	Comp98	Indian Hotels Co. Ltd.
Comp4	Aban Offshore Ltd.	Comp99	Indian Oil Corpn. Ltd.
Comp5	Abbott India Ltd.	Comp100	Indusind Bank Ltd.
Comp6	Adani Enterprises Ltd.	Comp101	Infosys Ltd.
Comp7	Aditya Birla Nuvo Ltd.	Comp102	Ingersoll-Rand (India) Ltd.
Comp8	Akzo Nobel India Ltd.	Comp103	Ipca Laboratories Ltd.
Comp9	Alok Industries Ltd.	Comp104	J B Chemicals & Pharmaceuticals Ltd.
Comp10	Alstom T & D India Ltd.	Comp105	Jammu & Kashmir Bank Ltd.
Comp11	Amara Raja Batteries Ltd.	Comp106	Jindal Saw Ltd.
Comp12	Ambuja Cements Ltd.	Comp107	Jubilant Life Sciences Ltd.
Comp13	Amtek Auto Ltd.	Comp108	Kansai Nerolac Paints Ltd.
Comp14	Apollo Hospitals Enterprise Ltd.	Comp109	Kesoram Industries Ltd.
Comp15	Apollo Tyres Ltd.	Comp110	Kotak Mahindra Bank Ltd.
Comp16	Arvind Ltd.	Comp111	L I C Housing Finance Ltd.
Comp17	Ashok Leyland Ltd.	Comp112	M R F Ltd.
Comp18	Asian Paints Ltd.	Comp113	Mahanagar Telephone Nigam Ltd.
Comp19	Atul Ltd.	Comp114	Maharashtra Seamless Ltd.

Comp20	Aurobindo Pharma Ltd.	Comp115	Mahindra & Mahindra Ltd.
Comp21	Axis Bank Ltd.	Comp116	Mangalore Refinery & Petrochemicals Ltd.
Comp22	B A S F India Ltd.	Comp117	Marico Ltd.
Comp23	B E M L Ltd.	Comp118	Max India Ltd.
Comp24	Bajaj Finance Ltd.	Comp119	Monsanto India Ltd.
Comp25	Bajaj Holdings & Invst. Ltd.	Comp120	Mphasis Ltd.
Comp26	Balmer Lawrie & Co. Ltd.	Comp121	N C C Ltd.
Comp27	Balrampur Chini Mills Ltd.	Comp122	Natco Pharma Ltd.
Comp28	Bank Of Baroda	Comp123	Navneet Education Ltd.
Comp29	Bank Of India	Comp124	Nestle India Ltd.
Comp30	Bata India Ltd.	Comp125	Novartis India Ltd.
Comp31	Bayer Cropscience Ltd.	Comp126	Oil & Natural Gas Corpn. Ltd.
Comp32	Berger Paints India Ltd.	Comp127	Orchid Chemicals & Pharmaceuticals Ltd.
Comp33	Bharat Electronics Ltd.	Comp128	Oriental Bank Of Commerce
Comp34	Bharat Forge Ltd.	Comp129	Pfizer Ltd.
Comp35	Bharat Heavy Electricals Ltd.	Comp130	Pidilite Industries Ltd.
Comp36	Bharat Petroleum Corpn. Ltd.	Comp131	Piramal Enterprises Ltd.
Comp37	Birla Corporation Ltd.	Comp132	Prism Cement Ltd.
Comp38	Blue Dart Express Ltd.	Comp133	Procter & Gamble Hygiene & Health Care Ltd.
Comp39	Bombay Dyeing & Mfg. Co. Ltd.	Comp134	Rain Industries Ltd.
Comp40	Bosch Ltd.	Comp135	Ramco Cements Ltd.
Comp41	Britannia Industries Ltd.	Comp136	Ranbaxy Laboratories Ltd.
Comp42	C E S C Ltd.	Comp137	Rashtriya Chemicals & Fertilizers Ltd.
Comp43	C M C Ltd.	Comp138	Raymond Ltd.
Comp44	Century Textiles & Inds. Ltd.	Comp139	Reliance Capital Ltd.
Comp45	Chambal Fertilisers & Chemicals Ltd.	Comp140	Reliance Industrial Infrastructure Ltd.
Comp46	Chennai Petroleum Corpn. Ltd.	Comp141	Reliance Industries Ltd.
Comp47	Cipla Ltd.	Comp142	Reliance Infrastructure Ltd.
Comp48	Corporation Bank	Comp143	Rolta India Ltd.
Comp49	Crompton Greaves Ltd.	Comp144	Ruchi Soya Inds. Ltd.
Comp50	Cummins India Ltd.	Comp145	S K F India Ltd.
Comp51	Cyient Ltd.	Comp146	S R F Ltd.

Comp52	Dabur India Ltd.	Comp147	Sanofi India Ltd.
Comp53	Deepak Fertilisers & Petrochemicals Corpn. Ltd.	Comp148	Selan Exploration Technology Ltd.
Comp54	Dena Bank	Comp149	Sesa Sterlite Ltd.
Comp55	Dr. Reddy'S Laboratories Ltd.	Comp150	Shasun Pharmaceuticals Ltd.
Comp56	E I D-Parry (India) Ltd.	Comp151	Shipping Corpn. Of India Ltd.
Comp57	E I H Ltd.	Comp152	Shree Cement Ltd.
Comp58	Eicher Motors Ltd.	Comp153	Siemens Ltd.
Comp59	Elgi Equipments Ltd.	Comp154	Sonata Software Ltd.
Comp60	Escorts Ltd.	Comp155	State Bank Of India
Comp61	Exide Industries Ltd.	Comp156	Steel Authority Of India Ltd.
Comp62	F A G Bearings India Ltd.	Comp157	Sun Pharmaceutical Inds. Ltd.
Comp63	F D C Ltd.	Comp158	Sundram Fasteners Ltd.
Comp64	Federal Bank Ltd.	Comp159	Supreme Industries Ltd.
Comp65	Finolex Cables Ltd.	Comp160	Suven Life Sciences Ltd.
Comp66	Finolex Industries Ltd.	Comp161	Tamil Nadu Newsprint & Papers Ltd.
Comp67	Future Retail Ltd.	Comp162	Tata Chemicals Ltd.
Comp68	G A I L (India) Ltd.	Comp163	Tata Communications Ltd.
Comp69	Gillette India Ltd.	Comp164	Tata Elxsi Ltd.
Comp70	Glaxosmithkline Consumer Healthcare Ltd.	Comp165	Tata Global Beverages Ltd.
Comp71	Glaxosmithkline Pharmaceuticals Ltd.	Comp166	Tata Motors Ltd.
Comp72	Graphite India Ltd.	Comp167	Tata Power Co. Ltd.
Comp73	Grasim Industries Ltd.	Comp168	Tata Steel Ltd.
Comp74	Greaves Cotton Ltd.	Comp169	Thermax Ltd.
Comp75	Gruh Finance Ltd.	Comp170	Thomas Cook (India) Ltd.
Comp76	Gujarat Alkalies & Chemicals Ltd.	Comp171	Timken India Ltd.
Comp77	Gujarat Fluorochemicals Ltd.	Comp172	Titan Company Ltd.
Comp78	Gujarat Gas Co. Ltd.	Comp173	Torrent Pharmaceuticals Ltd.
Comp79	Gujarat Mineral Devp. Corpn. Ltd.	Comp174	Trent Ltd.
Comp80	Gujarat Narmada Valley Fertilizers & Chemicals Ltd.	Comp175	Tube Investments Of India Ltd.
Comp81	Gujarat State Fertilizers & Chemicals Ltd.	Comp176	Uflex Ltd.
Comp82	H C L Infosystems Ltd.	Comp177	Unichem Laboratories Ltd.
Comp83	H D F C Bank Ltd.	Comp178	Usha Martin Ltd.

Comp84	Hero Motocorp Ltd.	Comp179	V I P Industries Ltd.
Comp85	Hindalco Industries Ltd.	Comp180	V S T Industries Ltd.
Comp86	Hindustan Construction Co. Ltd.	Comp181	Vakrangee Ltd.
Comp87	Hindustan Petroleum Corpn. Ltd.	Comp182	Voltas Ltd.
Comp88	Hindustan Unilever Ltd.	Comp183	Whirlpool Of India Ltd.
Comp89	Hindustan Zinc Ltd.	Comp184	Wipro Ltd.
Comp90	Honeywell Automation India Ltd.	Comp185	Zee Entertainment Enterprises Ltd.
Comp91	Housing Development Finance Corpn. Ltd.	Comp186	Zensar Technologies Ltd.
Comp92	I C I C I Bank Ltd.	Index1	Sensex
Comp93	I D B I Bank Ltd.	Index2	BSE100
Comp94	I F C I Ltd.	Index3	BSE200
Comp95	I N G Vysya Bank Ltd.	Index4	BSE500