TESTING RELIABILITY OF BETA AS AN INDICATOR OF THE VOLATILITY IN STOCK PRICES

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Abstract

The purpose of this study is to investigate the reliability of beta as the predictor of volatility of stock prices for select stocks listed on NSE. The stocks identified for the study are Ambuja Cement, Ultratech Cement, L&T, Asian Paints, ITC, HUL, Cipla, Dr. Reddys Lab, HCL, Infosys, HDFC Bank, SBI, Hero Motors, Mahindra & Mahindra, and Tata Motors. These stocks represent 6 key sectors of the Indian Economy, namely, Pharma, FMCG, Construction, Banking & Financial Services, IT, and Automobile. The study has used monthly closing stock prices of the selected stocks for 48 months ending June 2016 to measure their beta. Further, daily data for the same stocks is taken for a 180 days period starting from June 01, 2016 to test the reliability of beta estimated through the 48 month data. Nifty 50 closing levels have been taken for the same data duration to represent the market for beta calculations. Secondary data extract from Yahoo Finance has been analyzed through regression analysis using MS Excel 2010.

No specific conclusion could be drawn based on the study. Beta was seen to hold for few stocks but for most it did not. No sector specific conclusions could be drawn based on the analysis undertaken in the current study as no such pattern emerged. Statistical analysis of the output reveals that beta calculated and used so freely by industry for portfolio optimization purpose may lack statistical validity in many cases.

Key words: Beta, Alpha, r-square, Multiple r, Regression, Standard Error, Nifty 50, Systematic Risk

Introduction

Stock market plays an important role in stimulating economic growth of a country. It helps to channel fund from individuals or firms without investment opportunities to firms who have them and thus improves the country's economic efficiency. However, stock market is a volatile financial market, in which various factors can affect the return that investors can gain from investing in stocks. The uncertainty of reward from stock market is translated into risks that investors have to bear for investing in stocks. Broadly, risks existing in the stock market can be categorized into unsystematic risk which is as a result of company specific factors and systematic risk which is a consequence of market related factors. Off the two broad types of risks, the unsystematic risk can be diversified away through diversification of portfolio and thus the capital markets do not reward investors for bearing this type of risk. Instead, the capital markets only reward investors for bearing systematic risk that cannot be eliminated through diversification. Systematic risk of any stock is measured in terms of beta of that stock. Beta of a stock is a measure of how the stock moves vis-à-vis the market, where movement of market is taken to be represented by some or the other index that represents the market. In India, S&P BSE SENSEX and CNX Nifty are the two key broad market indices that are used for beta calculations. As beta represents volatility of a stock, it is a measure of the uncertainty of stock return and understanding beta helps knowing the risk and return nexus in the stock market.

This is crucial for investors to maximize their return and minimize their risk, thereby ensuring the attractiveness of investing in stock markets.

The current study investigates the reliability of beta as an indicator of the volatility of select companies in India, using Nifty 50 as the index representing the market. The stocks identified for the study are Ambuja Cements, Ultratech Cement, L&T, Asian Paints, ITC, HUL, Cipla, Dr. Reddys Lab, HCL, Infosys, HDFC Bank, SBI, Hero Motors, Mahindra & Mahindra, and Tata Motors. The selected stocks represent 6 key sectors of the Indian Economy, namely, Pharma, FMCG, Construction, Banking & Financial Services, IT, and Automobile.

No specific conclusion could be drawn based on the study. Beta was seen to hold for few stocks but for most it did not. No sector specific conclusions could be drawn based on the analysis undertaken in the current study as no such pattern emerged. Statistical analysis of the output reveals that beta calculated and used so freely by industry for portfolio optimization purpose may lack statistical validity in many cases.

Literature Review

Volatility in stock market is the main reason for the difference between expected and actual return of any stock. This volatility of stocks is attributed to a variety of factors. Study of volatility of stocks, be it its causes, measurement or forecasting, has been a key topic of focus for researchers interested in financial markets. There are many studies that have analyzed different aspects of volatility and beta in the context of stock prices individually and markets as a whole. A study by Khandaker and Islam (2015) found empirical evidence that certain emerging economies exhibited higher levels of stock return volatility and co-movement behavior during the study period (2001-2012) than the developed economies. In their study of Dubai Financial Market, Alsharairi and Abubaker (2016) found that the effect of Arab Spring on volatility of this market was limited to just two indices namely, the Telecommunications and Transportation indices.

In their study on the dynamics in realized betas, vis-à-vis the dynamics in the underlying realized market variance and individual equity covariances with the market, Andersen et al. (2004) found that realized variances and covariances were well approximated as fractionally integrated, realized betas.

Novak (2015) showed in his study that using forward-looking beta and modifying assumptions about expected market returns made beta highly significant to realized stock returns. The study confirmed that the relationship between beta estimated ex-post and realized stock returns is flat (or even slightly negative in the case of the sample used for this study), and also showed that when beta is estimated ex-ante it becomes positive and significant.

Taher and Khokan (2010) examined capital asset pricing model (CAPM) beta in Dhaka Stock Exchange and found that beta instability increased with number of holding periods. The study revealed existence of inter-period as well as intra-period beta instability and the fact that a small emerging capital market like Dhaka had the same extent of beta instability as that in any developed market.

Verma (2011) studied the forecasting power of the conditional relationship between beta and international stock returns and found the relationship between current period beta and future stock returns to be insignificant.

Das and Barai (2015) attempted to empirically estimate industry beta in Indian stock market and compare the accuracy of alternative models used for the study. The study confirmed the existence of dynamic beta in Indian market and revealed that Kalman Filter had lower forecasting errors than the rolling regression model.

These studies and their findings reinforce the need to investigate beta and volatility further in context of different markets and different stocks belonging to different sectors.

The current study attempts to investigate the reliability of beta in the context of fifteen stocks listed on National Stock Exchange in India.

Research Methodology

The purpose of this study is to investigate the reliability of beta as the predictor of volatility of stock prices in the future. To achieve the objective of the study, stocks having liquidity, appreciable volume of trading, high market capitalization, and representing key sectors of economic activity have been identified. The stocks used for the study are Ambuja Cements, Ultratech Cement, L&T, Asian Paints, ITC, HUL, Cipla, Dr. Reddys Lab, HCL, Infosys, HDFC Bank, SBI, Hero Motors, Mahindra & Mahindra, and Tata Motors. The selected stocks represent 6 key sectors of the Indian Economy, namely, Pharma, FMCG, Construction, Banking & Financial Services, IT, and Automobile. The study has used monthly closing stock prices of the selected stocks for 48 months ending in June 2016 to measure beta of these stocks. Further, daily data for the same stocks is taken for a 180 days period starting from June 01, 2016 to test the reliability of beta estimated through the 48 month data. Nifty 50 closing levels have been taken for the same data duration to represent the market for beta calculations.

Secondary data extract from Yahoo Finance has been analyzed through regression analysis using MS Excel 2010. The closing price levels have first been converted to returns using natural log, as given below.

Ret(stock) = ln(Current Closing Level/Previous Closing Level)*100

Each selected stock's monthly returns for the 48 month period ending in June 2016 are regressed to Nifty 50's return for the same period to compute the historical beta of each stock. Thereafter, stock prices of the same stocks are observed for the next six months to explore their movement with respect to the market, as represented by Nifty. This is done to examine if the beta calculated using the preceding 4 year returns data holds true for the time period under observation (6 months). Line graph is used to chart the percentage change in returns of the stock with respect to the percentage change in returns of the market to visually represent the co-movement of the stock and the market.

Data Analysis

Detailed analysis of each of the stock with respect to the calculated beta value is illustrated in this section.

Ambuja Cements

Alpha and beta values of Ambuja are obtained by regressing its returns on those of NIFTY 50. As seen in **Table 1**, beta of Ambuja = 1.17 and Alpha = -0.149. Here the beta value of 1.17 with standard error of 0.174 is statistically significant, thereby rejecting the null hypothesis that Ambuja's true beta is zero. The alpha value of -0.149 is statistically insignificant and the null hypothesis of the true value

of alpha being zero cannot be rejected.

The value of multiple r equal to 0.703 is quite high, indicating that Ambuja follows the movement in Nifty 50 quite closely. The second statistic, r square, with a value of 0.4945 indicates that 49.45 % of the variance in Ambuja's returns is attributable to the variation in the returns of Nifty 50. The third statistic, adjusted r square, is 0.4835 (slightly less than r square) as it corrects for an upward bias in the value of r square coming from the use of the fitted values of alpha and beta. With the number of observations used, this bias is quite small. Next statistic, standard error or the standard deviation of residuals, is 4.942 which represents the portion of returns of Ambuja that is independent of Nifty 50.

Table 1: Regression Statistics of 15 companies under the Study

AMBUJA CEMENTS		HUL		HDFC BANK	
Alpha	-0.149	Alpha	1.043	Alpha	0.583
Beta	1.17	Beta	0.592	Beta	1.084
Multiple R	0.703	Multiple R	0.383	Multiple R	0.821
R Square	0.495	R Square	0.146	R Square	0.673
Adjusted R Square	0.484	Adjusted R Square	0.128	Adjusted R Square	0.666
Standard Error	4.942	Standard Error	5.978	Standard Error	3.154
ULTRATECH		CIPLA		SBI	
Alpha	0.511	Alpha	0.499	Alpha	-0.765
Beta	1.288	Beta	0.528	Beta	1.71
Multiple R	0.651	Multiple R	0.281	Multiple R	0.143
R Square	0.423	R Square	0.079	R Square	0.02
Adjusted R Square	0.411	Adjusted R Square	0.059	Adjusted R Square	-0.001
Standard Error	6.283	Standard Error	7.521	Standard Error	49.511
L&T		DR REDDYS LAB		HERO MOTORS	
Alpha	-0.504	Alpha	1.334	Alpha	0.209
Beta	1.726	Beta	0.215	Beta	0.898
Multiple R	0.788	Multiple R	0.119	Multiple R	0.521
R Square	0.621	R Square	0.014	R Square	0.272
Adjusted R Square	0.613	Adjusted R Square	-0.007	Adjusted R Square	0.256
Standard Error	5.631	Standard Error	7.523	Standard Error	6.146
ASIAN PAINTS		HCL		MAHINDRA AND MAHINDRA	
Alpha	1.27	Alpha	2.5	Alpha	0.028
Beta	1.043	Beta	0.052	Beta	0.135
Multiple R	0.577	Multiple R	0.028	Multiple R	0.07
R Square	0.333	R Square	0.001	R Square	0.005
Adjusted R Square	0.318	Adjusted R Square	-0.021	Adjusted R Square	-0.017
Standard Error	6.17	Standard Error	7.583	Standard Error	8.01
ITC		INFOSYS		TATA MOTORS	
Alpha	-0.344	Alpha	2.041	Alpha	0.025
Beta	0.486	Beta	-0.201	Beta	1.481
Multiple R	0.289	Multiple R	0.056	Multiple R	0.608
R Square	0.084	R Square	0.003	R Square	0.37
Adjusted R Square	0.064	Adjusted R Square	-0.019	Adjusted R Square	0.356
Standard Error	6.728	Standard Error	15.039	Standard Error	8.076

The value of beta for Ambuja Cements equal to 1.17, indicates that it is more volatile than Nifty but not by much as this value is near one. This value is justified by the fact that construction supplies tend to have a beta of greater than 1 as seen in many research reports.

Now this historical beta of Ambuja will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
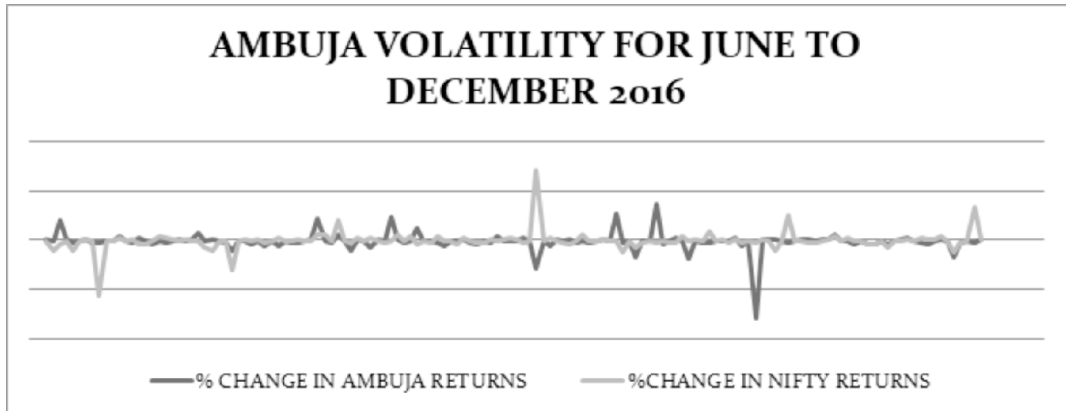

Figure 1: Co-movement of Ambuja Cements and Nifty 50 during the Test Period
(June 2016 to December 2016)

As exhibited in **Figure 1**, it is observed that percentage change in Ambuja's returns is at times more than the percentage change in market returns and sometimes the movement is in the opposite direction, that is, the market return is rising but the stock return is falling. However, more often than not, Ambuja has risen little more than the market and fallen more than the falling market as justified by a beta of little more than 1. There are many days during the period under observation when the percentage change in the returns of this scrip as well as the market has been nearly the same. Thus, the movement of returns of Ambuja vis-à-vis the market indicates that the beta calculated for the test period of preceding 48 months holds for the period under observation.

Ultratech

Ultratech has as statistically significant beta value of 1.29 with standard error of 0.222. The alpha value of 0.511 is statistically insignificant. The value of multiple R is 0.65 which suggests that Ultratech closely follows the market. The R square value is 0.42 suggesting that 42% of the variance in Ultratech is because of the market.

The beta value calculated for Ultratech indicates that the scrip is more volatile than the market. Now this historical beta of Ultratech will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
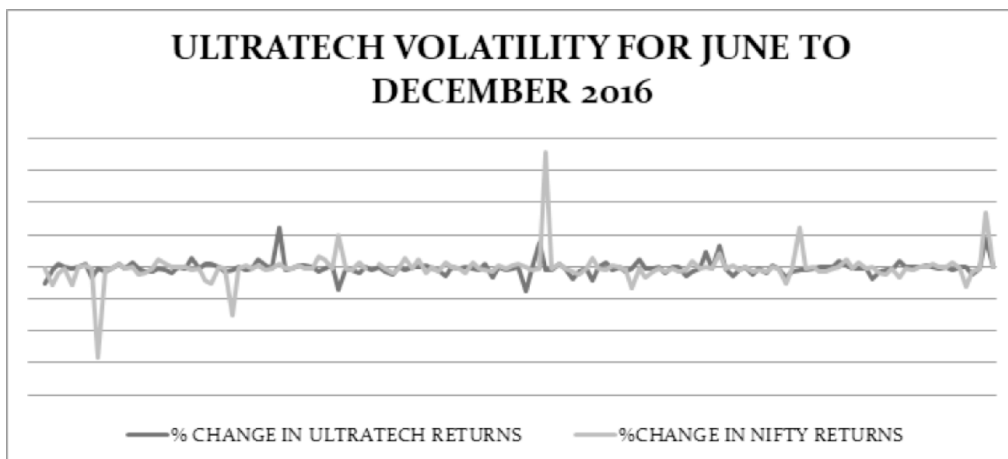
Figure 2: Co-movement of Ultratech and Nifty 50 during the Test Period
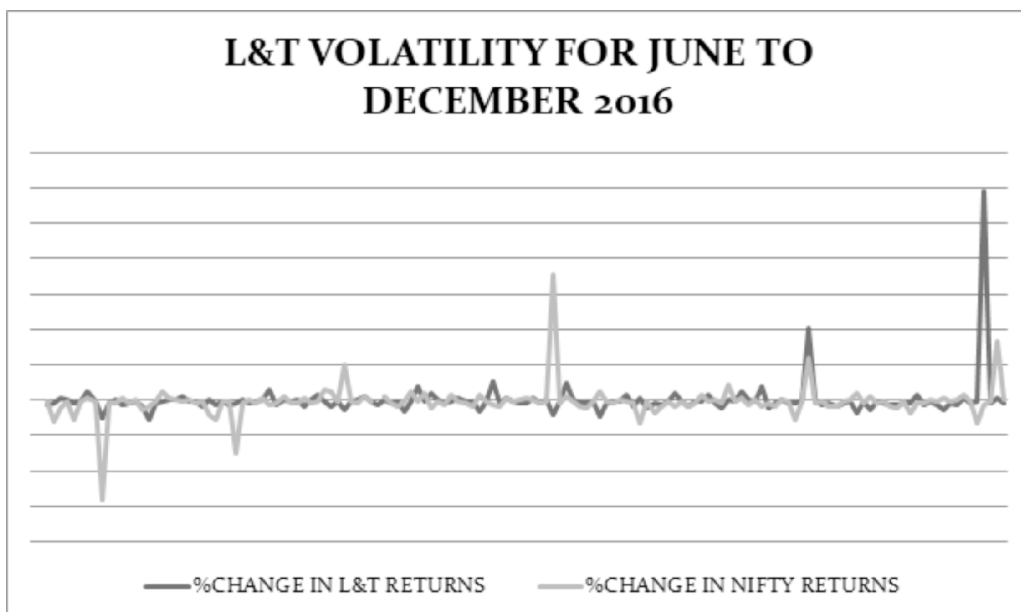
(June 2016 to December 2016)

As exhibited in **Figure 2,** the volatility of Ultratech during the six months period under observation doesn't justify its beta of 1.29 calculated for the preceding four years data. Nifty is more volatile than the Ultratech scrip on most occasions. In fact, for most of the period under observation, Ultratech's returns are represented by a graph that is deviating less than Nifty, showing that the beta computed for the past four years doesn't hold for Ultratech stock for the period under observation.

L&T

Alpha and beta values of L&T are obtained by regressing its returns on those of NIFTY 50. Beta of L&T is 1.73 with a standard error of 0.199 and Alpha = -0.504. Here the beta value is found to be statistically significant, thereby rejecting the null hypothesis that L&T's true beta is zero. The alpha value is found to be statistically insignificant.

The value of multiple r equal to 0.788 is quite high, indicating that L&T follows the movement in Nifty 50 and the positive value of beta indicates that the change is in the same direction. Further the value of beta at 1.73 indicates the scrip is more volatile than the market. The second statistic r square, with a value of 0.6213 indicates that 62.13% of variance in L&T's returns is attributable to the variation in the returns of Nifty 50. The third statistic, adjusted r square, is negative. 5.63 % of returns of L&T is independent of Nifty 50.

Now this historical beta of L&T will be tested to check if it holds good for a future period of 6 months, that is, this value of beta reflected in the returns for the subsequent period?

Figure 3: Co-movement of L& T and Nifty 50 during the Test Period
(June 2016 to December 2016)

As exhibited in **Figure 3,** the volatility for L&T during the six months period under observation doesn't justify its beta of 1.73 calculated for preceding four years data. Nifty is more volatile than the L&T scrip on most occasions. In fact, for most of the period under observation, L&T's returns either trail the Nifty returns or even move in opposite direction, showing that the beta computed for the past four years doesn't hold for L&T stock.

Asian Paints

Alpha and beta values of Asian Paints are obtained by regressing its returns on those of NIFTY 50. As seen in **Table 1,** beta of Asian Paints = 1.04 and Alpha = 1.270. Here the beta value of 1.04 with standard error of 0.218 is statistically significant, thereby rejecting the null hypothesis that Asian Paints' true beta is zero. The alpha value of 1.270345 is statistically insignificant and the null hypothesis of the true value of alpha being zero cannot be rejected.

The value of multiple r equal to 0.577 is moderately high, indicating that Asian Paints follows the movement in Nifty 50 but not too closely. The second statistic, r square, with a value of 0.3327 indicates that 33.27 % of the variance in Asian Paints' returns is attributable to the variation in the returns of Nifty 50. The third statistic, adjusted r square, is 0.318.

The value of beta for Asian Paints equal to 1.04 indicates it is as volatile as Nifty as this value is near one. This value is justified by the fact that Asian Paints falls in the Chemical (Specialty) sector which has a beta value of 1.00 as per a NYU research report.

Now this historical beta of Asian Paints will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
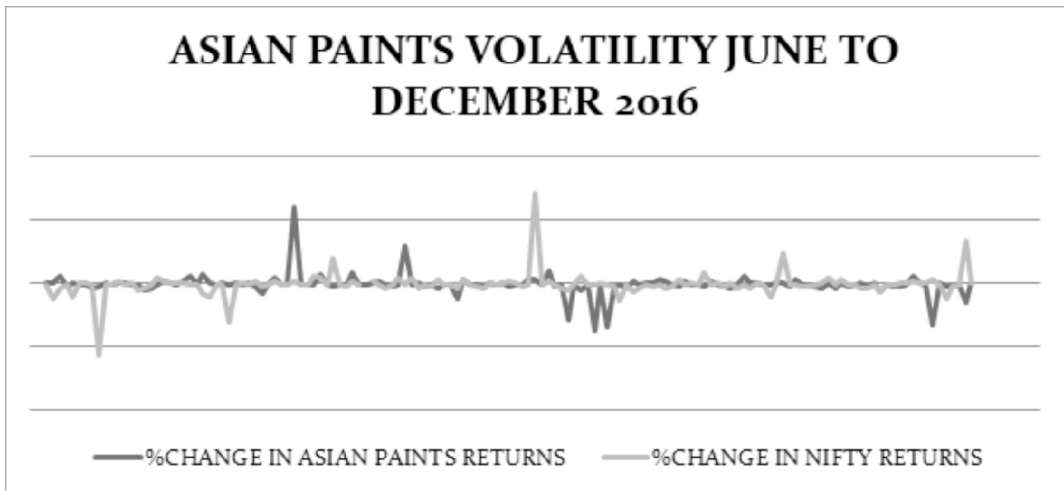
Figure 4: Co-movement of Asian Paints and Nifty 50 during the Test Period
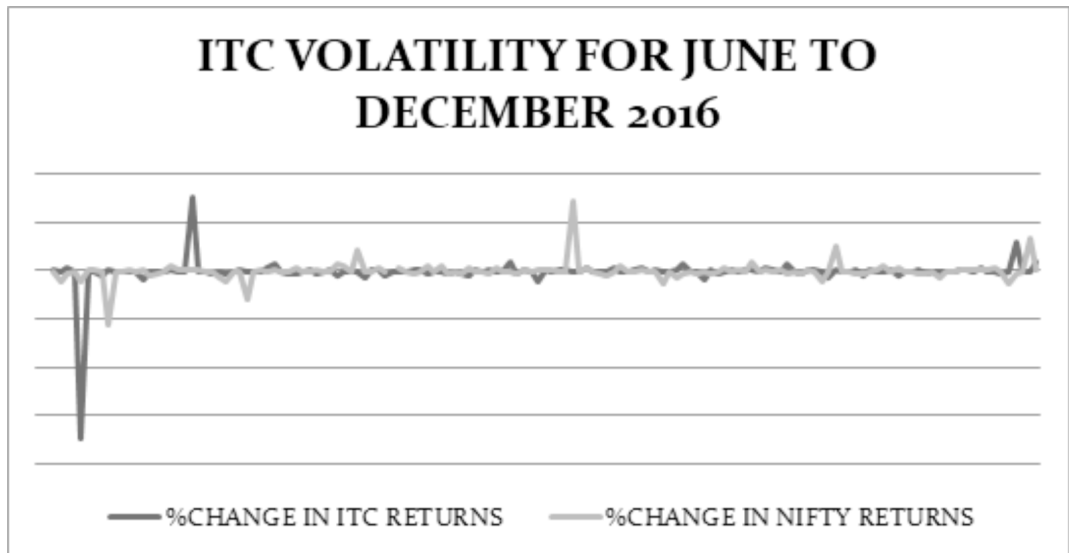**(June 2016 to December 2016)**

As exhibited in **Figure 4,** it is observed that percentage change in Asian Paints' returns is at times more than the percentage change in market returns and sometimes the movement is in the opposite direction, that is, the market return is rising but the stock return is falling. However, for most of the period under observation, Asian Paints' returns plot in line with the market's return, as justified by a beta of 1.04 calculated for the test period of preceding 48 months. Thus, there is a specific trend in the change in returns of Asian Paints as compared to the change in Nifty returns and it can be said that beta computed for the past four years holds for Asian Paints' stock.

ITC

Beta of ITC is 0.49, with standard error of 0.237 and Alpha = -0.344. Here the beta value is statistically significant, thereby rejecting the null hypothesis that ITC's true beta is zero. The alpha value is statistically insignificant.

The value of multiple r equal to 0.289 is low, indicating that ITC doesn't follow the movement in Nifty 50 too closely. The second statistic, r square, with a value of 0.083 indicates that only 8.3 % of the variance in ITC's returns is attributable to the variation in the returns of Nifty 50. The third statistic, adjusted r square, is 0.063. The value of standard error indicates that 6.73 % of returns of ITC is independent of Nifty 50.

The beta value calculated for ITC is 0.49 which indicates that the scrip is less volatile than the market. Now this historical beta of ITC will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period.

Figure 5: Co-movement of ITC and Nifty 50 during the Test Period
(June 2016 to December 2016)

It is seen that the change in Nifty returns is more than the change in ITC returns, which is in sync with the calculated beta. As exhibited in **Figure 5**, the volatility for ITC in the six months period under observation is justified by its beta of 0.49 calculated for preceding four years data. Nifty is more volatile than the ITC scrip on most occasions. In fact, for most of the period under observation, ITC's returns plot on a less deviating path as compared to the Nifty returns, Showing that the beta computed for the past four years holds for ITC stock.

HUL

Beta of HUL is 0.59 with standard error of 0.211 and Alpha = 1.043. Here the beta value is found to be statistically significant, thereby rejecting the null hypothesis that HUL's true beta is zero. The alpha value is statistically insignificant.

As the value of multiple r is low at 0.383, the impact of market on the stock price is not very significant. The value of r square is .146, which means that only 14.63% of the variance in HUL price is explained by the variance in the market index.

The beta value calculated for HUL indicates that the scrip is less volatile than the market. Now this historical beta of HUL   will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta is reflected in the returns for the subsequent period?
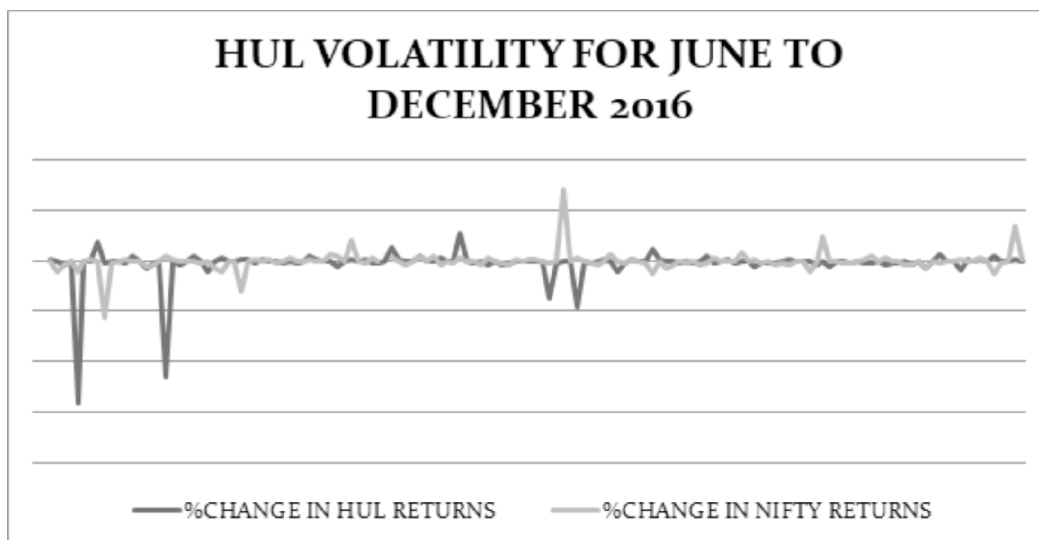
Figure 6 : Co-movement of HUL and Nifty 50 during the Test Period

(June 2016 to December 2016)

We can see that the market returns vary more than the stock's return which suggests that the beta calculated for HUL is correct in predicting the volatility. As exhibited in **Figure 6**, the volatility for HUL in the six months period under observation justifies its beta of 0.59 calculated for preceding four years data. Nifty is more volatile than the HUL scrip on most occasions. Except for few spells of high volatility, for most of the period under observation, HUL's returns plot in an almost straight line near Nifty returns, showing that the beta computed for the past four years holds for HUL stock.

CIPLA

Alpha and beta values of Cipla are obtained by regressing its returns on those of NIFTY 50. As seen in table 3, beta of Cipla = 0.53 and Alpha = 0.499. Here the beta value of 0.53 with standard error of 0.265 is statistically significant, thereby rejecting the null hypothesis that Cipla' true beta is zero. The alpha value of 0.499 is statistically insignificant and the null hypothesis of the true value of alpha being zero cannot be rejected.

The value of multiple r equal to 0.281 is low, indicating that Cipla doesn't follow the movement in Nifty 50 too closely. The second statistic, r square, with a value of 0.0791 indicates that only 7.91 % of the variance in Cipla's returns is attributable to the variation in the returns of Nifty 50. The third statistic, adjusted r square, is 0.059. Next statistic, standard error, is 7.521, which represents the portion of returns of Cipla that is independent of Nifty 50.

The value of beta for Cipla equal to 0.53 indicates it is less volatile than Nifty as this value is less than one. A research report published by NYU indicated that the beta value for drugs (pharma) industry is 1.02. It seems that the volatility of Cipla is less than the industry volatility.

 Now this historical beta of Cipla will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
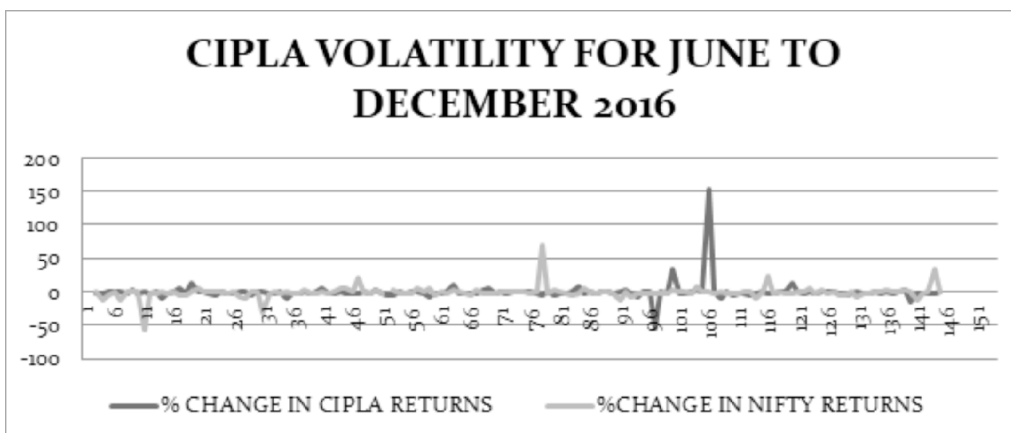
Figure 7: Co-movement of Cipla and Nifty 50 during the test period
(June 2016 to December 2016)

As exhibited in **Figure 7**, it is observed that percentage change in returns of Cipla is seldom more than the percentage change in market returns and very rarely, the movement is in the opposite direction, that is, the market return is rising but the stock return is falling. In fact, for most of the period under observation, Cipla's returns plot in almost a straight line with a slightly more mobile market return line, as justified by a beta of 0.53 calculated for the test period. Thus, there is a specific trend in the change in returns of Cipla compared to the change in Nifty returns and it can be said that beta computed for the past four years holds for Cipla' stock.

Dr Reddy's Lab

Alpha and beta values of Dr Reddy's Lab are obtained by regressing its returns on those of NIFTY 50. As seen in table 1, beta of Dr Reddy's Lab = 0.22 and Alpha =1.334. Here the beta value of 0.22 with standard error of 0.265 is statistically significant, thereby rejecting the null hypothesis that Dr Reddys Lab' true beta is zero. The alpha value of 1.334 is statistically insignificant and the null hypothesis of the true value of alpha being zero cannot be rejected.

The value of multiple r equal to 0.119 is low, indicating that Dr Reddy's Lab doesn't follow the movement in Nifty 50 too closely. The second statistic, r square, with a value of 0.014 indicates that only 1.41 % of the variance in Dr Reddy's Lab's return is attributable to the variation in the returns of Nifty 50. The third statistic, adjusted r square, is negative.

We see that the value of beta for Dr. Reddy's is 0.22. It indicates that the stock is less volatile than the market. The industry beta is 1.02 for drugs (Pharma). So this stock has very low volatility as compared to other players in the industry.

Now this historical beta of Dr. Reddy's will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
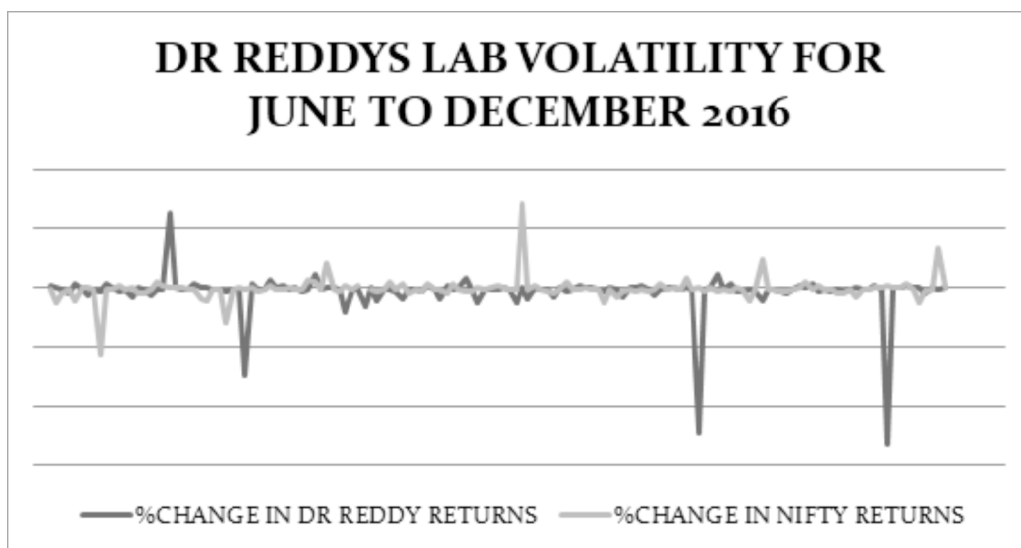
Figure 8: Co-movement of Dr. Reddys Lab and Nifty 50 during the Test Period

(June 2016 to December 2016)

As exhibited in **Figure 8,** it is observed that percentage change in Dr. Reddy's Lab's returns is more than the market on more than few occasions. On some occasions, the movement is also in the opposite direction, that is, the market return is rising but the stock return is falling. For substantial part of period under observation, Dr. Reddy's Lab's returns plot in almost the same way as the market return line, though not justified by a beta of 0.215. So it can be said that beta computed for the past four years doesn't hold for Dr. Reddy's Lab's stock.

HCL

Alpha and beta values of HCL are obtained by regressing its returns on those of NIFTY 50. As seen in **Table 1**, beta of HCL = 0.05 and Alpha = 2.5. Here the beta value of 0.05 with standard error of 0.268 is statistically significant, thereby rejecting the null hypothesis that HCL's true beta is zero. The alpha value of 2.5 is statistically insignificant and the null hypothesis of the true value of alpha being zero cannot be rejected.

The value of multiple r equal to 0.028 is low, indicating that HCL doesn't follow the movement in Nifty 50, though positive value of beta indicates that the change is in the same direction. The second statistic, r square, with a value of 0.0008 indicates that no variance in HCL's returns is attributable to the variation in the returns of Nifty 50. The third statistic, adjusted r square, is negative.

The beta value calculated for HCL is 0.05, indicating that the scrip is less volatile than the market. Now this historical beta of HCL will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
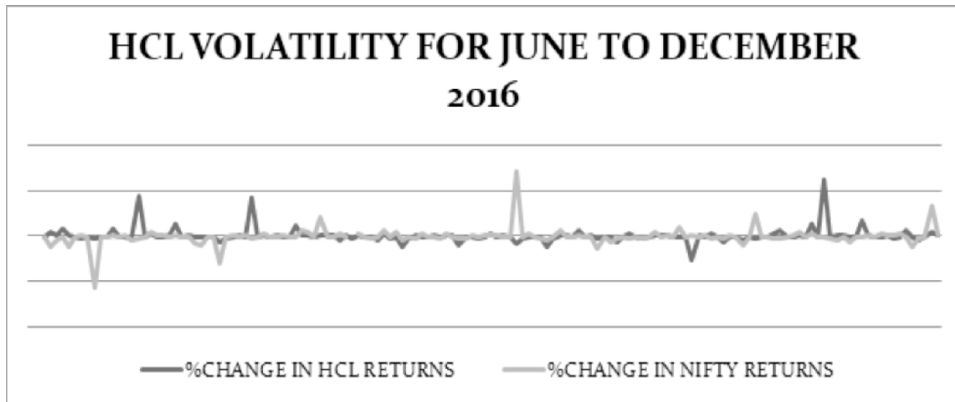
Figure 9 : Co-movement of HCL and Nifty 50 during the Test Period
(June 2016 to December 2016)

As exhibited in **Figure 9**, it is observed that percentage change in HCL's returns is more than the percentage change in market returns on few occasions only but on all such occasions the percentage increase in HCL has been noticeably high. In fact, for most of the period under observation, HCL's returns vary more erratically than justified by a beta of 0.05 calculated using returns of preceding four years. So it can be said that beta computed for the past four years doesn't hold for HCL stock.

Infosys

The value of multiple r is 0.055 shows this regression model is not statistically significant. The R square is 0.003 which means that only 0.3% of the variation in stock is due to the market returns. The beta value is -0.201 with an error of 0.531.

The beta value calculated for Infosys is -0.2, which indicates that the scrip moves in opposite direction of the movement in the market. Now this historical beta of Infosys will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
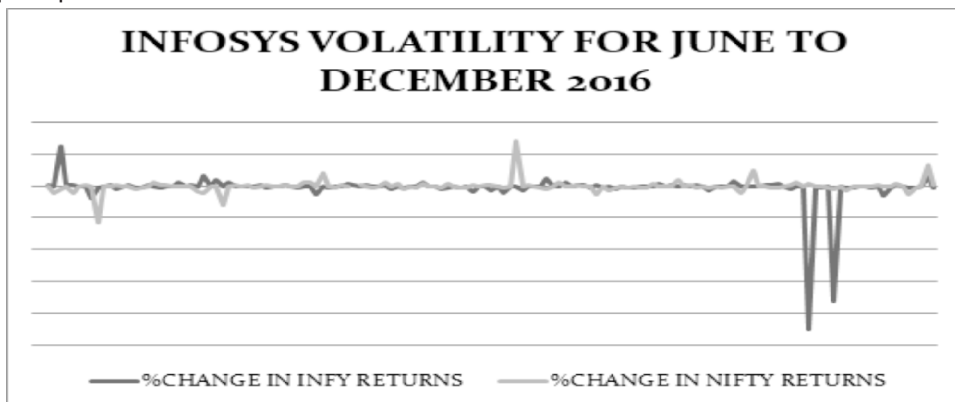

Figure 10: Co-movement of Infosys and Nifty 50 during the Test Period
(June 2016 to December 2016)

As exhibited in **Figure 10**, Infosys doesn't follow the volatility as calculated. Although there are some instances when the market increases and the stock returns of Infosys decrease and vice versa, but there is no specific trend followed, showing that the beta computed for the past four years doesn't hold for Infosys stock.

HDFC Bank

Alpha and beta values of HDFC Bank are obtained by regressing its returns on those of NIFTY 50. As seen in **Table 1**, beta of HDFC Bank = 1.08 and Alpha = 0.583. Here the beta value of 1.08 with standard error of 0.111 is statistically significant, thereby rejecting the null hypothesis that HDFC Bank's true beta is zero. The alpha value of 0.583 is statistically insignificant and the null hypothesis of the true value of alpha being zero cannot be rejected.

The value of multiple r equal to 0.821 is quite high, indicating that HDFC Bank follows the movement in Nifty 50 and the positive value of beta indicates that the change is in the same direction. The second statistic, r square, with a value of 0.6732 indicates that 67.32% of variance in HDFC Bank's returns is attributable to the variation in the returns of Nifty 50. The third statistic, adjusted r square, is negative.

The beta value calculated for HDFC Bank is 1.08 which indicates that the scrip is as volatile as the market. Now this historical beta of HDFC Bank will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
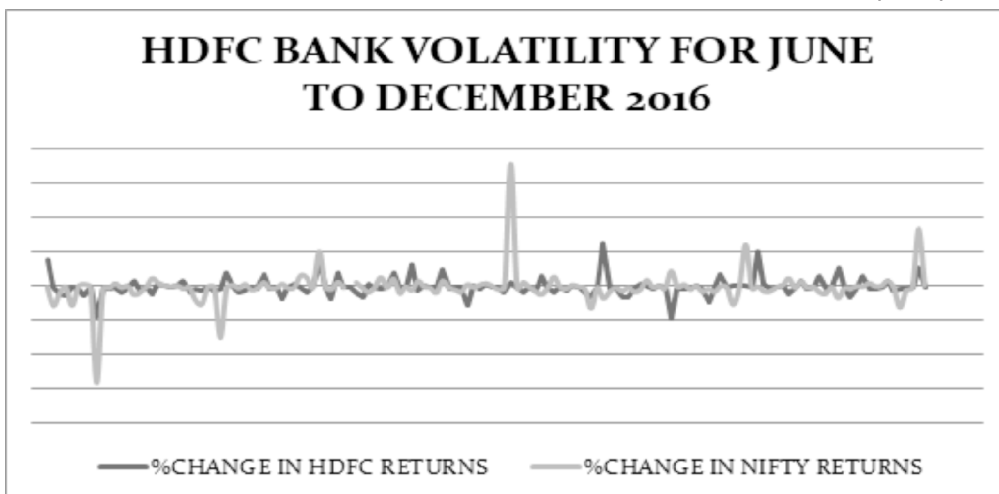

Figure 11: Co-movement of HDFC Bank and Nifty 50 during the Test Period
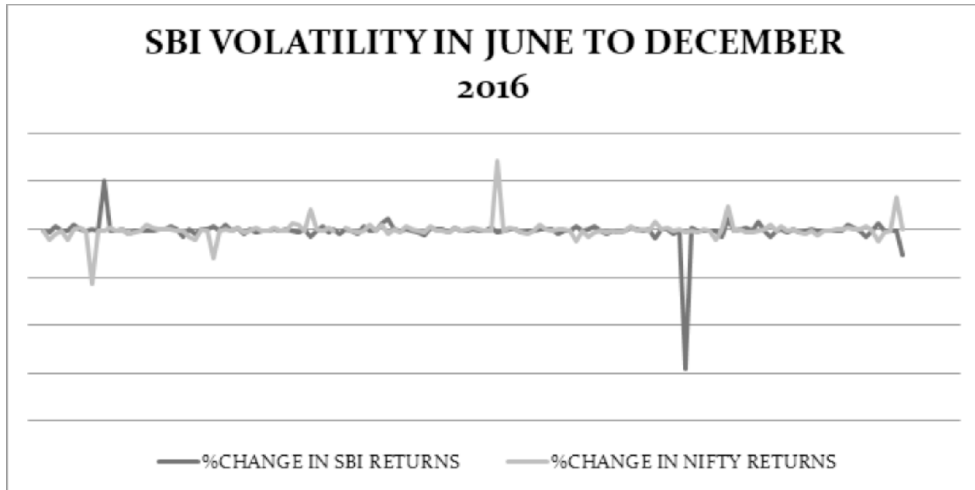**(June 2016 to December 2016)**

As exhibited in **Figure 11**, volatility for HDFC Bank in the six months period under observation doesn't justify its beta of 1.08 calculated for the preceding four years data. Nifty is more volatile than the HDFC bank scrip on most occasions. In fact, for most of the period under observation, HDFC bank's returns plot away from the Nifty returns, showing that the beta computed for the past four years doesn't hold for HDFC bank stock.

SBI

The value of multiple r is 0.143, which is quite low indicating that SBI doesn't follow the market closely.

The r square is 0.02 indicating that only 2% of the variation in SBI stock price is due to the market. The beta value is 1.71 with a standard error of 1.747 is significant.

The beta value calculated for SBI is 1.71 which indicates that the scrip is more volatile than the market. Now this historical beta of SBI will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta is reflected in the returns for the subsequent period?

Figure 12: Co-movement of SBI and Nifty 50 during the Test Period

(June 2016 to December 2016)

As exhibited in **Figure 12,** the volatility of SBI in the six months period under observation doesn't justify its beta of 1.71 calculated for the preceding four years data. Nifty is more volatile than the SBI scrip on most occasions. In fact, for most of the period under observation, SBI's returns seem to deviate less than the market, showing that the beta computed for the past four years doesn't hold for SBI stock.

Hero Motors

The value of beta is 0.89 and it is significant with standard error of 0.217. The value for multiple r is 0.521, which means that the stock prices of Hero follows the market to a moderate level. The adjusted r value is 0.256, which means that only 25.58% of the variance in stock price of Hero Motors is explained by the variation in market.

The beta value calculated for Hero Motors is 0.89 which indicates that the scrip is little less volatile than the market. Now this historical beta of Hero Motors will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
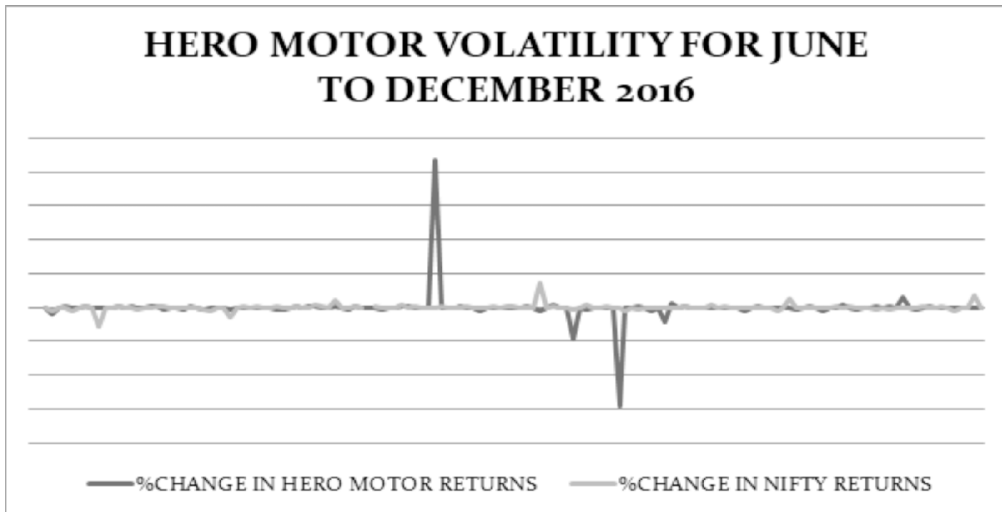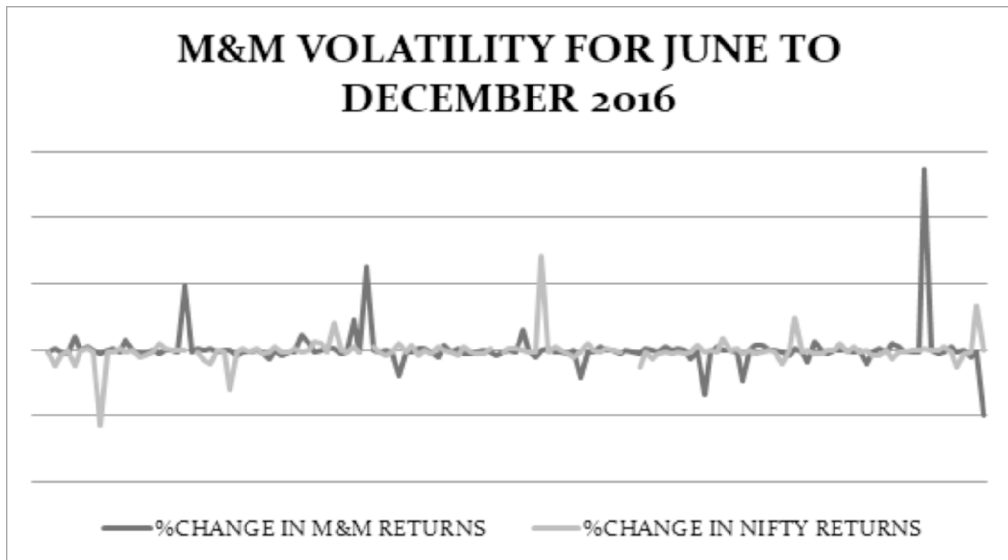
Figure 13: Co-movement of Hero Motor Corps and Nifty 50 during the Test Period

(June 2016 to December 2016)

As exhibited in **Figure 13,** the market returns have been more volatile than the stock returns during the period under observation. We see that the percentage change in returns of Hero Motors have been very flat in this period. This behavior of returns doesn't reflect a beta of near one, 0.89 to be specific. Thus, the beta calculated using the returns data of preceding four year period doesn't hold for the period under observation.

Mahindra & Mahindra

The multiple r value is very low at 0.07, which indicates that M&M doesn't follow the market closely. The r square value is also very low suggesting that only 0.4 percent of variance in the stock return is explained by the variation in market. The beta value for the stock is 0.14 with a standard error of 0.283.

The beta value calculated for M&M is 0.14, which indicates that the scrip has very low volatility as compared to the market. Now this historical beta of M&M will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?
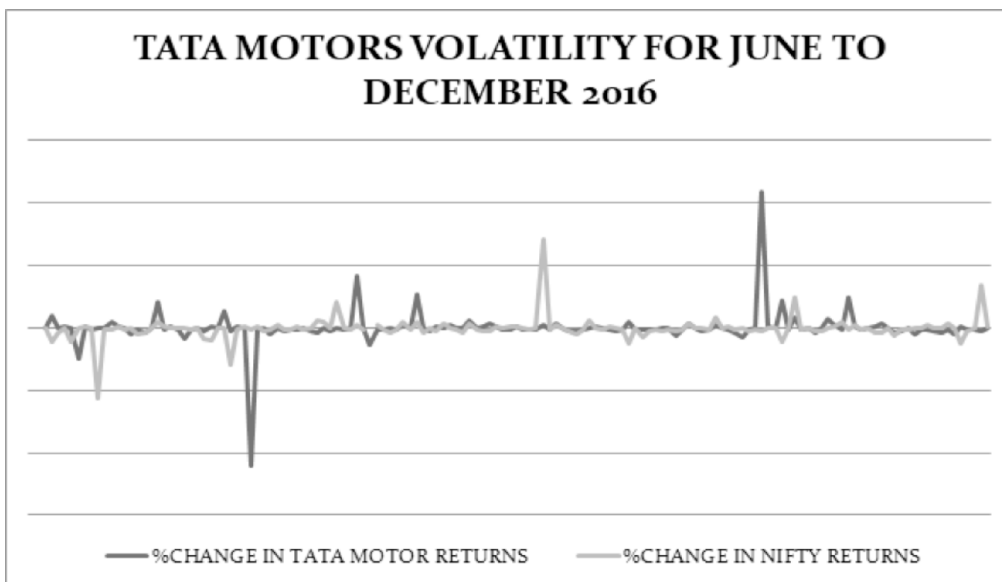
Figure 14 : Co-movement of M&M and Nifty 50 during the Test Period

(June 2016 to December 2016)

As exhibited in **Figure 14,** there is no specific trend followed by M&M. The volatility for M&M during the six months period under observation doesn't justify its beta of 0.14 calculated for preceding four years data. Percentage change in returns are more volatile for the stock than Nifty on more occasions than not. In fact, for most of the period under observation, M&M's returns plot away from the Nifty returns, showing that the beta computed for the past four years doesn't hold for this stock.

TATA Motors

The value for multiple r is 0.608, which is quite high suggesting that Tata Motors follows Nifty quite closely. The value of r square is 0.36 indicating that 36% of the Tata Motors share price variation is due to the stock market. The value of beta is 1.48 with a small error of 0.285.

The beta value calculated for Tata Motors is 1.48 which indicates that the scrip is more volatile as the market. Now this historical beta of Tata Motors will be tested to check if it holds good for a future period of 6 months, that is, is this value of beta reflected in the returns for the subsequent period?

Figure 15 : Co-movement of TATA Motors and Nifty 50 during the Test Period
(June 2016 to December 2016)

As exhibited in **Figure 15**, variance of Tata Motors returns is mostly more than the variance of the market except on some days where it has lower volatility. However, the volatility of the stock is not that higher than the market to justify a beta of 1.48, showing that the beta computed for the past four years doesn't hold for Tata Motors stock.

Summary and Limitations of the Study

The authors have used simple and time tested method of regression analysis for beta measurement. Regression analysis provides insights into the statistically significance of the values computed. Analysis of the values thus computed for the test period of 48 months and their comparison with the movements in prices observed during the observation period of following six months reveal some interesting facts. Beta computed for the test period seems to hold for five scrips, namely, Ambuja, Asian paints , ITC, HUL and Cipla. It doesn't hold for Ultratech, L&T, Dr. Reddys Lab, HCL, Infosys, HDFC Bank, SBI, Hero Motors, M&M and Tata Motors. Thus, beta has been reliable in predicting the volatility for 5 out of 15 stocks taken for observation. It is very difficult to say if the same reliability will be seen for these stocks in the future.

It can be further concluded that reliability of beta is not a sector specific phenomenon as it seems to hold for some scrips in a sector but not for others. For instance, it holds for Cipla but not for Dr. Reddys Lab.

The current study has many limitations. This study is just a preliminary attempt to increase the understanding of investors and researchers about the measurement of beta and its time-varying nature. More research needs to be undertaken by rolling windows across different periods of time to draw more robust conclusions. In addition, though it is always preferable to take as much data for study as is available for analysis to draw more reliable conclusions, this study is based on limited monthly data spanning 48 months ending in June 2016. The time period used in the study for

observation is six months which is also relatively small, leading to less reliable conclusions.

References:

- Alsharairi M., Abubaker W. (2016). Does Arab spring have a spillover effect on Dubai financial market? The Journal of Developing Areas, 50(6), 319–331. doi:10.1353/jda.2016.0121.

- Andersen T. G., Bollerslev T., Diebold F. X., Ginger Wu J. (2004). Realized Beta: Persistence and Predictability. SSRN Electronic Journal. doi:10.2139/ssrn.542802.

- Das S., Barai P. (2015). Time-varying industry beta in Indian stock market and forecasting errors. International Journal of Emerging Markets, 10(3), 521–534. doi:10.1108/ijoem-02-2013-0035.

- Khandaker S., Islam S. Z. (2015). Volatility and co-movement: an analysis of stock markets behavior of selected emerging and developed countries. The Journal of Developing Areas, 49(6), 333–347. doi:10.1353/jda.2015.0095.

- Novak J. (2015). Systematic risk changes, negative realized excess returns and time-varying CAPM beta. Finance A Uver: Czech Journal Of Economics & Finance, 65(2), 167-190.

- Taher Mollik A., Khokan Bepari M. (2010). Instability of stock beta in Dhaka Stock Exchange, Bangladesh. Managerial Finance, 36(10), 886–902. doi:10.1108/03074351011070251.

- Verma R. (2011). Testing forecasting power of the conditional relationship between beta and return. The Journal of Risk Finance, 12(1), 69–77. doi:10.1108/15265941111100085.