BETA RELIABILITY BIASNESS TOWARDS AGGRESIVE STOCKS - AN OBSERVED FAST FROM BOMBAY STOCK EXCHANGE

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Abstract :

The general perception among the investor is that stock market gives maximum return at high risk. Investors are concerned about the value of capital market index while investing in stock market. Investor behavior is related to the psychological factor which reveals that prices of stocks and market movements are closely related to each other. Investors think that value of their stock prices move in the same direction for any increase or decrease in the value of index. If investors are extremely bullish on the market, will focus on high beta stocks in order to leverage expected strong market conditions. The risk associated with this is known as systematic risk which explains the propensity of stock price movements with respect to change in market index. βeta (β) measures the systematic risk. Stocks with the $\beta > 1$ are more volatile than the index and are classified as aggressive stocks. Stocks with β less than 1 are less volatile and classified as defensive stocks.

$$\beta_i = r_{im} \times \sigma_i / \sigma_m$$

Here the ratio of standard deviations measure how variable the stock return is relative to the variability of the market return. The correlation coefficient measures the nature and extent of relationship. If value of 'r' is not a big number, then βeta would have little meaning which indicates mutual relation between the stock and market return is weak. The strength of the relationship is determined by coefficient of determination. R^2 gives the proportion of variation in dependent variable (stock return) that is explained by the independent variable (market return). βeta with lower value of R^2 suggests that βeta is of little use in explaining the movements in stock return as some other factors may be affecting the variation other than market return. Hence we can use R^2 as a measure of degree of reliability of beta in prediction line. This study helps to understand whether degree of reliability of βeta coefficients for aggressive stocks is significantly higher than defensive stocks.

Need for the study :

Normally investors think that value of their stock prices move in the same direction the value of index moves. They expect that value of their holdings would move in accordingly if there is any Upward or downward movement in Sensex. βeta (β) measures the systematic risk which explains the propensity of stock price movements with respect to change in market index. If you are extremely bullish on the market, you will focus on high βeta stocks in order to leverage expected strong market conditions. Generally βeta > 1 are treated as aggressive stocks but βeta with lower value of R^2 suggests that βeta is of little use in explaining the movements in stock return as some other factors may be affecting the variation other than market return. R^2 is a direct measure of the explanatory power of simple regression equation. Hence there is need to study whether R^2 values for aggressive stocks are significantly higher than defensive stocks so that investors can trust on aggressive stocks while building a portfolio.

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Objective :

To observe whether degree of reliability of βeta coefficients for aggressive stocks in Sensex is significantly higher than that of defensive stocks. Since index model is followed by BSE for the estimation of βeta which is a similar to SLRM, R^2 can be used as an appropriate tool to signify the degree of reliability of βeta in prediction line.

Introduction :

Investor behavior is related to the psychological factor which reveals that prices of stocks and market movements are closely related to each other. Behavioral finance proposes psychology based theories to explain stock market anomalies. Evidence in the psychology literature reveals that individuals have limited information processing capabilities, exhibit systematic bias in processing information, are prone to making mistakes and often tend to rely on the opinion of others. While investing in stock market, they will be concerned about the value of capital market index. Any increase or decrease in the value of index gives raise to expectation of investors that value of their stock prices move in the same direction. This risk is known as systematic risk arising on account of economic, political or sociological uncertainties. Systematic risk explains the propensity of stock price movements with respect to change in market index.

βeta coefficient measures the systematic risk (non diversifiable risk) of the security that can not be avoided through diversification. It refers to the slope of characteristic regression line. It describes the relation between stock return and index return. It measures the volatility of a given stock relative to the volatility of the market. Stocks may have a βeta value of less than, equal to, greater than one. An asset with a βeta of zero means that its price is not at all correlated with the market; that asset is independent. A positive βeta means the asset generally tracks the market. A negative βeta shows that the asset inversely follows the market; asset generally decreases in value if the market goes up. Stocks with the βeta higher than one are classified as aggressive stocks and these are more volatile than the index. Stocks with βeta value less than one are less volatile and classified as defensive stocks. Sensitivity coefficient (βeta) of a stock is estimated through SLRM. The characteristic regression line or the CRL is a simple linear regression model estimated for a particular stock against the market index return to measure it's diversifiable and un diversifiable risks. The equation is given by,

$R_i = \alpha_i + \beta_i R_m + e_i$..1

Where R_i and R_m are the return on the stock i and return on the market m respectively. α_i is the intercept; It indicates that stock return is independent of market return. It indicates return on stock when market return is zero. β_i is the slope of regressions line. e_i is the error term or the residual risk which represents the unexplained component of R_i. It has a expected value of zero and is uncorrelated with R_m. The e_i contributes to the variance but not to the predicted value of R_i.

As $E[e_i] = 0$, we get,

$E(R_i) = \alpha_i + \beta_i E(R_m)$.......................................2

Equation 2 is referred to be as prediction line. This indicates that predicted value of R_i equals to α_i (intercept) plus β_i (slope) times the expected value of R_m.

The slope of the equation is determined by,

$\beta_i = \text{Covr}_{i,m} / \alpha^2_m$

$\beta_i = \alpha_i \alpha_m r_{i,m} / \alpha^2_m$

$\beta_i = r_{i,m} * \alpha_i / \alpha_m$ 3

βeta depends upon the variability of individual stock return (σ_i), variability of market return (σ_m) and correlation coefficient between market and stock returns ($r_{i,m}$). The ratio of standard deviations measure how variable the stock return is relative to the variability of the market return. The more variable the stock return relative to the variability of market return, the greater risk associated with the individual stock. The correlation coefficient represents whether this relative variability is important. βeta would have little meaning if mutual relation between the stock and market return is weak. That is if value of r is not a big number. Normally the strength of the relationship is determined by coefficient of determination R^2. Coefficient of correlation is squared to get the Coefficient of determination. R^2 gives the proportion of variation in dependent variable (stock return) that is explained by the independent variable (market return). R^2 is a direct measure of the goodness of fit of SLR equation. βeta with lower value of R^2 suggests that βeta is of little use in explaining the movements in stock return as some other factors may be affecting the variation other than market return. Here degree of reliability of prediction line (βeta) is determined by R^2. Hence we can use R^2 as a measure of degree of reliability of beta in prediction line.

Beta calculation practiced at BSE :

Bombay Stock Exchange mentions the βeta values of stocks which constitute Sensex. Sensex 30 stocks represent the most liquid stocks. BSE revises this data every month. The standard βeta estimation practice needs daily paired observations of market index return (R_{Sensex}) and stock return (R_i) over a period of one year. BSE follows single index model for βeta estimation. The historical values of daily paired observations of R_{Sensex} and R_i are estimated as below.

$$R_{Sensex}(t) = \frac{\{ CV_{Sensex}(t) - CV_{Sensex}(t-1) \}}{CV_{Sensex}(t-1)} \quad \ldots\ldots\ldots\ldots 4$$

$$R_i(t) = \frac{\{ CV_i(t) - CV_i(t-1) \}}{CV_i(t-1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots 5$$

Where $R_{Sensex}(t)$ is the return on the market index, Sensex of t^{th} day. $CV_{Sensex}(t)$ is the closing value of Sensex of t^{th} day. $CV_{Sensex}(t-1)$ is the closing value of Sensex of $t-1^{th}$ day. Similarly, $R_i(t)$ is stock return of t^{th} day. $CV_i(t)$ is the closing value of stock i of t^{th} day and $CV_i(t-1)$ is the closing value of stock i of $t-1^{th}$ day.

Hypothesis :

Null hypothesis (H_0): μ ($R2_{\text{Aggressive stocks}}$) ? μ ($R^2_{\text{Defensive stocks}}$)

Alternate hypothesis (H_1): μ ($R2_{\text{Aggressive stocks}}$) > μ ($R^2_{\text{Defensive stocks}}$)

Here μ ($R2_{\text{Aggressive stocks}}$) is the population mean of R^2 values of aggressive stocks and μ ($R^2_{\text{Defensive stocks}}$) is the population mean of R^2 values of defensive stocks. The test is conducted to determine whether population mean of R^2 Aggressive stocks is significantly higher than the population mean of R^2 Defensive stocks.

Data source and Methodology :

A sample of 30 stocks of listed companies on BSE has been taken for the study. The sample of stocks is selected from SENSEX which is diversified 30 stocks index accounting for 11 sectors of the economy. This sample is prominent enough because:

- SENSEX represents about 47% of the total market capitalization of stocks listed on BSE.

- Traded value of all SENSEX stocks is approximately 21% of the traded value of all stocks listed on BSE.

Data of daily closing values of SENSEX & its 30 stocks is obtained from BSE website for the period of one year that is from 1st March 2011 to 29th February 2012. Stock prices have been adjusted to the corporate actions. Daily paired observations of R_{sensex} and R_i are estimated through the equations 4 & 5. Microsoft excel regression tool is used to find SLRM statistics of stocks. The sample of 30 stocks is divided into two groups.

Aggressive stocks with beta coefficient > 1

Defensive stocks with beta coefficient $\leq$ 1

Means of R^2 Aggressive and R^2 Defensive are compared. We have compared the variability of $R^2_{Aggressive\ Stocks}$ and $R^2_{Defensive\ Stocks.}$ *F* test is used for testing the equality of two variances. This is done to determine whether we have to use equal variance test or unequal variance test for the hypothesis testing. We have used equal variance test for testing the hypothesis.

Statistical Analysis :

We have used Microsoft Excel Regression to obtain SLRM statistics of Sensex 30 stocks which are tabulated in table 1. The table 1 indicates that first 12 stocks are aggressive which have βeta coefficient > 1 and remaining 18 stocks are defensive which have βeta value $\leq$ 1. Table 2 indicates the Descriptive Statistics for $R^2_{Aggressive\ Stocks}$ & $R^2_{Defensive\ Stocks}$ groups.

Table 1 : SLRM Statistics of SENSEX 30 Stocks

Sl.No.	Name of the Stock	Alpha	Beta	R^2
1	Tata Motors Ltd	0.00117311	1.56	0.53
2	DLF Ltd	0.00061048	1.56	0.47
3	Hindalco Ltd	-0.00094586	1.53	0.50
4	Sterlite Industries Ltd	-0.00082873	1.52	0.56
5	ICICI Bank Ltd	-0.00014609	1.46	0.69
6	Tata Steel Ltd	-0.00083544	1.33	0.55
7	Jindal Steel Ltd	-0.00020362	1.27	0.49
8	Reliance Industries Ltd	-0.00047176	1.22	0.60
9	State Bank of India Ltd	-0.00042814	1.21	0.50
10	Larsen & Toubro Ltd	-0.00052473	1.17	0.49
11	Mahindra & Mahindra Ltd	0.000535299	1.04	0.41
12	BHEL	-0.00083896	1.04	0.35
13	Infosys Ltd	-0.000036983	1.00	0.47
14	HDFC Ltd	0.000287221	0.99	0.57
15	TCS Ltd	0.000579397	0.98	0.44
16	HDFC Bank Ltd	0.00097011	0.94	0.57
17	Wipro Ltd	0.000116696	0.90	0.42

Sl.No.	Name of the Stock	Alpha	Beta	R^2
18	Tata Power Ltd	0.000249736	0.88	0.30
19	Bharti Airtel Ltd	0.000387227	0.79	0.25
20	NTPC Ltd	0.000187312	0.78	0.38
21	Maruti Suzuki Ltd	0.00012915	0.73	0.23
22	Bajaj Auto Ltd	0.001416192	0.72	0.26
23	Coal India Ltd	0.000196212	0.58	0.13
24	ONGC Ltd	0.000468433	0.57	0.18
25	ITC Ltd	0.000892212	0.55	0.30
26	GAIL (I) Ltd	-0.0005476	0.52	0.19
27	Hero Motor Corp Ltd	0.00131441	0.50	0.10
28	Sunpharma Ltd	0.0009968	0.48	0.15
29	Cipla Ltd	0.000270532	0.43	0.14
30	Hindustan Unilever Ltd	0.001278547	0.40	0.12

Table 2 : Descriptive statistics

	R^2 Aggressive Stocks	R^2 Defensive Stocks
N	12	18
Range	0.34	0.47
Minimum	0.35	0.10
Maximum	0.69	0.57
Sum	6.14	5.20
Mean	0.5117	0.2889
Std. Error Mean	0.02510	0.03605
Std. Deviation	0.08695	0.15297
Variance	0.008	0.023
Skewness	0.193	0.605
Kurtosis	1.131	-0.812

Descriptive statistics (Table:2) indicates that means of $R^2_{Aggressive}$ and $R^2_{Defensive}$ are 0.5117 and 0.2889 with Standard Error Mean 0.02510 and 0.03605 respectively. Variances of $R^2_{Aggressive}$ and $R^2_{Defensive}$ are 0.008 and 0.023 respectively. Now, we use *F* test to determine whether two independent populations, $R^2_{Aggressive\ stocks}$ and $R^2_{Defensive\ stocks}$ have same variability.

That is,

Null hypothesis (H_0): $\sigma^2\ (R^2_{Aggressive\ stocks}) = \sigma^2\ (R^2_{Defensive\ stocks})$

Alternate hypothesis (H_1): $\sigma^2\ (R^2_{Aggressive\ stocks}) \neq \sigma^2\ (R^2_{Defensive\ stocks})$

Table 3 : *F* Test results for the difference between σ^2 ($R^2_{\text{Aggressiv stocks}}$) and σ^2 ($R^2_{\text{Defensive stocks}}$)

F Test Differences in Two Variances	
Data	
Level of Significance	5%
Sample 1 : R^2 Aggresive Stocks	
Sample Size	12
Standard Deviation	0.08695
Variance	0.007560303
Sample 2 : R^2 Defensive Stocks	
Sample Size	18
Standard Deviation	0.15297
Variance	0.023399821
***F* Test Statistic**	0.323092323
Population 1 Sample Degrees of Freedom	11
Population 2 Sample Degrees of Freedom	17

In the table 3, *F* test statistic is 0.3231. In testing for equality of variances, using 5% level of significance, the Critical value of *F* distribution with 11/17 degrees of freedom is 2.70; therefore we accept the null hypothesis and conclude that there is no significant difference in the variability of $R^2_{\text{Aggressive stocks}}$ and $R^2_{\text{Defensive stocks}}$.

Now, the test is conducted to determine whether population mean of R^2 Aggressive stocks is significantly higher than the population mean of R^2 Defensive stocks. Here μ ($R^2_{\text{Aggressive stocks}}$) is the population mean of R^2 values of aggressive stocks and μ ($R^2_{\text{Defensive stocks}}$) is the population mean of R^2 values of defensive stocks.

Null hypothesis (H_0) : μ ($R^2_{\text{Aggressive stocks}}$) $\leq$ μ ($R^2_{\text{Defensive stocks}}$)

Alternate hypothesis (H_1) : μ ($R^2_{\text{Aggressive stocks}}$) > μ ($R^2_{\text{Defensive stocks}}$)

Group Statistics :

		N	Mean	Std. Deviation	Std. Error Mean
Co-efficient of Determination (R2)	> 1.00	12	.5117	.8695	.02510
	<= 1.00	18	.2889	.15297	.03605

beta_val <=1 (FILTER) = Selected

Table 4 : t- Test : Two independent samples test assuming Equal Variances

Equal variances assumed	Levene's Test for Equality of Variances								
	F	Sig.	T	df	Sig (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Co-efficient of Determination (R2)	5.736	.024	4.561	28	.000	.22278	.04884	.1227	.32283

beta_val <=1 (FILTER) = Selected

Table 4 displays results of the equal – variance test for comparing means of two independent populations, μ ($R^2_{\text{Aggressive stocks}}$) and μ ($R^2_{\text{Defensive stocks}}$). At 5% level of significance with 28 degrees of freedom, null hypothesis is rejected. Hence we conclude that μ ($R^2_{\text{Aggressive stocks}}$) is significantly higher than the μ ($R^2_{\text{Defensive stocks}}$).

Conclusion :

It becomes clear from the above outcome that, aggressive stocks not only carry big ?eta coefficients but also have significantly higher R^2 values when compared with counterparts. Since Coefficient of Determination statistic is the direct measure of explanatory power of SLR equation, we conclude that ?eta coefficients for aggressive stocks carry significantly higher degree of reliability over defensive stocks.

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