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Low Volatility Anomaly in India

(*An Empirical Analysis*)

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***Abstract* — Theory suggests a direct relationship between risk and return. But several empirical studies find that portfolio of low volatility stocks outperforms portfolio of high volatility stocks. This is termed as low risk anomaly. Our objective is to study whether low risk anomaly exists in India. Using data for the sample period running from January 1994 to June 2010 we find that high volatility quintile yields high return in India.**

Keywords- low volatility anomaly, capital asset pricing model, asset pricing anomaly

I. INTRODUCTION

A great deal of research has been done on asset pricing but still there is no consensus on the relationship between risk and return. Sharpe (1964), Lintner (1965) and Black (1972) developed the Capital Asset Pricing Model (CAPM) which postulates a linear relation between stock return and market risk factor. But further research demonstrated that the market factor alone cannot explain the cross sectional variation in asset returns. Accordingly several asset pricing anomalies have been identified. Prominent anomalies are book to market value (Stattman, 1980), size (Banz, 1981), price earnings ratio (Basu, 1983), debt equity ratio (Bhandari, 1988), return reversals (De Bondt and Thaler, 1985, 1987) and return momentum (Jegadeesh and Titman, 1993).

An anomaly which is well documented but not well exploited is low risk anomaly. It is perhaps the most puzzling anomaly as it challenges the traditional asset pricing theory that securities with high risk should be rewarded with higher expected return. Common sense as well as theory suggests a direct relationship between risk and return. Regardless of whether we define risk as volatility or beta, when stocks are sorted into risk quintiles, the low risk portfolio significantly outperforms the portfolio of high risk securities. This has been termed as low risk anomaly.

Black, Jensen and Scholes (1972) found negative alphas for high beta stocks and positive alphas for low beta securities. Further Fama and French (1992) demonstrated that high beta stocks and low beta stocks had similar average returns. Haugen and Heins (1975) introduced the concept of survival bias in their working paper covering the period 1926 to 1971 and found a negative relationship between risk and return in the U.S. Stock Market and the U.S. Bond Market. Ang, Hodick, Xing and Zhang (2006, 2009) found that stocks with high idiosyncratic volatility have abysmally low returns. Their results are robust to controlling for size, book to market, leverage, liquidity, volume, turnover, bid-ask spreads, coskewness, or dispersion in analysts' forecasts characteristics. The effect also persists in bull and bear markets,NBER recessions and expansions, volatile and stable periods, and is robust to different formation and holding periods. Blitz and Vliet (2007) analyzed the volatility anomaly in detail and demonstrated its robustness across regions and to controls for size, value, and momentum effects. They created volatility deciles and found that stocks with low volatility exhibited low beta while high beta is associated with high volatility stocks.

Baker, Bradley and Wurgler (2011) used data from January 1968 to December 2008 to divide stocks into five groups based on their five year trailing volatility and trailing beta. Their results demonstrate that low volatility and low beta stocks outperformed high volatility and high beta stocks in the U.S. markets. Baker and Haugen (2012) covered 21 developed countries and 12 emerging markets for the period running from 1990 to 2011. They demonstrate that low risk stocks outperform high risk stocks in all equity markets in the world. According to De Silva (2012) , an investor has to have a long horizon to benefit from low volatility anomaly. The study found that low volatility quintile generates average monthly return of 1% while high volatility portfolio yields 0.8% per month for the period 1968 to 2005. Further, the higher the level of volatility, the greater is the gap between the returns of low and high volatility stocks portfolios. Ramos and Hans (2013) suggest that investors should consider an allocation to strategies taking advantage of low-volatility anomaly. They found that equities with less than average volatility have delivered higher returns.

Several explanations have been offered for why low volatility anomaly exists. A possible behavioral explanation is that investors are irrational and demand high volatility stocks due to their preference for lotteries, the representativeness bias and the overconfidence bias. Buying a high volatility stock at low price is like a lottery ticket, i.e., there is a small chance of doubling or tripling the value and a much higher chance of declining in value. Overconfidence also leads to preference for high volatility stocks. Those who are optimistic about high volatility stocks become overconfident and sell such stocks for high prices. High demand for high volatility stocks increases their market price leading to lower returns. Another possible

explanation is that it is difficult for individuals to borrow and add leverage to their portfolio. Whenever investors want to bear more risk than the market, they can add leverage to their market portfolio. But if leverage is not available or is very expensive, then they can choose to go for high volatility stocks. Thus high volatility stocks become overpriced and yield low returns.

II. RESEARCH OBJECTIVE

In this paper our objective is to study whether low volatility anomaly prevails in Indian stock market. Thus our research question is:

- If investors buy high volatility securities, will they earn a high return?
- Conversely, if investors buy low volatility securities, will they earn low returns?

This paper is divided into six sections. The first section gives a background and brief review of literature. Second section gives research objectives. Third section describes data used and the fourth section explains the methodology adopted. Section five presents empirical results and the last section gives summary and conclusions.

III. DATA

Our sample includes the companies that form a part of BSE-500 index. The sample companies chosen account for roughly 90% of the total trading activity and market capitalization and hence the selected sample is a fairly good representative of market performance. We use monthly share prices, adjusted for stock dividends, stock splits and rights issues, for the sample period running from January 1994 to June 2010. Monthly share prices have been converted into monthly returns for further analysis. BSE-200 has been used to proxy market returns. We used Bloomberg database to extract the relevant data. Implicit yield on 91-days Treasury bills has been used as risk free return. Risk free rate has been obtained from Reserve Bank of India (RBI) website (www.rbi.org.in).

IV. METHODOLOGY

We use a simple and easily replicable methodology for our analysis.

Every month we divide our sample companies into five portfolios on the basis of trailing volatility. Standard deviation has been used as a measure of volatility. We compute volatility over the previous 60 months, i.e., 5 years. Our sample period is from January 1994 to June 2010. Therefore our portfolio analysis starts from January 1999. Using monthly stock returns from January 1994 to December 1998 we compute volatility for every stock. On the basis of volatility values (i.e. standard deviation) of every stock, we divide our sample stocks into quintiles. Portfolio 1 (P1) comprises of stocks with low volatility while portfolio 5 (P5) consists of high volatility stocks. We estimate equally weighted returns on these portfolios for the month of January in 1999. Portfolio rebalancing has been done every month and it has been assumed that no transaction costs arise in the process. We again sort our stocks, form portfolios and observe returns for the month of February 1999. For February 1999, we compute volatility estimates on the basis of previous 60 months, i.e., February 1994 to January 1999. The procedure continues till we reach the end of our study period. Thus, we construct five portfolios, hold them for a month and then rebalance the portfolios in the next month. We finally end up with 138 monthly return values for each of the quintile portfolios.

Next we check if Capital Asset Pricing Model (CAPM) is a good descriptor of returns on the volatility sorted portfolios. For this excess returns on each volatility portfolio are regressed on the market factor. We test CAPM using the excess return version of the market model:

$$(r_{pt} - r_{ft}) = \alpha + \beta\,(r_{mt} - r_{ft}) + e_t \quad \ldots\ldots\ldots\ldots\ldots (1)$$

where $(rpt - rft)$ is excess return on volatility sorted portfolio p, $(rmt - rft)$ is excess return on the market factor, and α, β are the estimated parameters. CAPM constraints α to be zero.

V. EMPIRICAL ANALYSIS AND RESULTS

Monthly rebalancing gives 138 monthly return observations for each quintile. Table 1 gives the average portfolio excess returns ($r_{pt} - r_{ft}$). One can clearly see that high volatility sorted portfolio, i.e., P5 gives high return (refer figure 1 and table 1).

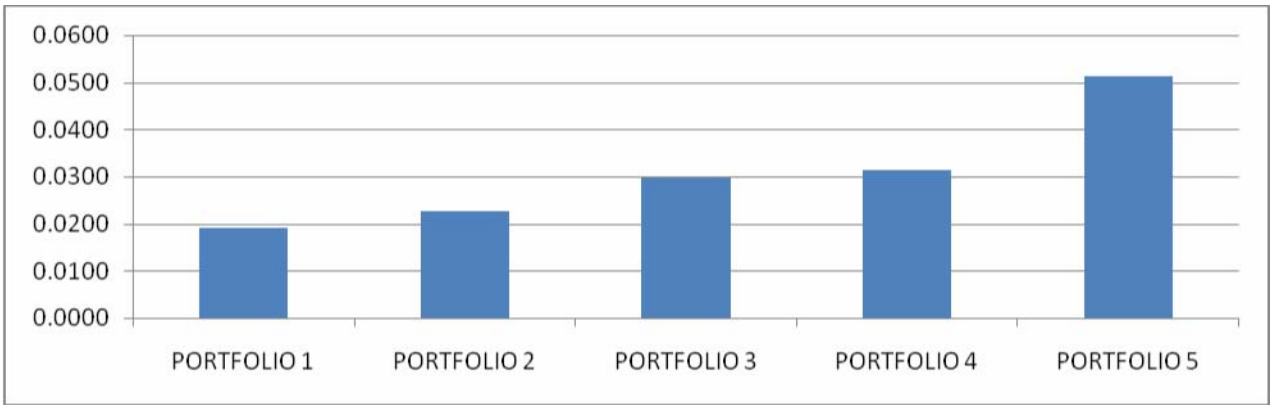

Figure 1: Mean Excess Return

Table 1: UNADJUSTED RETURNS

Portfolios have been formed every month by sorting the stocks on the basis of their trailing volatility. Portfolio 1(portfolio 5) consists of low (high) volatility stocks. The table gives mean portfolio excess returns and associated *t*-values.

	PORTFOLIO 1	PORTFOLIO 2	PORTFOLIO 3	PORTFOLIO 4	PORTFOLIO 5	RISK PREMIUM
MEAN RETURN	0.0191	0.0226	0.0296	0.0314	0.0512	0.0322
t-value	3.1613	2.7848	3.1873	2.9407	4.1075	2.3145

This is consistent with risk return trade off, i.e., higher risks are associated with high potential returns. The mean portfolio excess returns monotonically increase from 1.91% (Portfolio 1) to 5.12% (Portfolio 5). Portfolio returns are statistically significant at 5% level. The average risk premium of 3.22% per month is estimated as the difference between the return on portfolio 5 and portfolio 1. The estimated risk premium is statistically significantly positive for the sample period. Thus low volatility anomaly does not exist in Indian stock market.

Figure 2 shows the difference between return on high volatility and low volatility portfolio. There are some months where low volatility quintile yields higher returns but in most of the cases high volatility portfolio outperforms low volatility portfolio

Next we check if the returns on volatility sorted portfolios can be explained by the Capital Asset Pricing Model. To test CAPM we run the regression equation (1). Regression results are shown in Table 2.

The regression results are quite interesting. The coefficient of the market factor (i.e. β) monotonically increases as we move from low volatility portfolio to high volatility portfolio. This implies that portfolio 1 has low total volatility as well as low systematic volatility. Portfolio 5, on the other hand, is low total volatility and low systematic volatility portfolio. Thus high systematic volatility portfolio yields high return and low systematic volatility portfolio gives low returns. Further, CAPM constraints the intercept term to be zero. But the table clearly shows that the intercept is statistically significant at 5% level for all the portfolios and monotonically increases from portfolio1 to portfolio 5. Alpha is a measure of abnormal return. Thus high volatility portfolio yields high abnormal return. The significant alpha values imply that CAPM is not a good descriptor of asset returns. There may be some other risk factors that can capture the returns on volatility sorted portfolios.

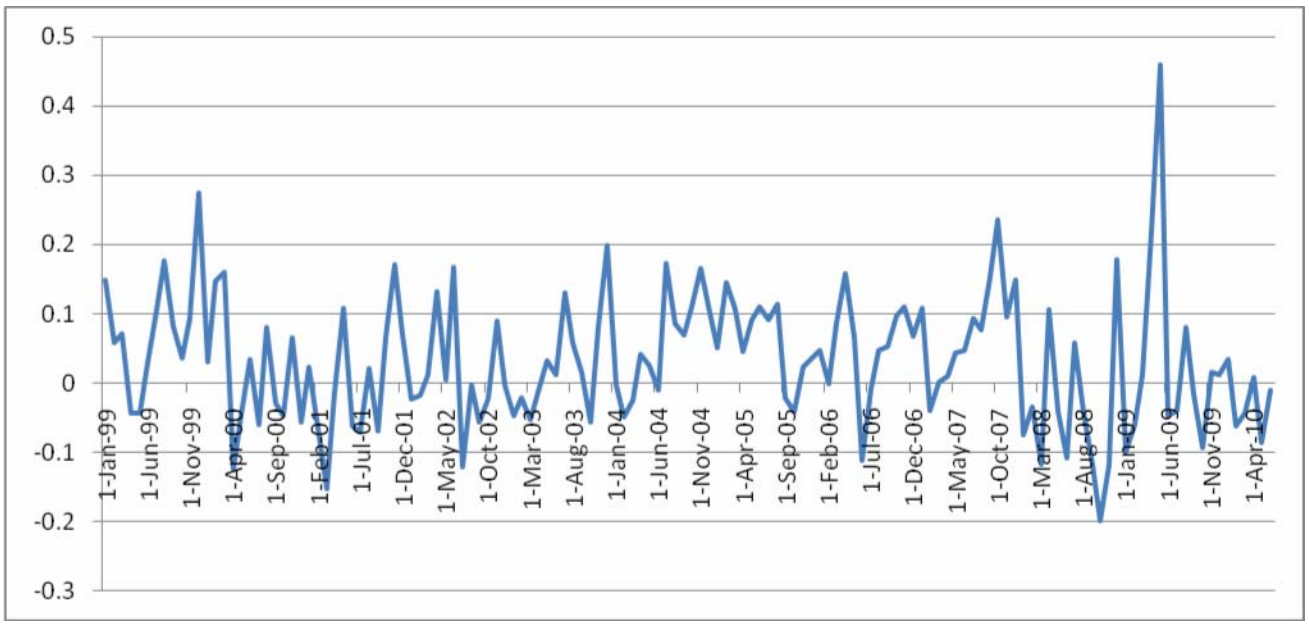

Figure 2: Return difference between high volatility and low volatility quintile

Table 2: CAPM Regression: $(r_{pt} - r_{ft}) = \alpha + \beta (r_{mt} - r_{ft}) + e_t$

The table gives results of CAPM model where excess returns on volatility sorted portfolios are regressed on the market factor.

	α	β	t_α	t_β	Adjusted R^2
PORTFOLIO 1	0.0104	0.6861	3.3808	19.8911	0.7437
PORTFOLIO 2	0.0108	0.9436	2.7541	21.5673	0.7734
PORTFOLIO 3	0.0161	1.0709	3.5279	20.9126	0.7624
PORTFOLIO 4	0.0163	1.1956	2.8681	18.7810	0.7212
PORTFOLIO 5	0.0335	1.4052	5.1082	19.1160	0.7282

VI. SUMMARY AND CONCLUSIONS

According to theory, investors realize high returns only by bearing high risk. However research gives contradictory results. Low volatility anomaly is well documented in existing finance literature. Regardless of whether we define risk as volatility or beta, low risk securities outperform high risk securities. This is called low risk anomaly.

Using data from January 1994 to June 2010 we attempt to study low volatility anomaly in India. We use standard deviation as a measure of volatility. Stocks are sorted into quintiles on the basis of trailing volatility. We rebalance portfolios every month and hold them for one month. Monthly returns on these volatility sorted quintiles are observed.

Our empirical analysis shows that high volatility quintile yields high return and vice versa. Average excess returns monotonically decrease as we move from high volatility portfolio to low volatility portfolio. Hence, low volatility anomaly does not exist in India and our results are consistent with finance theory. We further regress portfolio returns on excess market return and find that high volatility portfolios have high beta coefficient and high alpha values. Further , every portfolio has significant alpha value which is a measure of abnormal return. Abnormal returns increase monotonically from low volatility quintile to high volatility quintile.

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