

Risk Anomaly Exploration in Indian Stock Market

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Abstract— The traditional theories tell us that high returns are associated with high degree of risk. This paper shows that in certain conditions, a portfolio of low-risk stocks can outperform the portfolio of high-risk stocks, a phenomenon known as 'risk-based anomaly.' The phenomenon has comprehensively studied in the US and a few other countries in the last few years; but not in emerging market, particularly India. In light of the fact, the paper focuses on testing the risk anomaly in the Indian Equity market over an eleven-year period (July 2007 – December 2017) with continuous monthly iterations using the low volatility portfolio strategy. The research provides empirical evidence to the existence of risk anomaly in the Indian equity market where the low volatility portfolio returns absolutely outperformed the high volatility portfolios as well as the market returns as a whole. In addition to that, this paper also tries to explain the behavioural aspects of investors linked to the anomaly of risk in the market.

Index Terms— Risk Anomaly, Low volatility investing, Risk-Return Tradeoff, Volatility Effect, Indian Stock Market, Portfolio Investing, Anomaly exploration

1 INTRODUCTION

According to the 'Modern Portfolio Theory', the risk and the expected return are directly associated with each other. It means that higher the risk, the higher should be the expected return. In an efficient market, investors can anticipate realizing above average returns only by taking above-average risks. Generally, stocks with the high level of risk-adjusted yields higher returns than the average returns, while the safer stock does not. Thus, for every additional risk borne by the investors, a higher return is expected.

The question, then instantaneously approaches the mind is that is it possible to have portfolios, which provides returns greater than the market portfolio with lower risk. Is it possible to have a portfolio, which lies above the Capital market Line? This is the foundation behind "Risk Anomaly Exploration in Indian Stock Market."

The two approaches used to test and exploit the risk anomaly in global markets are the Low volatility (LV) portfolio Investing and Minimum variance (MV) portfolio Investing.

(a) Low Volatility investing – This approach organizes the observations in the order of their volatility and/or beta. The portfolio is formed by taking subset out of it, which contains the stocks with the lowest beta and/or volatility.

(b) Minimum Variance investing – The observations and/or estimates of correlations of individual stocks is used under this strategy. The formation of minimum variance portfolio uses optimal diversification to yield minimum risk.

These investment strategies have been noteworthy in the sense that they have been able to deliver higher absolute returns as well as risk-adjusted returns over time.

2 REVIEW OF LITERATURE

Over the world, in various markets, there have been numerous instances of low-volatility stocks producing the higher risk-adjusted returns. Fama & French, 1992 report flat relationship between beta and cross section of returns in U.S. markets for 1963-1990 period. (Haugen & Baker, 1991) and (Haugen & Baker, 1996) offer initial evidence on inverse relationship be-

tween risk and return.

Many other studies specific to U.S. markets including (Chan, Karceski, & Lakonishok, 1999), (Schawartz, 2000), (Jagannathan & Ma, 2003) report both higher returns and lower realized risks for the minimum variance portfolio (MVP) versus a capitalization-weighted benchmark (MWP).

Clarke et al. (Clarke, DeSilva, & Thorley, 2006) study reports that MV portfolios based on the 1,000 biggest U.S. stocks over the period of 1968 – 2005, attained a volatility reduction of about 25% while providing comparable or even greater average returns than the market portfolio. MV portfolios gave average 6.5% additional return above T-Bills with a volatility of 11.7% whereas the market index provided average additional return of 5.6% with a volatility of 15.4%.

Blitz & Vliet (Blitz & Vliet, 2007) study shows that the low volatility stocks have higher risk-adjusted returns in comparison to the FTSE World Development Index. The study additionally reports that high beta stocks have lesser returns while low beta stocks have more prominent returns than predicted by CAPM. They show outperformance associated with the low historical volatility stocks both in terms of higher Sharpe ratio and higher positive CAPM alpha.

Ang et.al. (2006, 2009) report confirms for an inverted relationship between idiosyncratic volatility as differentiating to systematic and total risk for a fleeting one-month volatility measure in U.S. and additionally in other worldwide markets. Fu (Fu, 2009) study reports that idiosyncratic volatilities are time varying and thus, their findings should not be used to imply the relation between idiosyncratic risk and expected return. The study additionally demonstrates a significant positive relationship between the evaluated conditional idiosyncratic volatilities and expected returns utilizing the exponential GARCH models. In another recent study by (Baker & Haugen, 2012) finds that from 1990 – 2011, low risk stocks have produced higher returns in every market worldwide – including emerging markets.

Rambhia (2012) examined the risk anomaly in Indian equity market using the low volatility portfolio strategy over an elev-

en-year period (from 2001 to 2011) with rolling monthly iterations. The study provides empirical evidence to the existence of risk anomaly in the Indian equity market where the low volatility portfolios as compared to the high-volatility portfolios produces not only higher absolute returns, but also higher risk-adjusted returns.

Most recently, Frazzini & Pedersen (2014) document that portfolios of high-beta assets have lower alphas and Sharpe ratios than portfolios of low-beta assets. The investigation additionally shows that the security market line isn't just flattering than predicted by the standard CAPM for US equities, yet for 18 out of 19 global equity markets, in Treasury markets, for corporate bonds and futures markets.

3 RESEARCH METHODOLOGY

3.1 Sampling

The sample for the study comprises of the fundamental stocks from NIFTY 500 index. The NIFTY 500 is the first broad-based benchmark of the Indian capital market. It symbolizes the top 500 companies of Indian equity market, representing about 95.2% of the free float market capitalization of the stocks listed on NSE as on March 31, 2017. The purpose behind selecting NIFTY 500 constituents stocks as a sample for the research is that in addition to the index representing almost the entire market; it also helps in avoiding the concerns associated with small and illiquid stocks directing the results.

3.2 Data Collection

Adjusted monthly closing prices of the stocks on NSE for the sample stocks for the period July 2007-December 2017 were attained from the Yahoo! Finance database, with the analysis period being August 2010 - December 2017.

Out of the total available list of 500 companies of NIFTY 500, following companies are excluded from the final sample:

- Companies for which data for 36 months historical data was not available and hence their volatility could not be calculated.
- Companies for which price and volume data for the test period is not available.
- Stocks replaced during the study period and not part of NIFTY 500 index now.

3.3 Portfolio Formation

The logarithmic returns were used to measure the stock's yield on a monthly basis on adjusted monthly average prices of the companies. It helps in avoiding the base effect problem. For example, an investment of Rs.100 that yields an arithmetic return of 10% followed by an arithmetic return of -10% results in a return value of Rs. 99; while an investment of Rs.100 that yields a logarithmic return of 10% followed by a logarithmic return of -10% results in Rs. 100. yield on a monthly basis on adjusted monthly average prices of the companies. It helps in avoiding the base effect problem.

In this paper, volatility was taken as the measure of risk, defined as the standard deviation of monthly returns over a period of 36 months. This period of 36 months was called the formation period of the portfolio.

The volatility in this period was used to select the stocks for the portfolio. The portfolios were constructed by arranging the eligible stocks in the ascending order of their volatility and then dividing them into 10 equal parts. Thus, Portfolio 1 (LV) contains the least volatile stocks and the Portfolio 10 (HV) contains the stocks with highest level of volatility. For each month, the performance of the portfolios were measured as the arithmetic average of returns of all the stocks in the portfolio for that month, implying that the portfolios are equal weighted portfolios.

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3.4 Frequency of transaction

The composition of the portfolios changes every month basis the volatility of stocks in previous 36 months. Hence, for the first portfolio of August 2010, the formation was over the 36-month period starting from July 2007 to July 2010. The volatility was calculated using the price movements in the concerned period. After calculating the volatility, the portfolios were formed in the way described above for each month. On a continuous basis, the returns of the portfolios for each month were calculated. Portfolios had been constructed till December 2017 using this iterative process, and in total there are 89 such iterations used for the analysis.

4 RESULT & ANALYSIS

As seen from Figure 1, the LV portfolio delivered absolute

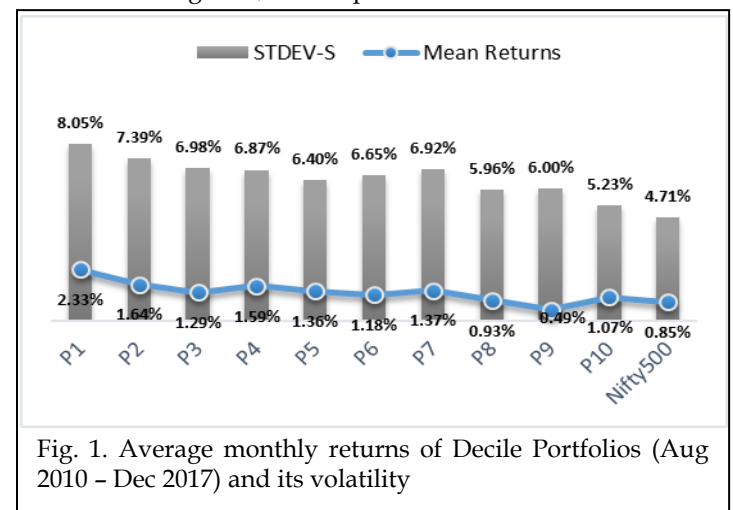


Fig. 1. Average monthly returns of Decile Portfolios (Aug 2010 - Dec 2017) and its volatility

average monthly returns of 2.33% in comparison to the HV portfolio that produced absolute average monthly returns of 1.07%. In the same period NIFTY 500 index, the broad market

index, gave the absolute average monthly returns of 0.85%. In addition, the Sharpe-ratio (Table 1) of P1 is highest with 0.226 compared to 0.075 of NIFTY 500 index and 0.108 of P10. In this case, the risk-free rate is taken as 6.19% on yearly basis which translates to a 0.50% monthly rate on continuous basis. Table-1 provides this information for all the ten portfolios along with the NIFTY 500 returns, volatility and the Sharpe ratio for the same.

Table 1

Average and Volatility of Monthly Returns over the testing period and Sharpe Ratios of the Portfolios

Portfolios/ Statistics	Average of Monthly Returns	Volatility of Monthly Returns	Sharpe Ratio
P1 (LV)	2.33%	8.05%	0.226
P2	1.64%	7.39%	0.155
P3	1.29%	6.98%	0.113
P4	1.59%	6.87%	0.158
P5	1.36%	6.40%	0.133
P6	1.18%	6.65%	0.102
P7	1.37%	6.92%	0.125
P8	0.93%	5.96%	0.071
P9	0.49%	6.00%	-0.002
P10 (HV)	1.07%	5.23%	0.108
NIFTY 500	0.85%	4.71%	0.075

Imagine investing Rs.100 in each of HV, LV and NIFTY 500 index portfolios and rebalancing them as per the criteria of the portfolios on the monthly basis. In such a case, the above chart (Figure 2) is obtained.

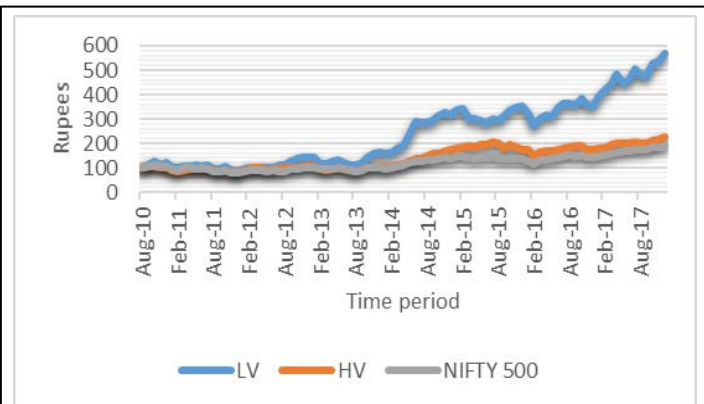


Fig. 2. Value of Rupees 100 Portfolio over 89 months i.e. August 2010 to December 2017.

One thing to be noted here is that the cost of rebalancing the portfolios is not included, which if considered will give similar chart but with lower values.

Over the long term, it is the LV portfolios, which give higher returns than the index and HV portfolios. This fact would ensure that LV investing can be used as a good long-term strategy in volatile markets to beat the HV portfolios and more so, the broad index.

Table 2

Comparison of LV portfolio, HV portfolio and NIFTY 500 index in terms of number of months with higher returns

Comparison of Returns	Months	Total Months
LV returns > HV Returns	53	89
LV returns < HV Returns	36	
LV returns > NIFTY 500 Returns	60	89
LV returns < NIFTY 500 Returns	29	
HV returns > NIFTY 500 Returns	52	89
HV returns < NIFTY 500 Returns	37	

Table 2 gives a comparison about the number of months for which LV portfolio gave higher returns than HV portfolio. It can be clearly seen that LV portfolio outperformed HV portfolio in 53 out of the 89 months of the testing period. In comparison to NIFTY 500 index returns, it is evitable that the LV portfolio outperformed the market index returns in 60 out of 89 months of testing period whereas the HV portfolios gave higher returns in 52 months out of the total of 89 months of the testing period.

5 IMPLEMENTATION ISSUES/CONSIDERATIONS

Before drawing conclusion from this study with respect to the efficacy of the LV strategy in Indian market for higher risk-adjusted returns, the following aspects of the study need to be taken into consideration.

5.1 Associated Costs

The calculation of the average monthly returns for the portfolios has not considered transaction cost, brokerage, security transaction tax and impact cost. While the relative results between the HV and LV portfolios will be the same, the actual returns for both will be lower than the ones observed.

5.2 Monthly Rebalancing (Trading month considered)

Many would question the feasibility of changing the portfolio combination every month especially in view of the high associated costs of doing this so frequently. Even though monthly rebalancing was considered in this study, the results of this study will not change when the frequency of rebalancing is reduced. In fact, monthly rebalancing was used for robustness of statistical tests by having more iterations. In practice, when funds are started based on this strategy, the rebalancing period can be longer than one month decided by the fund manager itself.

5.3 Back testing using quantitative analysis

The LV approach used in this paper is purely based on the historical data of adjusted monthly closing prices. One needs to take into considerations issues such as liquidity of the stocks in terms of volume and average turnover and other implementation issues by using real-time simulation before launching portfolios based on this strategy.

6 BEHAVIOURAL ASPECTS

Despite the fact that low volatility portfolios can generate higher absolute returns, in the real world, high-volatility stocks are still preferred. The behavioral aspects leading to the investment in high volatility stocks than the low volatility stocks in spite of the unexpected higher returns of low-volatility vis-à-vis high-volatility portfolios are as follow:

1. **Lottery Effect:** The observers argue that buying a volatile stock is similar to buying a lottery coupon where a small payment may produce a large amount of money although the probability of such event is very less. Therefore, the investors due to the 'irrational' preference for volatile stocks usually end up paying more than the true intrinsic value.
2. **Representativeness:** Investors have a tendency to overpay for the high volatility stocks because of the success of a handful of such stocks. The investors in light of the glamorous or well-publicized success often overlook the speculative nature of such stocks.
3. **Overconfidence:** The factor of investor's overconfident instinct to forecast the future and the extent of their differences in attitudes is greater for the high volatility stocks.
4. **Agency Issue:** The low volatility stocks are generally avoided by the asset managers because these stocks are the least considered ones by the brokers and others for research.
5. **Winners Curse:** The winner's curse is a tendency of investors to make the winning bid in an auction. The asymmetric information, emotions or any other number of factors regarding the item being auctioned, bidders tend to have a difficult time determining the item's intrinsic value. As an outcome, the biggest over-estimation of an item's value winds up winning the auction.

7 CONCLUSION

The findings of the study are consistent with global markets, it shows an evidence for existence of low risk anomaly. The low volatility portfolio outperforms both high volatility portfolio and market portfolio on absolute as well as risk-adjusted basis over a period of full market cycle. Thus, it can be considered a very good strategy when the markets do not display any specific direction and the volatility in general is relatively high. In such circumstances, it ensures minimum erosion of wealth while considerably safeguarding the upside returns of investors. The study provides empirical support to the usefulness of this strategy in the Indian context. This opens new doors for the Indian markets to the investment strategies that have been successfully tested and executed in developed markets.

To conclude, Risk anomaly is here to stay as long as irrational investors and traders functions in constrained environment. It offers an opportunity to earn superior returns to market weighted benchmark portfolio at a much lower risk over a period of full market cycle. This strategy is best suited to investors who are using equity as an asset class for building wealth to attain their long-term goals such as building for re-

tirement corpus without suffering extreme turmoil that equity markets are known to go through repeatedly. Further, this study also provides the empirical evidence that the behavior of emerging market like the Indian stock market is similar to mature US and other markets and that similar anomalies exist in these markets.

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