Portfolio Optimization, Risk Management and Professional Bias: An Empirical Analysis of The Indian Stock Market

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INTRODUCTION

BACKGROUND OF THE RESEARCH

With the changing aspirations of the middle-income group, there is a quiet revolution taking place in savings and investment patterns among Indian investors. The slow and steady flow of funds from the traditional investment avenues, such as fixed deposits, real estate, gold and precious metals to other classes of assets, such as mutual funds, stocks and bonds is becoming a reality. Physical assets such as land and gold, which used to be the dominant assets in an Indian family's portfolio, have seen a downtrend from 16.3 of the savings percent in FY 2012 to 10.6 percent in FY 2018. The household savings as a ratio of GDP has fallen from 34.6 percent in FY 2012 to 30.5 percent in FY 2018 (Mohanty, 2019). Yet, the investments in the mutual funds under the systematic investment schemes continue to grow from Rs. 67,190 in FY 2017-2018 to Rs. 1,00,084 in FY 2019-2020. The investors are willing to make investments rather than saving any amount above their consumption level. Thus, a holistic approach is needed to study possible factors which affect the expected returns from the investments, in terms of the movement of stock market returns, macroeconomic factors, optimal risk measures and the behavioural biases of the investment advisors suggesting such investments. In this context, the study seeks to examine the following objectives in the context of the Indian financial market:

- To examine the temporal periodicity of returns of the S&P BSE Sensex.

- To examine the sensitivity of returns of the S&P BSE Sensex to market movements.

- To investigate the impact of macroeconomic variables on the Indian stock market dynamics.

- To examine the relationship between risk measures and expected portfolio returns on a sample of the S&P BSE 500 Index companies.

- To explore and examine the impact of behavioural bias on the investment performance of the investment advisors.

- To suggest portfolio optimisation strategies that meet investor's return expectations keeping in view their risk appetite and prevailing market conditions.

THEORETICAL BACKGROUND

Traditional and modern financial portfolio theories have addressed the issues related to portfolio optimization and risk management. Traditional financial theories, such as the random walk theory focus on stock price movements. Modern portfolio theories such as the mean-variance framework, capital asset pricing theory and arbitrage pricing theory have paved the way for asset allocation in a portfolio by quantifying risk in the form of standard deviation (β). These models assume a constant β which may change due to the firm-specific decision making and macroeconomic factors (Chaudhary, 2019). The macroeconomic variables have positive as well as a negative impact on the performance of the company. As the macroeconomic factors impact the beta value of the portfolio, it is pertinent to understand the rationale behind the relationship of the macroeconomic variables. The Fisher effect, endogenous growth model and discounted dividend model, provide a possible explanation to the macroeconomic variable. The study further undertakes to understand not just the risk and volatility of the stock market movements but also the timing and frequency of these movements. The random walk theory, efficient market hypothesis and the Kondratiev wave give an overview of why the stock moves in a particular manner or has random patterns.

The management of active and passive portfolios can be supported by the extreme value theory (EVT). EVT deals with extreme deviations from the probability of stock market returns and is propounded by Andrew Lo (2004) synchronize the efficient market hypothesis with behavioural economics. Consequently, a theoretical explanation for biased investment decision-making can be found in these theories.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The extant literature underlines that the expected returns from the stock market depend on many factors. The primary first being its past price movements. These studies have used various econometric techniques, such as the variance ratio and GARCH model, to study the frequency of stock price movements. Evidence in favour and against the existence of random walk in the stock market, especially in the Indian context, has been found. As the complexity and the intertwining of the stock markets increase, the stock pattern is found to be more volatile and sensitive to minute changes in global events. Be it leading market indicators, such as yields from short-term government securities or

lagging indicators such as macroeconomic indicators, the factors affecting developing countries differ from those affecting the advanced ones. The reviewed literature highlights that specific region such as Asian stock market are more affected by inflation, exchange rate and crude oil prices, while advanced stock markets are more affected by U.S federal rates.

The traditional financial theories such as the mean-variance framework and even the modern portfolio theory, namely, the capital asset pricing model and arbitrage pricing theory suffer from shortcomings. These models do not support the time-varying changes that affect the portfolio composition and consequently, the risk measure calculations. Since the financial crisis, the investor's expectation is not just to estimate returns from the investment but to evaluate the extent of losses they could suffer. As put forth in the previous research, new risk measures such as the omega and new asset allocation techniques such as the Black-Litterman model have developed and empirically proved to be more efficient in active portfolio management.

The behaviour of the market participants has an impact on the stock price movements. Studies suggest that the unexplained anomalies of the stock market and irrational trends result from the market participants' behavioural biases. While most studies focus on individual investors, researchers have found that even professionals, such as mutual fund managers, hedge fund managers and institutional investors, suffer from these biases. Very few research has been conducted on investment professionals. Most studies have either compared professionals to laypersons or the individual investor. Despite being financially literate, trained, and experienced, cognitive biases tend to impact their decision-making significantly.

RESEARCH METHODOLOGY

The present research work aims to identify the extent to which various factors affect the Indian stock market. The literature review lays the foundation to the hypotheses developed and the consequent research methodology adopted for the study. The period taken for the study is from April 1996 to December 2017, and the S&P BSE Sensex has been selected as the representation of the Indian stock market. The time and frequency variant analysis employ various econometric techniques, such as variance ratio test, Season Trend Loess decomposition, and GARCH models, to understand the temporal periodicity and the sensitivity of the Indian stock market.

The break-even analysis and Autoregressive Distributive Lag model are applied to evaluate the impact of selected macroeconomic variables, i.e., index of industrial production, inflation, interest rate, exchange rate, and international crude oil prices, on stock prices.

A portfolio of categorically selected fifty companies from the S&P BSE 500 was formulated using the Black-Litterman model. The model's expected returns have been compared with the conditional value at risk and past historical returns from April 1, 2012, to August 31, 2018, to examine the most appropriate risk measure for active portfolio management in the Indian context. The t-statistics and the Sharpe ratio have been invoked to test the significance of the difference between the portfolio optimising models and risk measures.

Finally, the primary research design has been adapted from Seppälä, (2009), Horani and Haddad (2011) as well as Prosad (2014). A survey response of 253 SEBI Registered investment advisors was collected to study the effect of cognitive illusions (representative bias, overconfidence, disposition effect and anchoring) and behavioural cascade (herding behaviour) on investment performance. One-way ANOVA was invoked to examine the demographic differences between the respondents while the linear regression establishes the degree of impact of these behavioural biases on the advisor's financial performance.

TIME AND FREQUENCY VARIANT ANALYSIS OF THE INDIAN STOCK MARKET

The temporal periodicity of the Indian stock market pertains to the patterns and sensitivity analysis of the stock price movements from April 1996 through December 2017. The variance ratio proves that the Indian stock market movements do not follow a random pattern. An analysis of the movements by employing the Season Trend Loess (STL) decomposition method confirms the synchronicity between the stock prices and the business cycles (bull-runs). The detrended time series were further examined for the sensitivity of stock prices with past information. The ARMA-GARCH-M model with autoregressive term AR (1) shows that the Indian stock market is highly reactive. The study concludes that the Indian stock market is extremely volatile, and the impact of any event takes a long time to withdraw.The sensitive dynamics between the Indian

stock market and the market movements were analysed by employing a GARCH model. High volatility clustering from 2006-2009 could be identified, suggesting that imminent economic disorder such as the 2009 financial crisis can be avoided. The market movements have been measured using the yields of 91 days treasury-bills, which impact 12.65 percent on the stock market returns. The ARCH and GARCH values show a highly volatile and reactive stock market. Another observation made in the study was that after 2009 the ARCH effect reduced due to corrective changes in the prices, thus, averting the start of another financial crisis.

MACROECONOMIC ANALYSIS OF THE STOCK MARKET

Exploring the past two decades of macroeconomic performance of the Indian economy and its impact on the stock market, a change in the structure of the economy was anticipated. To keep up with the dynamic business environment, the economy, the relation between the macroeconomic indicators and the capital markets has evolved. One such significant breakpoint identified by applying the Augmented Dickey-Fuller t-Statistics was June 2009. Thus, a set of two series, one from April 1996 to June 2009 and the other from July 2009 to December 2017 was created to conduct the macroeconomic analysis of the Indian stock market.

The pre-breakpoint analysis highlights that in short-term, inflation, international crude oil prices, index of industrial production and interest rate had a significant impact on the stock market returns before June 2009. While the long-term influence of crude oil prices (negative) and the IIP (positive) existed prior to the financial crisis, the post-breakpoint analysis shows the changing dynamics between the macroeconomic and stock markets. From July 2009 to December 2017, the inflation and exchange rate were found to affect the short-term stock returns. The inelastic demand for oil consumption by the country's increasing population and disposable income make international crude oil prices a significant macroeconomic variable post-June 2009. Similarly, from July 2009, the interest rate is found to impact the stock prices significantly. The variance decomposition analysis highlights that the variation caused by the real effective exchange rate in the stock market returns has magnified from a mere 3.2 percent to 9.9 percent in the post-breakpoint period. In comparison to the pre-breakpoint VCM analysis, the contribution made

to variation in the stock prices by the interest rate also increased.

PORTFOLIO OPTIMISATION AND RISK MEASURES

The focus of the portfolio management has shifted from the modern portfolio theory to extreme value theory where equal attention is given to estimating the expected returns and potential losses. In the study, a comparison between the historical gains, conditional value at risk and expected returns from the Black-Litterman model has been made to understand the best risk measure applicable to the Indian stock market. The comparative analysis of the asset allocation models highlights that the BL model predicts the expected returns more closely to the actual company returns. Although there are differences between the expected returns from the BL model and historical returns, they are not statistically significant. However, complex risk measures such as the CVaR could not anticipate the extent of potential loss due to external forces as the business condition keeps changing daily, especially for the small capitalisation companies.

The performance of some companies has been far worse than anticipated by the CVaR. The results suggest that although the CVaR is considered the most sophisticated risk measure, the input from the investor's expectation and analysis gives a more realistic estimate of risk associated with the portfolio. This has been further tested using the Sharpe ratio for the BL model and weighted market capitalisation portfolio, where the same weights as per the market capital of the company have been assigned to the selected companies in both the models. The results prove that the BL model performed better even with the same weights than the market capitalisation-weighted portfolio. This emphasises that for active portfolio management, the investor inputs are important, and risk measures such as the omega and alpha are superior to the standard deviation.

BEHAVIOURAL BIAS AND INVESTMENT PERFORMANCE

Beyond the numbers, efficient portfolio management lies in financial professionals' skill set to diversify and nullify the associated risk. Yet, even the most trained investment professional cannot be free from behavioural bias. In the study, the impact of behavioural biases on the financial performance of the SEBI registered investment advisors has been

assessed. The demographic analysis reveals that gender only affects herding behaviour. Further, age is significant for overconfidence and anchoring bias. Mature investment advisors (46-55 years) were less confident than their younger counterparts. However, advisors in the age bracket of 36-45 years showed significant focalism, thus evidencing the anchoring effect.

Pearson's correlation coefficient between behavioural biases and investment performance shows a strong correlation between cognitive illusions. Further, the analysis highlights that overconfidence has the highest degree of correlation with investment performance amongst the cognitive illusions. The linear regression analysis highlights that except for representative bias, all behavioural biases have a significant positive effect on the investment advisors' investment decision-making and performance. Akin to the correlation analysis results, the regression analysis concludes that overconfidence has the most significant impact on the advisors' investment performance. The most seasoned financial advisors are overconfident about their ability to anticipate the returns from the stock market. The investment advisors find the information provided by their prospective colleagues to be an important source.

INFERENCES AND IMPLICATIONS

The study highlights that the returns from the Indian stock market are affected by multiple factors. Yet the losses due to those factors can have a devastating effect, in terms of bankruptcy for companies and even countries. The inferences drawn from the temporal periodicity and the macroeconomic analysis could provide insight into strengthening the Indian economy's internal structure. Macroeconomic variables and geopolitical and international factors, such as the global trade war, U.S. federal rate, exchange rate, and international crude oil prices, impact the Indian stock market. The implications of the study can be used for formulating better policies for the market participants. Policies to mitigate and avoid extreme risks borne by the listed company and the retail investors have to be drawn up.

The investment professionals and industry experts are the market movers, especially for a developing stock market like the Indian stock market. The empirical evidence highlights overconfidence as the most dominant bias affecting an investment advisor's decision-making. The implication of the research for academicians and researchers is in developing theories that match the current direction of the stock market and the theoretical explanation of these movements