Factor Models in the Indian Stock Market: A Review and Research Agenda

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Abstract—**This paper provides a review of factor models in the Indian Stock Market. It discusses findings from various studies on the Fama-French three-factor and five-factor models. Studies addressing the suitability and relevance of these models for explaining returns on stock prices and sectoral indices are considered. The paper concludes with an elaborate discussion on scope for future work on this topic.**

Index Terms—Factor models; three-factor model; five-factor model; factor investing; Indian Stock Market.

I. INTRODUCTION

Stock markets are the backbone of the modern financial world, where stocks of publicly listed companies are traded. Companies can raise capital needed for financing their growth plans and invest in research and innovation. Stock markets serve as market-based platforms where investors and firms interact to arrive at exchangeable prices for stocks of companies. In this role, the stock market serves as an evaluator of the health of the corporate sector and the economy at large.

Investors, big and small, invest in companies of their choice through the stock market to become shareholders of companies, and share the financial rewards (or losses) with the other owners. Thus, the stock market plays a key role in allocating capital to the most promising and profitable companies in the economy. The ups and downs of the overall economy, and the performance of individual companies gets reflected in the stock prices of companies listed on the stock market. This makes investing in the stock market to be a challenging task. Investors all over the world use different investing styles that suit their individual risk and return appetites.

Research on investment in the stock markets is also equally interesting. We focus on one such stream of research on investment in the stock market: factor investing. Factor investing techniques are based on factor models that help in assessing stock prices. We provide a quick review of the literature on factor models, focusing on the applicability of factor models in the Indian stock market. Lastly, we elaborate on scope for future work on this topic.

II. CAPM AND FACTOR MODELS

The first factor model is the Capital Asset Pricing Model (CAPM). CAPM was proposed in the 1960s by Sharpe [1] and Lintner [2]. CAPM uses the overall excess market return as the single factor that is used to explain the variation in stock returns. Subsequent researchers found the CAPM to be lacking in many ways, and this resulted in the next version of factor models. Fama and French [3][4] developed the three-factor model that added the size and the value factor to the CAPM's market factor to form the three-factor model. In the three-factor model, the market factor was the original CAPM factor of excess market return. The size factor was formed by taking the returns on a portfolio of stocks that was formed by dividing the stocks into small and large cap stocks. The size factor is the return on a portfolio of stocks that is long on small cap stocks and short on large cap stocks. Similarly, the value factor was formed by sorting the stocks on their book-to-market (BM) ratios. The value factor is the return on a portfolio of stocks that is long on high BM stocks and short on low BM stocks. Fama and French [3][4][5] divided the stocks into three BM groups and took the difference in the returns of the two extreme groups to be the value factor. The three-factor model was found to be better than the CAPM and the model soon found validatory support in markets around the world. Fama and French [5], Dimson, Nagel and Quigley [6], and Connor and Sehgal [7] were among the first to validate the three-factor model.

As it happened in case of the CAPM, problems started emerging for the three-factor model. Fama and French [8] documented some of these anomalies and also collected the findings of other researchers to further develop their model. After incorporating all the findings till date, Fama and French [9] proposed the five-factor model by adding two new factors to the three-factor model. The new factors were for profitability and investment. The profitability factor was obtained by sorting the stocks on their operating profits and it is the return on a portfolio of stocks that is long on firms with high operating profits and short on firms with low operating profits. The investment factor was obtained by sorting the stocks on the incremental investment for the past one year, and it is the return on the portfolio of firms that is long on firms that invest conservatively and short on firms that invest aggressively. Fama and French [9] found the five-factor model to be better than the three-factor model in its suitability to explain the returns in stocks. Chai, Faff and Gharghori [10] and Foye [11] provided evidence for validating the five-factor model in markets outside the US.

III. FACTOR MODELS IN THE INDIAN CONTEXT

As we can see that factor models have evolved from the single factor model of CAPM, then the three-factor model and the five-factor modes. Studies from the Indian stock market data suggested that these models are suitable for the Indian context.

Fama-French Three-Factor Model

The three-factor model has been found to be working in the Indian context by most researchers. Connor and Sehgal [7] found strong evidence in support of the three-factor model, where the three-factor model was able to significantly reduce the unexplained alphas in the CAPM regressions. They reported that the value factor gave positive returns for small stocks, but the relationship reversed for large cap stocks. Overall, the size factor helped in increasing the explanatory power of the model, and the value factor contributed to some extent in their data set covering stock prices of 364 companies in the time period from 1989 to 1999.

Deb [12] considered stocks in the Indian stock market for a period from 1996 to 2011 and found that value stocks provided better returns than growth stocks. Sehgal and Balakrishnan [13] found the three-factor model performed better than the CAPM model based on their study covering data in the Indian stock market for a period spanning the years 1996-2010. They considered the stocks in BSE-500 and factor construction method of Fama and French [4]. Dash and Singh [14] also worked with BSE-500 stocks for the period 1997 to 2004, but reported negative results for the value factor. Their coverage window of seven years might have given results for that small period of time, and hence are at odds with the findings of all other researchers.

Agarwalla, Jacob and Verma [15] is a comprehensive work on the three-factor model in the Indian context, where they create a library of the three factors like the Fama-French library [16]. The main difference from the Fama-French methodology is that they use different breakpoints for the size factor. They used the 90th percentile to sort out the large cap stocks. They found the value factor to be prominent, but the size factor was found to be weak in the Indian context. Much of the explanatory power in their model comes from the momentum factor of the Carhart model [17]. The momentum factor is an augmented factor that was first proposed by Jegadeesh and Titman [18]. It is constructed by sorting stocks on their immediate past 11 month returns, and it is the return on the portfolio of stocks that is long on stocks that have high returns (winners) and short on stocks that have low returns (losers). This study was later expanded by Agarwalla, Jacob and Verma [19] to include more data and support their factor library on the Internet.

Deb and Mishra [20] studied the three-factor model in the Indian context with data from 1995 to 2014, and focused on the role of the median portfolio. They found that the median portfolio gives zero factor premium, and can be considered as the benchmark portfolio. The median size portfolio gave zero value premium, and the median value portfolio gave zero size premium. Value premium was found to be positive for small cap stocks and negative for large cap stocks, and zero for the median portfolio. Similarly, the size premium was found to be positive for value stocks and negative for growth stocks, and zero for the median portfolio. Based on their study, they proposed mixed investment strategies as the factor returns varied on the level of the other factor.

An interesting study on the three-factor model was by Harshita and Yadav [21], where they studied whether the value premium was stable through the years. Their study considered the data from 1995 to 2015, and they found that the value premium was vanishing in their data after the sub-prime crisis period (2008-2015). They attribute this occurrence to increased efficiency and regulatory enhancements and investor awareness in the later period.

On the application side, Anwar and Kumar [22] tried to apply the three-factor model to explain the sectoral returns on the Nifty indices in the period 2009 to 2016. They found the three-factor model and a two-factor model with market and value as factors to be performing better than the CAPM. These results are in line with other findings in the literature that found strong value presence and a weak size effect. Another application study was done by Datta and Chakraborty [23] in which they considered industry portfolios from 2002 to 2016 as test portfolios to see if the three-factor model can be used to estimate the cost of equity for the industry. They found that the excess industry returns that were left unexplained in the CAPM were explained by the three-factor model. Further to this, they found little support for any parsimonious model with two factors, thus establishing the three-factor model as the main successor to the CAPM.

Fama-French Five-Factor Model

There have been very few studies on the five-factor model in the Indian context. Singh and Yadav [24] considered the five-factor model by adding the profitability and the investment factors to the three-factor model. They found that the improvement of the two new factors increased the explanatory power of the model only to a modest extent. The profitability factor was found to be significant, but the investment factor was found to be insignificant. Both the three-factor and the five-factor models were found to be better than the CAPM. Alam [25] considered stocks from the NSE-500 for a period spanning from 1995 to 2022 to study the relevance of the five-factor model in the Indian stock market. They found size and profitability factors to be significantly present, but the value and the investment factors were found to be weak. Moreover, the value and the profitability factors were found to be negatively correlated. Overall, the study found the five-factor model to be more successful than the three-factor model and the CAPM. In the end, it suggests development of context-specific model for the Indian stock market.

IV. RESEARCH AVENUES

Based on the discussion so far, we can see that the three-factor model is better than the CAPM. The study on the five-factor model found that the profitability factor had a negative correlation with the value factor, and the investment factor was found to be weak. These results need to be investigated in detail using data on more stocks. Agarwalla, Jacob and Verma [15][19] covered all BSE stocks, but their study is restricted to the three-factor model with the momentum factor. Alam [25] considered only the NSE-500 stocks, and not the other stocks on the NSE. A comprehensive study of the five-factor model in the Indian context with data covering all exchange listed stocks and spanning over several years is needed. The characteristics of the two new factors in the five-factor model need more investigation.

Looking at the changing nature of the factors over time, it becomes apparent that there is a need to study the time-varying nature of the factors. Such studies can include regressions run over specific time windows or certain rolling time periods. Many events act as shocks and result in a lasting change on the economy. Looking at the factor premia and their nature through the lens of such external shocks can be an interesting study to undertake. A few events that can qualify for external shock events include the dot-com crash, the subprime crisis, the GST rollout, and the COVID pandemic. Studies before and after these shock events may show interesting changes in factor premia.

At the methodological level, factor construction techniques can be relooked at. Apart from book-to-market, several other accounting ratios can be used to construct the value factor. Similarly, the profitability and the investment factors can be constructed in several ways. As in case of the size factor, most of the current studies are using the market capitalization of the firms to estimate the size factor. Computing the size factor with the free-float market capitalization as a measure for firm size may give a different flavor of the size and other factors.

There is much scope for adding new factors to the five-factor model. One may add factors for different sources of risk like the extent of promoter shareholding, affiliation to business groups, various liquidity risks and other risk factors. The stock market works within the reality of the overall economy, and hence adding any factors that capture the trends and movements in the economy will enhance model performance. Factors that capture macroeconomic states of the economy are relevant here. These may be augmented by factors for geopolitical risks and government policies. There is scope to develop country specific models that capture the peculiarities of the Indian economy. This can be extended to sectors to develop sectoral models that have sector specific factors.

This paper reviewed the study on factor models in the Indian Stock Market. The evolution of factor models from CAPM to the five-factor model was discussed. Lastly, it enlists scope for further work on the topic.

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