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Macro-Economic Determinants of Variability in Foreign Portfolio Investment and the Stock Prices in India: An Econometric Analysis

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Abstract:
The connection between the macro economies, foreign portfolio investment, Stock Market Performances (SMP), particularly in emerging economies, has sparked heated discussions. Using monthly data from July 1997 to June 2016, this article investigates the causal connections between SMP, foreign portfolio investment and selected Macroeconomicfactors (MEF) in India. For Econometric analysis, we employ factor analysis and appropriate stochastic processes for capturing volatility including the GARCH model. We discover a strong link between the Stock market indexes (SMI) and Foreign Portfolio Investment (FPI)and macroeconomic variables (MEV). Through factor analysis, we were able to identify three major factors: Inflation, Interest rate (IR), and exchange rate (ER). From the sequential development in the Stock Markets (SM) to the actual economy, there appears to be one-way causation. According to the findings, five co-integrating connections exist between Volatility in Stock Markets (VSM), Volatility in FPI and MEF. These results show that the variability inthe FPI is not just a result of behaviour in selected MEV, but also one of the major causesis the movements in Stock Prices (SP). Other related macroeconomic dimensions arising out of policy dynamics also play an important role in the variability of FPI and stock prices.
Keywords: Saving and Investment, Stock Indexes, Foreign Portfolio Investment, GARCH Model, Stochastic Process.

I. Introduction

Information defining the macro and microenvironments of economies is now easily available because of the advancement of information technology, particularly internet-based applications in global financial markets. This flood of information may have made capital markets more efficient since players are better positioned to access & act in response to changing macro environmental dynamics. Information access is simple & ubiquitous intoday's globally linked society. An efficient capital market, according to the efficient-market hypothesis (EMH) theory, is one in which stock values move fast when new information becomes available. Several studies have discovered a link between global economic developments and changes in MEF. These studies also show that SMI is very sensitive to changes in the economy's fundamentals, as well as changes in expectations about the future and that they may even serve as a proxy for widespread risk concerns.

A favourable macroeconomic climate boosts corporate profitability, propelling them to a point where they may access securities for long-term growth. In general, barometers for assessing the economy's success include the real GDP growth rate, Inflation rate, ER, fiscal

situation, debt position, and a variety of other indicators. These macroeconomic elements are the most important determinants of an economy's growth. SP should also be used as leading indications of future economic activity since they properly represent the underlying fundamentals. India's economy has been one of the world's bright spots (Economy Watch, 2008), as it is one of the world's fastest-growing and fourth-biggest economies in terms of purchasing power parity. The present development phase of the Indian economy is driven by the country's capital investment boom. Markets respond quickly to any news, including but not limited to increasing political tensions or even war rumours, changes in the regulatory environment (business). These are interpreted negatively for business sentiments by the business (investment) community, and variations in IR affect the economy's overall performance. Other factors that influence economic developments include population, worldwide market movements, money supply expansion, manufacturing sector growth, aggregate deposits of scheduled banks, etc. The stable environment has been aided by investment and strong savings rates, with the gross rate of savings as a percentage of GDP rising from 23.5 to 34.8 percent during the sample period.

The Indian economic situation has shifted away slightly from the trend as a result of recent global recessionary forces. As international hedge funds unwind their holdings in various capital markets as a result of these pressures, substantial changes in the capital markets have occurred throughout the world. The Indian market has also been hit hard, with currency appreciation due to increased foreign exchange inflows which resulted in the falling of exports, and as market, sentiments moving adversely for SP in the IT & textile industries. Currently, a huge number of global participants are closely monitoring the fluctuations of India's MSMEs. As a result, policymakers, traders, investors, & other stakeholders may find a grasp of MEV that impact Indian SMs positively at this point.

Against this background, the current research aims to investigate how various MEV impact FPI and the Indian SMs. The goal of this study is to look at how MEV such as Inflation, IR, exchange rates, & savings affect the variability of FPI, through the dynamics of movements S&P CNX Nifty & BSE Sensex. There are five sections to this study. While the introduction is placed in section I and, a review of the literature is given in Section II. The research techniques and econometric analysis are explained in Section III. The results & inferences generated from them are discussed in Section IV. Finally, Section V summarises the results and presents conclusions, & recommendations.

II. Review of Literature

Chen et al. (1986) were the first to use the macroeconomic parameters in the Arbitrage Pricing Theory (APT) as proxies for multivariable analysis. They looked at equity returns to a set of MEV and discovered that growth in industrial production, changes in the risk premium, yield curve twists, measures of unanticipated Inflation, and changes in expected Inflation during periods of volatile inflation are among the MEV that can significantly explain Stock Returns (SR).

Mukherjee & Naka (1995) investigated the dynamic connection between six MEF and Japanese SM returns, discovering that there was a cointegration relationship and a positive association between Japanese industrial production and SM returns.

The relationships between currency rates and SP are studied by Abdalla & Murinde (1997), Nath and Samanta (2004), & Narayan (2009). While Abdalla & Murine researched the cases of India, Korea, Pakistan, and the Philippines, finding unidirectional causality from ER to SP in all but the Philippines. Nathinvestigated the extent of integration between the foreign exchange and SMs in India during the liberalisation era, using Granger's causality test in the VAR framework and Gweke's Feedback Measures. Gweke's Feedback Measures, on the other hand, found a high level of integration between the two, as well as a bi-directional and contemporaneous causal link between them. The ER and SR have a complementary link, according to Narayan's research. Furthermore, appreciation of the Indian rupee decreases volatility more than depreciation does.

Increased savings & investment, technology transfer to emerging countries, stronger macroeconomic policies, & the development of financial markets all help to bring more Foreign Portfolio Investments (FPI)back to the home nation. As a result, several researchers discovered a positive relationship between economic growth and FPI. According to Ramey and Ramey (1994), it would be fascinating to establish a positive link between the stability of foreign capital flows and the growth of a country's economy. However, Levchenko & Mauro (2007) observed insignificant results because foreign investors may favour economic progress measured in terms of GDP per capita. Thapa & Poshakwale (2010), for example, concluded that GDP growth was significant but not for all nations because investors were more focused on the economic development expressed by GDP per capita, which was very significant, rather than the economic growth recorded by GDP growth rate. As a result, it is reasonable to conclude that foreign investors were more concerned with the country's economic progress than with its expansion. As a result, we believe that there is a link betweenGDP growth rate and Foreign Portfolio Investment Volatility (FPIV).

Muradoglu et al. (2000), Kandir (2008), & Mohammad et al. (2009) explored the impact of MEF in explaining SR, namely Inflation, industrial production index, IR, and foreign ER. The IR and foreign ER seemed to be important in explaining SR, whereas other factors were not. Pethe and Karnik (2000) investigated the association between SM behaviour & several MEF and discovered a weak causal link between IIP and the Nifty. For Singapore and Bangladesh, Maysami et al. (2004) and Ahmed and Imam (2007) respectively, have examined the link between the SM and several MEF. All MEF were shown to have substantialconnections with the Singapore SM and the SES All-S Equities Property Index. The Bangladesh SM, on the other hand, does not reflect macroeconomic effects on stock prices (SP) indexes. Agarwalla and Tuteja (2008) used a multivariate Granger causality test within an error correction framework to investigate the relationship between the share price index and economic growth in India. They discovered that the causality runs from economic growth proxied by industrial production to share price index and not the other way around, indicatingthat SMs in India are still demanding driven and industrious.

Gay (2008) took the help of the Box Jenkins ARIMA model to examine the relationship between SP and MEV in the cases of Brazil, Russia, India, & China, all of which are emerging economies, using oil prices and ER as explanatory variables, and found insignificantresults, implying market inefficiency.

Using the Granger causality test, Singh (2010) attempted to investigate the causative relationship between the SMI, the BSE Sensex, and MEF in the Indian economy. The IIP is the sole variable that has a bidirectional causal relationship with the BSE Sensex, according to him. WPI has a significant correlation withthe Sensex, however, it only has one-way causation with the BSE Sensex. In India, Basu & Chawla (2010) investigated the validity of core CAPM theory. It examines 10 portfolios comprising 50 equities that are part of the S&P CNX Nifty Index during 5 years from January1, 2003, to February 1, 2008, utilising weekly data to verify the model's efficiency &usefulness. The study uses regression analysis to discover that CAPM performs poorly and fails in the Indian setting.

The most important element in attracting FPIs is SMs. The country's SM is sometimes referred to be the economy's face, thus understanding the SM& FPIV is essential. Increasing SM profits entice international investors & increase their confidence in making more SM investments. In exchange, FPIs in the country enhance local SM liquidity. Returns in emerging SMs may be the most influential element that has been discovered to have a favourable impact on FPI, and capital flows are influenced by prior returns. Ulha (2006) discovered that the SMI reflected improving macroeconomic fundamentals while also providing a good return on investment. Higher domestic financial growth is associated with decreased portfolio volatility, according to Easterly, Islam, & Stiglitz (2001). It sets off a chain reaction; growth in the banking sector attracts foreign investment (FI), andFI attracts growth in the financial system. The positive relationship between Stock Returns (SR) and FPIis largely dependent on the stage of SM development. As a result, it seems that there is a strong link between SMF and the volatility of overseas PI.

Basu & Chawla (2012) investigated the APT model's validity for India. This article uses weekly data to evaluate 10 portfolios comprising 50 stocks that are part of the S&P CNX Nifty from January 1, 2003, to February 1, 2008, to test the model's efficiency and usefulness. The 91-day Treasury bill rate, which is a proxy for the risk-free IR, the 10-year government bond rate, the USD for ER, the Wholesale Price Index (WPI), & gold prices are among the macroeconomic indicators examined in the study. The factor analysis was used foraddressing the problem of multicollinearity among macroeconomic regressors, yielding two factors: Inflation & market indexes. The regression findings show that each of the 10 portfolios has accurate associations with moderate to high explanatory power. As a result, it finds that APT is a good match for India during the sample period selected.

Kumari (2011) analysed the link between SR & Inflation in India, concluding that there is no substantial association between SR & Inflation in India post-reform. It suggests that SR does not act as an Inflation hedge. Mishra & Singh (2011) investigated whether MEF drives the SM in India. They discovered that industrial production & FII have a favourable impact on SR volatility using OLS and semiparametric Generalized Additive Model (GAM).Furthermore, MEV accounts for greater Sensex volatility than S&P CNX Nifty volatility.

III. Methodology

1. Measurement of Variables

GDP growth rate has been used to measure economic growth. It is believed that income growth has a significant effect in the form of saving, which is a counter-cyclical reaction of capital flows. When the economy grows, employees expect higher wages, and if consumptionrises as a result, pro-cyclical capital flows can also rise as well. For emerging nations, financial flows have a pro-cyclical relationship with the host country's GDP growth rate. A rise in the GDP of the host nation is thought to lessen the volatility of foreign PI. Inflation hasan impact on the projected rate of return for investors. The Consumer Price Index (CPI) is used as a proxy for Inflation. The consumer price index (CPI) is used because it is acomprehensive metric for estimating changes in the prices of goods & services over time. Inflation pressures are thought to enhance the volatility of overseas PI. The natural log of the time series was used to determine the monthly Inflation rate.

ER uncertainty, according to Eun & Resnick (1988), has an impact on foreign portfolio flows. Furthermore, currency rate fluctuations decrease the benefits of international diversification. "Using E-Views, the yearly frequency of the real ER (RER) is transformed into monthly data. The formula for calculating the real ER is RER =NER (nominal ER) (CPI_{Ind}/CP_{USA}) and vice versa. IR differentials are an important factor in attracting foreign PI to the country. Investors prefer to invest in developing countries with high IRs over industrialized countries that have low IR, such as the United States & the United Kingdom. The information is gathered from WDI. $LN(RIR_t/RIR_{t-1})$ is the formula for calculating the monthly real IR (RIR). It's calculated as RIR = NIR –Inflation. Foreign direct investment is typically assumedto be permanent, which is induced as a macroeconomic component and responsible for Foreign Portfolio Investment Volatility (FPIV) and subsequently, might influence investor'schoice to invest. As a result, it is predicted that increasing FDI will lower foreign FPIV. Mody et al. (2001) utilized industrial output growth as a nation-specific factor, therefore, this factor has an impact on FPIV. Industrial production reflects total economic activity in the very short run& has an impact on SP. Increased industrial production, it is thought, decreases the volatility of foreign PI. To gauge industrial output growth, we utilized the industrial production index. FPIV is also influenced by SMI. The SM's performance draws internationalinvestors looking for a higher return than their home market. The SM is a predictor of future performance as well as investor expectations.

2.Econometric Model

The volatility framework is used for capturing the variability in FPI, and the BSE stock index is incorporated to analyze the link between FPIV and stock markets. Other macro variables modelled are duly explained above, and the appropriate volatility model is selected from various alternative specifications estimated by using standard model selection criteria.

The general perception is that the variations in the stock returns and stock indexes attract a considerable amount of flow of FPI through macroeconomic adjustment that can be reflected by fiscal and monetary actions.

The changes in the inflation rate, interest rate differentials, economic growth and other macro variables can engage in the recreation of Pulling portfolio capital. It is these dynamics, which is captured in the volatility modelling attempted in this exercise to demonstrate the link between the variability in foreign portfolio investmentinflows and movements in the stock returns.

By incorporating delayed conditional variance components in the equation, the GARCH concept was born. Bollerslev (1986) developed the concept in a study titled ―Generalized Autoregressive Conditional Heteroskedasticity. The GARCH (1,1) model is the most basic type of GARCH. The GARCH model equation is as follows:

$$FPI_t = \beta_0 + \beta_1 FPI_{t-1} \quad (1)$$

$$h_t^2 = \alpha + \beta\mu_{t-1}^2 + \gamma\sigma_{t-1}^2 \quad (2)$$

Where;
α= Constant
β= Coefficient

$\boldsymbol{\mu_{t-1}}$= Previous time period portfolio investment volatility
$\boldsymbol{\sigma_{t-1}}$ = Volatility of previous time period portfolio investment volatility

Eq. (1) is the mean equation that represents the link between variations in FPI& lagged Values of the same variable. The volatility connection is described, as a standard framework by Eq. (2), which is the variance equation of FPIV. The GARCH (1, 1) model may be extended to include more lag components. The order of GARCH equation is provided by; theGARCH (p,q) process, where ―p" is the order of GARCH term σ^2 and ―q‖ is the order of ARCH term μ^2, which is given by the following:

$$\sigma_t^2 = \alpha + \alpha_1\mu_{t-1}^2 + \ldots + \alpha_q\mu_{t-q}^2 + \beta_1\sigma_{t-1}^2 + \ldots + \beta_p\sigma_{t-p}^2 \quad (3)$$

In summation form, the above equation might be written as:

$$h_t = \alpha + \sum_{i=1}^{q} \alpha_i\mu_{t-i}^2 + \sum_{i=1}^{p} \beta_i\sigma_{t-i}^2 \quad (4)$$

σ_t^2=Conditional variance at time t.
μ_t=Disturbance term.

GARCH (1, 1), according to Hansen & Lunde (2001), gives the best predicting volatility outcomes. Because they suggest that GARCH (p, q) will be utilised if daily data from several

decades or hourly data from several years are used, GARCH (1, 1) is used here. Because monthly data is used in this analysis, GARCH (1, 1) is the strongest predictor for determining the volatility of foreign PI. Because it responds fast to shocks and innovations generated.

Our GARCH model's final equations are as follows:

$$\Delta \ln FPIv_t = \alpha_0 + \sum_{i=0} \Delta \ln(FPIv_{t-i}) + \mu_t \quad (5)$$

$$h_t = \gamma_0 + \sum_{i=1}^{p} \delta_i h_{t-1} + \sum_{j=1}^{q} \gamma_j \mu_{t-j}^2 + \sum_{k=1}^{r} d_1 \Delta \ln CPI_{t-k} + \sum_{l=1}^{s} d_2 \Delta \ln RER_{t-l} + \sum_{m=1}^{t} d_3 \Delta \ln RIR_{t-m} + \sum_{n=1}^{u} d_4 \Delta \ln FDI_{t-n} + \sum_{o=1}^{v} d_5 \Delta \ln GDPGR_{t-o} + \sum_{p=1}^{w} d_6 \Delta \ln SMI_{t-p} + \sum_{q=1}^{x} d_7 \Delta \ln IPG_{t-q} + \mu_t \quad (6)$$

IV. Result and Discussion

The data has been organized into tables. Table 1 displays descriptive data for our key variables, whereas Table 2 offers GARCH results, which illustrate how MEF affect FPIV while including BSE for SMI to capture the dynamics. Table 1 shows descriptive statistics for MEV.

Table 1: Descriptive Statistics of Variables

Variables	Mean	Median	Max	Min	SD
CPI	128.43	119.38	190.55	85.18	31.15
FDI	21.36	22.47	48.41	4.66	14.86
FPI	15.85	14.86	37.85	-18.92	10.22
GDPGR	8.04	7.95	12.33	4.21	3.98
IPG	6.85	6.42	19.42	-8.43	6.44
RER	58.11	57.56	95.43	48.80	12.39
RIR	6.44	6.18	9.21	-0.35	2.32
BSE	13456.31	13431.56	22518.20	2737.63	6133.45

The first equation in Table 2 is the GARCH mean equation, and the second equation is the GARCH variance equation (1, 1). The mean equation's intercept is negative and insignificant, indicating that no other factors are influencing current FPI flows. FPI (t-1) has a significant value in the mean equation, implying that current flows are anticipated by previous returns and flows. In India, the lagged return value of FPI is significant at the 1% level; this indicatesthat previous FPI flows anticipate future FPI patterns. For India, the coefficient of theresidual term is positive, implying that the random factor from the previous period anticipates present volatility. As a result, we may conclude that historical price behaviour and present FPIV have a significant positive association.

The GARCH model defines volatility persistence as the ability to anticipate future volatility patterns based on previous volatility. The estimated model suggests that the GARCH(t-1) coefficient is positive, indicating that prior volatility is boosting present FPIV. However, because the GARCH coefficients for India are less than one, there is no clustering effect. As a result, the volatility of the previous day will continue at a certain rate in the future. Consequently, it is reasonable to conclude that India's foreign portfolio investment is volatility persistent.

While examining the impact of MEF, in the case of India, Inflation has a significant negative impact on FPIV. Foreign investors are attracted to India's higher IR and therefore greater the inflation, the lesser would be the fluctuations in FPI. As a result, the real rate of returns on foreign portfolio investment (PI) is lowered, provided IR does not move upwards in tandem with inflation, but certainly, nominal returns might go up. Lesser variability in FPI will create stability of the flows but returns may be adversely affected, and foreign investors may be contemplating other investment options. As a result, it may be noted that Inflation has a key role to play in FPIV.

Table 2: GARCH Results of Macroeconomic Factors

	β	**SE**	**t-values**
C	-0.114	0.336	-0.339
FPI(t-1)	0.853***	0.155	5.503
Variance Equation			
C	0.164	0.022	7.454
$RESI(t-1)^2$	0.465**	0.202	2.301
GARCH(t-1)	0.683***	0.246	2.776
ΔCPI	-2.813**	1.232	-2.284
ΔFDI	-0.458*	0.263	-1.741
ΔGDPGR	-0.018	0.071	-0.254
ΔIPG	0.254	0.301	0.845
ΔRER	0.772	0.811	0.953
ΔRIR	0.135***	0.044	3.062
ΔBSE	0.221***	0.078	2.830

The impact of foreign direct investment on the volatility of India's FPI is negative. It indicates that as FDI increases, FPIV decreases. Based on these findings, FDI plays a significant role in not only attracting foreign portfolio investors to the nation but also offers a solid platform for them to pursue FDI. Furthermore, the importance of FDI for India demonstrates that the financial sector is developing, which will aid in understanding diverse real investment scenarios and options.

An increase in the IR raises FPIV because of a greater Inflation rate than the decreases in IR, which can eliminate the benefit of PI of foreigners, causing foreign investors to flee the country. The allure of a high IR for portfolio investors has diminished. As a result, the outcomes are consistent with Salahuddin & Islam (2008). It is imperative to note that rising share prices lead to better SR and lower FPIV. BSE indices are predicted to have a strong positive relationship with FPIV indicating that there exist a well-articulated long-term co- movement in the volatility of both BSE and FPIV.

V. Conclusion and Recommendations

Foreign portfolio investment is very volatile, and it often departs the nation owing to macroeconomic instability. It is inferred, that all MEF influence foreign PIV, based on the econometric results. Inflation, foreign direct investment, IR, and stock indexes all affect the volatility of foreign PI in India. India's Inflation rate invites more international investment and decreases the volatility of FPI. These findings are in line with those implying that India is managing and controlling Inflation in an efficient manner. As is the case in India, FDI reduces foreign PIV, implying that the Indian financial sector is improving. In India, economic growth has little effect on FPIV, which agrees with Thapa & Poshakwale (2010) who claim that portfolio investors are drawn to the country's economic progress as measured by per capita GDP and not on the mere growth of GDP. Interest rates in emerging nations are often higher than that of industrialized countries, and accordingly, it attracts international investors. The IR has a beneficial effect for India, demonstrating that high Inflation reduces the benefit of IR and further decreases volatility in FPI, contradicting Hymer (1976). The volatility of international PI is reduced when the domestic SM rises. The significance of domestic SMs demonstrates the literature's approval, whereas India's outcomes are consistent with ulha (2006). Based on these findings, it may be inferred that MEV influence foreignPIV, and give wider policy options for improving parameters of management of foreign PIV.

Policies aimed at enhancing SM structure, increasing the country’s infrastructure, strengthening institutions, and reducing macroeconomic instability will minimise volatility in foreign PI, attracting more foreign investments to the country. As a result, this research will assist regulators and policymakers in formulating policies aimed at stabilising the country's macroeconomic structure and performance. Future research may be undertaken to distinguish between pull & push variables to gain a better understanding of the differences in results caused by different macroeconomic conditions and economic policies. Alternative MEV can be used to offer more light on FPI fluctuations.

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