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An Empirical Analysis of Exchange Rate Volatility and Foreign Investment Inflows from the Post-Reform Period to 2020 in India

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Abstract

The paper empirically examined the impact and relationship between exchange rate volatility andforeign investment inflow in India. The parameters selected to examine the impact and relationship are exchange rate volatility and foreign investment inflow. The analysis was carried out using time series data of thirty years from the period of 1990 to 2020. For the methodology, we used the Augmented Dickey-Fuller (ADF) stationarity test for unit roots. Viewing the stationarity test, we got our data is stationary at first difference with intercept. After that, the Engel Granger cointegration test is conducted to check the relationship, and finally VAR model is constructed to know the significance of the coefficient of the model. Here we reject the null hypothesis and get that data is highly significant at 1%, 5% and 10% level of significance. The study finds that there is a short-run relationship between exchange rate volatility and foreign investment inflow but there is a high impact of exchange on capital inflow in India.

JEL Classification: C22; C33; F21; F23

Keywords: exchange rate, Volatility, Investment inflows and foreign trade.

1. Introduction

Prior to 1991, India maintained a closed capital account, which limited capital mobility through both explicit and implicit prohibitions and administrative controls. After a brief period of dual exchange rates in 1991–1992, it moved to a flexible exchange rate system in 1993 in response to the balance of payments crisis in 1991 and the implementation of market-oriented economic reforms. At the same time, attempts were made at both internal and external sector reform and financial liberalization (**Hilpinen,1995**). The first financial flows to be liberalized were direct investment flows, which were followed by portfolio equity flows in a year and bond flows in four. A flexible exchange rate regime would enable developing nations like India to reduce their reliance on foreign capital and their external vulnerability and fragility. This would allow for the adoption of domestic economic policies that would enable macroeconomic stabilization, which is defined as the state in which price stability and full employment coexist (**AHLQUIST, 2006**). To do this, ideas about capital inflows and exchange rate policy are developed, together with a perspective on financial globalization and exchange rate behaviour, with the goal of demonstrating how each contributes to the preservation of full employment (**Saborowski,2009**). Mainstream economists and international financial organizations, like the International Monetary Fund (IMF), typically view an exchange rate regime with a completely flexible exchange rate and a largely unrestricted capital market as being ideal for emerging nations (**International Monetary Fund, 2002**). In a regime like this, domestic financial assets (securities) are seen as ideal replacements for foreign securities, and as a result, parity between domestic and international interest rates defines effective monetary policy; that is, monetary expansion drives down domestic interest rates to levels below the international rate, causing capital flight and the ensuing devaluation of the exchange rate, which in turn drives up aggregate demand, which in turn drives up domestic interest rates until equilibrium is restored in the balance(**Cavoli, 2010**).

Over the past ten years, there has been a significant surge in global capital mobility. Cross-national patterns in capital flows show that official capital flows have virtually disappeared, with private capital flows currently dominating. Concurrently, an increase in portfolio capital has skewed the makeup of global capital flows in favour of short-term investments, putting certain nations at risk for increased volatility and abrupt withdrawals (**Wright, 2004**). Globalization has made it possible to pursue

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greater returns and diversify one's portfolio; it has also facilitated market-oriented reforms in many nations, which have opened up access to financial markets (**Asongu, 2012**). In terms of impact and seamless management, the makeup of flows matters a great deal. Because portfolio movements are irregular and short-term in nature, they are more difficult to intermediate and more volatile than direct investment flows. Because of this, they have a bigger effect on the local money supply and stock markets. They can also cause abrupt increases in liquidity in the financial markets, which can trigger booms in the real estate and consumption sectors (**Zhang, 2018**). Conversely, FDI has a longer time horizon. Because it is ingrained in the purchase of plant and equipment, it is less vulnerable to abrupt withdrawals and promotes capital productivity and economic expansion. Therefore, longer-term inflows of foreign capital are required to balance out short-term flows (**Gari, 2014**). For this reason, it's critical that FDI flows are encouraged to impart stability to capital inflows. Numerous economic factors, including interest rates, foreign currency reserves, exchange rates, domestic monetary conditions, and the financial system, are impacted by capital flows (**PIPPENGER, 1967**). Recent studies have revealed several often-seen effects of capital inflows, such as appreciation of real exchange rates, booms in the stock and real estate markets, reserve accumulation, monetary growth, and effects on output and consumption (**International Monetary Fund, 1988**). Nowadays, the majority of developing nations welcome foreign direct investment. Since 1991, India's FDI policy has become much more liberalized after previously being rather restricted. Alongside this liberalization, there have been changes in the origins, entry points, and sectoral mix of foreign direct investment. Inflows have also increased ("Growth and Instability in Foreign Direct Investment Inflows to India Since 1991," 2022).

2. Review of literature

According to Delisle Worrell (1980), the majority of theoretical approaches to exchange rate determination advance the idea that a fundamental imbalance should be avoided or eliminated by fixing the rate. A situation where predicted foreign exchange inflows cannot meet planned foreign spending over a particular planning horizon is a working description of a fundamental imbalance (**Lewis, 1979**). According to Shankari Banerjee (1991), the major focus of India's policy on direct foreign investment (DFI)—acquiring improved technology and know-how along with capital from greater reliance—is placed on technology imports and less on other activities associated with DFI. Thus, DFI has played a supplementary and subsidiary role since it has been used as a mechanism for technology transfer (**Banerjee, 1991**). In this work, Ross Garnaut (1998) examines the recent history of East Asian exchange rate regimes within the broader international exchange rate discourse. It investigates whether the crisis would have arisen under different exchange rate regimes or if the exchange rate regimes were a cause of the crisis. It focuses on the connection between the recovery process and the exchange rate regime (**Garnaut, 1998**). Sadhana Srivastava (2003) says India is widely regarded as an underperformer when it comes to attracting foreign direct investment (FDI), particularly in comparison with China and the rest of East Asia. However, there are major differences in the definition of FDI and the interpretation of FDI data. Comparison of the methods of measurement of FDI inflows to India with those prescribed by the International Monetary Fund and suggestions for improving the coverage of Indian FDI data (**Ranjan, 2007**). Khli Renu (2003) argues that the growth, liquidity, and volatility of the stock market as well as the domestic money supply are all significantly impacted by foreign capital inflows. However, because of the central bank's policy measures and obstacles to direct capital inflows into the banking system, the banking sector is still comparatively protected. Initial data for India indicates that there is a correlation between some stock market indices and portfolio flows, indicating that capital inflows have an impact on market prices (**SRIVASTAVA, 2013**). Kumar Nagesh (2005) says that nowadays, the majority of developing nations welcome foreign direct investment. Since 1991, India's FDI policy has become much more liberalized after previously being rather restricted. Alongside this liberalization, there have been changes in the origins, entry points, and sectoral mix of foreign direct investment. Inflows have also increased. MNEs are becoming more aware of India's locational advantages in knowledge-based industries, which has resulted in increased spending on software development and the establishment of international R&D centres in India to take advantage of these advantages. This essay examines India's foreign direct investment (FDI) experience since 1991 from a comparative East Asian standpoint (**Saikia, 2021**).

Ferrari-Filho Fernando and others (2008–2009) analyzed that, a proposal for an exchange rate regime that would enable emerging nations to reduce their reliance on foreign capital and external vulnerability and fragility, thereby enabling the adoption of domestic macroeconomic policies that would boost output and employment. Limiting capital flows and implementing a different currency rate regime can be important, but they are not adequate requirements in an open economy to ensure steady economic growth in developing nations (**Ferrari-Filho & De Paula, 2008**). According to Francis Smith (2010), preferences for and treatment of foreign direct investors become legally binding through free trade agreements and bilateral investment treaties. It is important for governments in developing countries to promote foreign direct investment (FDI) to understand that FDI definitions also safeguard the "rights" of the investors in the host country, which goes beyond

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the issue of accurately calculating the "real" financial and economic contribution of FDI inflows. The essay examines India's present FDI policy in light of this (Nishiyama & Yamaguchi, 2010). Mitra Rajarshi (2017) says most regression analysis results have demonstrated that there is not always a consistent association between currency depreciation and stock transactions with respect to economic theory (**Mitra, 2017**). According to P. C. Muhammed Rati and M. Ramachandran (2018), there has been a significant rise in cross-border capital flows, and a large chunk of it is being attracted by emerging economies. This is evident from the impulse response, which indicates that exchange rate volatility significantly increases in response to shocks in portfolio capital flows rather than shocks in foreign direct inflows (**Rafi & Ramachandran, 2018**).

3. Research Objective

From the above literature, we have drawn the following objectives of the study.

- To investigate the relationship between exchange rate volatility and foreign portfolio investment from the period 1991 to 2020 in India.

Research question

- What is the relationship between exchange rate volatility and foreign portfolio investment from the period of 1991 to 2020 in India?

Research Hypothesis

Hypothesis	Criteria for acceptance	Criteria for rejection
Relationship between exchange rate volatility and foreign portfolio investment	P is < or = 0.05	P is > 0.05

4. Data and Methodology of the Study

4.1 Sources of data

The empirical analysis was carried out using annual secondary time series data of approximately thirty years, based on purely available official data and the duration period of the data from 1990 to 2020. We have taken two variables: one is the annual average data of the exchange rate of the Indian rupee with respect to the US dollar (rupees per unit of $US), and the other is foreign investment inflows in terms of yearly million US dollars. The sources of data from RBI official statistics are https://rbi.org.in/Scripts/Statistics.aspx(Reserve Bank of India - Database, n.d.). Where, unit root test was checked, and we got that data is stationary at first difference with intercept. It means that the data is highly significant at the critical significance level. In this scenario, we used the Cointegration Test to establish the long-run relationship, but the data does not exhibit a long relationship; therefore, we ran the Vector Autoregressive Model (VAR) along with the Wald Test.

4.2 Cointegration

Engel Granger created the Cointegration Test in 1987 to examine whether a long-term link could be established between multiple time series. The test is a statistical technique used to test whether two or more non-stationary time series are integrated in the same order and have a long-term relationship. It indicates that when two or more non-stationary time series are integrated together, they are unable to eventually diverge from equilibrium. The test measures how sensitive two variables are to the same average variable over a given amount of time (**Wang et al., 2021**). There are two methods of cointegration:
Engel Granger Two-Step Method: It is a residual based on static regression, then testing the residuals for the presence of a unit root test using the Augmented Dickey-Fuller Test (ADF) or other test for stationarity in time series. I have used this method because it best suits my data (**Harris, 1992**).

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Johansen Cointegration Test: It is used to cointegrate relationships between several non-stationary time series data. It allows for more than one cointegrating relationship, subject to a large sample size (**Miller, 2019**).

4.3 Vector Autoregressive (VAR) Model.

The VAR Model is a workhouse multivariate time series model that relates current observations of a variable with past observations of itself and past observations of other variables in the system. VAR models differ from univariate autoregressive models because they allow feedback to occur between the variables in the model. For example, we could use a VAR model to show how exchange rate volatility is a function of capital flows and how capital flows are, in turn, a function of exchange rate volatility (**Hartwig, 2020**).

VAR modelling is a multi-step process, and a complete VAR analysis involves specifying and estimating a VAR model. The steps to estimate a VAR model are as follows: The Autocorrelation Function (ACF) and partial Autocorrelation Function (PACF) tests are used in time series analysis to determine the order of the Vector Autoregression (VAR) model, which specifies the number of lags to include in the model. Unit root tests are used in Vector Autoregression (VAR) models to determine whether the variables of interest are stationary or non-stationary. Inputting data into a Vector Autoregression (VAR) model involves organizing and preparing the data to be used in the model. Using inferences to check and revise the model (as needed), like forecasting and structural analysis (**Semmler & Mittnik, 2012**). A VAR model is made up of a system of equations that represent the relationships between multiple variables. When referring to VAR models, we often use special language to specify such things as how many endogenous variables are included in the model. Or how many autoregressive terms are in the model? For instance, if we have two endogenous variables and autoregressive terms, we say the model is a **bivariate VAR (2)** model. If we have three endogenous variables and four autoregressive terms, we say the model is a **trivariate VAR (4)** model. In general, a VAR model is composed of n-equations (representing n endogenous variables) and includes p-lags of the variables (**Huang et al., 2019**).

The equation for a Vector Autoregression (VAR) model is:

$$Yt=A1Yt-1+A2Yt-2+...+ApYt-p+\varepsilon t$$

Empirical results

Unit Root Test: Table 1. at level form

Variables	ADF Test			
	At level withNone	At level withintercept	At level withintercept & trend	Probabilityvalue
FII	-1.427256	-1.761022	-2.063777	0.1393 0.3896 0.5387
EXCH	3.294488	-2.142054	-2.584439	0.9994 0.2307 0.2895

Source: Author's estimation

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Table 2. at first difference

Variables	ADF Test			
	1st differencewith None	1st difference with intercept	1st difference withintercept& trend	withProbabilityValue
FII	-0.899792	-9.046226	-0.242667	0.3162 0.0000 0.9877
EXCH	-1.751596	-4.590147	-4.531145	0.0758 0.0011 0.0062

Source: Author's estimation

Table 3. at 2nd difference

Variables	ADF Test			
	2nd difference withNone	2nd differencewith intercept	2nd difference intercept &trend	withProbabilityValue
FII	-7.737924	-7.652591	-7.929826	0.0000 0.0000 0.0000
EXCH	-8.092122	-7.917954	-7.828713	0.0000 0.0000 0.0000

Source: Author's estimation

5. Discussion of result

Viewing the above stationary test, we got that our data is stationary at 1st difference with intercept. Here we reject the null hypothesis, now data is highly significant at all the critical levels such as 1%, 5% and 10% level of significance. The cointegration test suggests that, there is no cointegration (no long run relationship between the variables). If series are not cointegrated, it means they do not exhibit long run relationship, in this scenario we only go for short run model that is Vector Autoregressive (VAR) model. In this model we only have coefficient, standard error and t- statistic values of respective variables. Here in this case, we do not know the significance of standard error and t- statistics without probability value because probability value tells the statistical significance of the respective t-statistics. So, there is need to find out probability value. From the above required test, we got there is no need to check serial correlation because Durbin- Watson test exhibits close to 2 that is statistically significant for the model. The specification ofmodel in form of equation such as follows:

LNEXCH = C(1)*LNEXCH(-1) + C(2)*LNEXCH(-2) + C(3)*LNFII(-1) + C(4)*LNFII(-2) +C(5)
LNFII = C(6)*LNEXCH(-1) + C(7)*LNEXCH(-2) + C(8)*LNFII(-1) + C(9)*LNFII(-2) +C(10)

Now only one coefficient is significant and restare insignificant. So, to check significance we go for redundant test or Wald test. The model is significant because probability value is less than 1% level of significance. It means these coefficients having influence on dependent variable. We reject the null hypothesis and accept the alternative, which states that exchange rate

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volatility significantly affects foreign investment into India. Between 1992–1993 and 1997–1998 there was a spike in capital inflows into the nation as a result of modifications to the trade and investment policies and the exchange rate regime. But as India's economy is liberalizing, it's critical to record how these flows are affecting the financial system, the behavior of economic variables, and the consequences for economic policy.

After Liberalization Privatization Globalization (LPG) reform in 1991 India started opening the economy step by step as required in the respective sectors. In this purview, India has become a hub of FDI in the last decade which trended upward growth performance in the economy. Moreover, exchange rate flexibility is one of the factors which used to fluctuate, reason being impact on investment inflow but as per the study's result the impact of fluctuation of exchange rate on foreign portfolio investment is short run, it means there is a short run relationship between them. There are various other means which attract the foreign portfolio investment such as political stability, cheap labor and big market etc. but the impact may vary from the above result of the study. Therefore, exchange rate stability is very important towards a lucrative attraction of foreign investment inflows in India that would trend upward in the growth and development of Indian economy.

6. Conclusion

Our conclusion that greater fluctuations in exchange rates are linked to greater inflows of foreign investment suggests that investors' profit-seeking tendencies may be one explanation for this. Short-term changes in the financial markets will have an impact on investors' decisions because their primary concerns are capital appreciation and safety. Any nation may experience an unanticipated capital flight as a result of this. There could be a sharp increase in exchange rate volatility as a result of this shock. Furthermore, we discovered that speculative capital movements have a major impact on exchange rate volatility while foreign direct investment flows had little effect. Researchers generally agree that exchange rate volatility is expensive and detrimental to the home economy, with negative effects on businesses, investors, exporters, importers, and the public at large. Studies also reveal that developing countries bear a disproportionate share of these economic costs compared to developed ones. The sporadic exchange rate volatility that many emerging and developing nations have experienced in recent decades, however, was not predicted by the much-heralded exchange rate models, such as monetary models and portfolio balance models, which are based on macroeconomic fundamentals. The aforementioned developments have given rise to significant skepticism among academics and policymakers regarding the validity of these models. They have led to the suspicion that factors other than typical macroeconomic fundamentals—like speculative forces—are driving the foreign exchange market. As we known from above exchange rate volatility has strong relation with foreign investment inflows.

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