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Macroeconomic Uncertainty and Foreign Portfolio Investment Volatility: Evidence from Nigeria

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Abstract

This paper examined the effect of information asymmetries on macroeconomic volatility and FPI volatility in Nigeria using the AR(k)-EGARCH(p,q) model, and the nexus between macroeconomic uncertainty and FPI volatility in Nigeria using the LA-VAR Granger Causality test. Quarterly time series data were drawn from the Central Bank of Nigeria Statistical Bulletin, 2011 spanning through 1986Q1 to 2011Q4. The study found that all the included variables were highly volatile and responded asymmetrically to information shocks. The results also predict that a stable macroeconomic environment is necessary for steady FPI inflow and steady FPI inflow is also needed for some levels of macroeconomic stability. It was therefore recommended that insiders' activities in the Nigerian capital market be properly monitored and that policy makers should be sensitive to possible policy tradeoffs when the need arises between higher economic growth and rising price levels, and sustained economic growth and stable prices.

Keywords: Macroeconomic uncertainty, FPI Volatility, AR-EGARCH Model, and LA-VAR Model.

JEL Classification: C26, C58, E31, G14

1. Introduction

The role of macroeconomic policies in determining the flow of Foreign Portfolio Investment (FPI) in developing market economies has been a subject of serious debate among economists. FPI is being viewed as a source of foreign private capital to any economy. Foreign investors are always interested in the security of- and returns to-their investments. A highly volatile macroeconomic environment means that investors may not be able to predict correctly what the future holds for their investments and so become skeptical about increasing their investment outlays. They can more appropriately manage their investments (increase returns and/or lower risk) if they can use macroeconomic news releases as reliable indicators for where the economy is heading. On the other hand, policymakers are interested in increasing the quantity and quality of FPI flows to the economy due to the acclaimed benefits it carries. They can therefore better control the direction and magnitude of FPI inflow by adjusting macroeconomic variables if the relationship between FPI and key macroeconomic variables has a strong predictive power to stimulate the growth of the economy.

The relationship between FPI and key macroeconomic variables has been subjected to series of economic research, analysis and discussions. Historically, foreign private investment plays a prominent role in shaping a country's socio-economic development. Since no nation is an island of its own in terms of needed resources to stimulate investment, generate employment, foster economic growth, etc recourse must be made from time to time to woo foreign investment to bridge the dual gap of savings-investment requirement and foreign earnings and foreign exchange requirement.

According to Mailafia (2005), capital flows have contributed in filling the resource gap in countries where domestic savings are inadequate to finance investment. However, while emerging economies experience spectacular inflows, Nigeria has been historically afflicted with the worrisome problem of capital flight. Although the country potent a large market for both consumer and producer goods given the huge size of its population, many years of military rule, the recent Niger Delta crises, which culminated in the Federal Government Amnesty Programme, the current wave of terrorist activities, fraudulent behavior of citizens, the level of corruption in the country and the underdeveloped nature of the capital market and the existence of a dual economy have been faulted amongst other things for the low level of FPI inflow.

If all available information in a current period is taken into account, there would be a close relationship between macroeconomic variables and expected FPI flow. To this extent, FPI flow might react quickly to macroeconomic

information, which would be an indicator of real economic activities. Thus FPI volatility depends on volatility of expected future macroeconomic variables such as interest rate, inflation, exchange rate, market capitalization rate, GDP, etc. This means that if domestic interest rate rises over and above the world interest rate foreign capital flows in because expected returns to investment is higher compared to the rest of the world and the reverse would be the case for a decrease. However, a high and rising inflation rates means that the gains from investments are quickly eroded and investors react accordingly to protect their funds thus there is (massive) outflow of foreign capital (capital flight).

This study therefore examines the asymmetric impact of information on volatility of various macroeconomic variables which include interest rate, inflation rate, market capitalization rate, nominal exchange rate, GDP and FPI in Nigeria, and the nexus between macroeconomic uncertainty and FPI volatility in Nigeria for the period 1986Q1-2011Q4.

2. Literature Review

There has been a large body of empirical work done on macroeconomic volatility in relation to many variables in Nigeria and in other countries of the world. Mougani (2012) was concerned with the impact of international financial integration on economic activity and macroeconomic volatility in African countries. He showed that the impact of external capital flows on growth depend mainly on the initial conditions and policies implemented to stabilize foreign investment, increase domestic investment, productivity and trade, develop the domestic financial system, expand trade openness and other actions aimed at stimulating growth and reducing poverty. Mougani also showed that financial instability was particularly severe from the nineties and more pronounced in the case of portfolio investments than in foreign direct investments. It was further established that trends in official capital flows were less unstable than in private capital flows, and the volatility of capital flows observed in financially “open” and “closed” countries was accompanied by moderate macroeconomic instability. Anayochukwu (2012) investigated the impact of stock market returns on foreign portfolio investment in Nigerian using a multiple linear regression and Granger causality tests. Anayochukwu showed that foreign portfolio investment has a positive and significant impact on stock market returns while inflation rate was statistically not significant. He also found a unidirectional causality running from stock market returns to foreign portfolio investment in the economy. Enyim, Sylvester and Nweze (2013) examined the nexus between real exchange rate instability and foreign private investment in Nigeria and showed that a long-run relationship exists between CFPI and the explanatory variables; EXR, INF, INT and GDP.

Gabriel and Ugochukwu (2012) examined Stock Market volatility in Nigeria using the month end stock prices of four major companies from January 2005 to December, 2009. Using the ARCH model, the study showed the presence of volatility in all four stock prices. The study also showed that out of the four, two companies’ stock prices were predictable by past stock prices. Oseni and Nwosa (2011) employed AR (k)-EGARCH (p, q) model to examine the volatility in stock market and macroeconomic variables, and used LA-VAR Granger Causality test to analyze the nexus between stock market volatility and macroeconomic variables volatility in Nigeria for the periods 1986 to 2010 using time-series data. They showed that there exists a bi-directional causality between stock market volatility and real GDP volatility; and there is no causal relationship between stock market volatility and the volatility in interest rate and inflation rate. The study recommended that in order to reduce stock market volatility, government should take pro-active role in building a stable market through tapping the growing interest of the general public in the market by increasing supply of shares. Xiufang Wang (2010) investigated the time-series relationship between stock market volatility and macroeconomic variable volatility for China using exponential generalized autoregressive conditional heteroskedasticity (EGARCH) and lag-augmented VAR (LA-VAR) models and found evidence that there is a bilateral relationship between inflation and stock prices, while a unidirectional relationship exists between the interest rate and stock prices, with the direction from stock prices to the interest rate. However, a significant relationship between stock prices and real GDP was not found. Also, Chinzara (2011) studied macroeconomic uncertainty and stock market volatility for South Africa. He indicates that stock market volatility is significantly affected by macroeconomic uncertainty, that financial crises raise stock market volatility, and that volatilities in exchange rates and short-term interest rates are the most influential variables in affecting stock market volatility whereas volatilities in oil prices, gold prices and inflation play minor roles in affecting stock market volatility.

Lee (1992) was concerned with the causal relationships and dynamic interactions among asset returns, real economic activity, and inflation in the postwar US. Using a VAR approach he showed that stock returns helped

in explaining real economic activities, but elucidated little about the variability in inflation. Dropsy and Nazarian-Ibrahimi (1994) examined the impact of macroeconomic policies on stock returns from 1970 to 1990 using monthly data for 11 industrialized countries and concluded that macroeconomic policies that are predictable were unable to predict stock returns accurately. Park and Ratti (2000) examined the dynamic interdependencies among real economic activities, inflation, stock returns, and monetary policy, using a VAR model. While results from the monthly U.S. data for the period 1955 – 1998 showed that shocks due to contractionary monetary policy significantly explained movements in inflation and expected real stock returns, there was no feedback effect.

From the foregoing it is obvious that there is a dearth in the empirical literature of studies on the nexus between macroeconomic volatility and foreign portfolio investment volatility in Nigeria. In this study therefore, we focused on the causal relationships between macroeconomic variables uncertainty and FPI volatility in Nigeria. We also examine the asymmetric relationships between information set and FPI volatility and macroeconomic variables volatility for the periods spanning through 1986Q1 to 2011Q4.

3. Methodology

3.1 Data and Sources

Due to dearth in high frequency data for all of the variables of interest we used quarterly time series data drawn from the Central Bank of Nigeria Statistical Bulletin, 2011.

3.2 Model Specification

To achieve the objectives of study we employed a step by step estimation approach. First we estimated the AR-EGARCH models to examine the variables for volatility and second, we examined the nexus between macroeconomic uncertainty and FPI volatility in Nigeria. To examine the volatility of macroeconomic variables including FPI we adopt the autoregressive exponential generalized autoregressive heteroscedasticity (AR-EGARCH) model. The EGARCH model was developed by Nelson (1991) to capture information asymmetries and also ensure that the conditional variance is always positive. Assuming y_t follows an autoregressive process of order k the mean equation is specified as:

$$y_t = \beta_0 + \sum_{i=1}^{k} \beta_i y_{t-i} + \varepsilon_t \quad . \ . \ . \quad (3.1a)$$

The complete model will include the following variance equation:

$$log\sigma_t^2 = \varphi + \sum_{i=1}^{q} \alpha_i log\sigma_{t-i}^2 + \sum_{i=1}^{p} \beta_i \left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right| + \sum_{k=1}^{r} \gamma_k \left(\frac{\varepsilon_{t-k}}{\sigma_{t-k}}\right) \quad . \ . \ . \quad (3.1b)$$

The left-hand of equation 3.1b is the logarithm of the conditional variance. The logarithmic form of the EGARCH (p, q) model certifies the non-negativity of the conditional variance without the need to constrain the model's coefficients. The asymmetric effect of positive and negative shocks (information) is represented by the inclusion of the term $\varepsilon_{t-i}/\sigma_{t-i}$. If $\gamma_k > 0$ (< 0) volatility tends to rise (fall) when the lagged standardized shock, $\varepsilon_{t-i}/\sigma_{t-I}$ is positive (negative). The persistence of volatility to the conditional variance is given by $\sum_{i=1}^{q} \alpha_i$.

We may consider a special case EGARCH(1,1) model as follows:

$$log\sigma_t^2 = \varphi + \alpha log\sigma_{t-1}^2 + \beta \left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad . \ . \ . \quad (3.2)$$

For a positive shock, $\varepsilon_{t-1}/\sigma_{t-1} > 0$ eqn. (3.2) becomes:

$$log\sigma_t^2 = \varphi + \alpha log\sigma_{t-1}^2 + (\beta + \gamma) \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad . \ . \ . \quad (3.3)$$

and for negative shocks, $\varepsilon_{t-1}/\sigma_{t-1}<0$ it becomes:

$$log\sigma_t^2 = \varphi + \alpha log\sigma_{t-1}^2 + (\beta - \gamma)\frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad . \quad . \quad . \quad (3.4)$$

Therefore the presence of a leverage effect can be tested by the hypothesis $\gamma=0$. There is an asymmetric effect if $\gamma\neq0$. Furthermore, the parameter α governs the persistence of volatility shocks for the EGARCH (1, 1) model. The benefits in using the EGARCH model are: (i) Since the logarithm of volatility is used as the regressand, imposing nonnegative constraint on the parameters of variance dynamics is no longer necessary; (ii) the EGARCH model takes into consideration the asymmetric effect of volatility; and (iii) only the coefficients of the GARCH term determines the persistence of volatility shocks. Thus, this paper will provide empirical evidence regarding the asymmetric of volatility in foreign portfolio investment and macroeconomic variables in Nigeria.

To examine the link between macroeconomic uncertainty and FPI volatility we estimate a lag-augmented vector autoregressive (LA-VAR) model. This model was developed by Toda and Yamamoto (1995) and adopted by Oseni and Nwosa (2011) to examine the link between stock market volatility and macroeconomic variables volatility in Nigeria alongside the Exponential GARCH model. The basic strength of the model is its ability to test for causality among variables without paying attention to the stochastic process generating the time series. That is it could be applied even when the order of integration or cointegration is not known.

The model is specified as follows:

$$x_t = \alpha_0 + \alpha_1 t + \theta_1 x_{t-1} + \theta_2 x_{t-2} + \cdots + \theta_k x_{t-k} + \varepsilon_t \quad . \quad . \quad . \quad (3.5)$$

where: x_t is a vector of n-dimensional macroeconomic volatility variables and foreign portfolio investment; ε_t is an n-dimensional vector of random error terms with zero mean and variance covariance matrix $\sum\varepsilon$; t is time trend; k is the lag length which would be determined empirically; and α_0, α_1, θ_i are vectors of coefficients to be estimated.

The null hypothesis that the θth variable does not granger-cause the ith variable is tested using the formulation in eqn.(3.6) below.

$$\theta_{ij}(1) = \theta_{ij}(2) = \cdots = \theta_{ij}(k) = 0 \quad , \quad , \quad , \quad (3.6)$$

where $\theta_{ij}(h)$ is the (i, j)th element of the matrix $\theta_{ij}(h=1,2,3,...,k)$. we estimated a VAR model formulated at levels using the classical OLS regression to test the above hypothesis. The Toda and Yamomoto (1995) formulation established that the Wald statistic asymptotically follows a chi-square distribution with degrees of freedom equal to the number of excluded lagged variables without paying attention to the time series properties of stationarity and or cointegrating processes.

4. Results and Discussion

We used the Schwarz Bayesian Information Criterion (SBIC) to select the best model that fits our data. The models with the lower SBIC were selected. The AR(1)-EGARCH(1,1) model was selected for logFPI and logGDP. Whereas AR(2)-EGARCH(1,1) was selected for Market capitalization rate the model selected for interest rate, inflation rate and nominal exchange rate were AR(4)-EGARCH(3,1), AR(3)-EGARCH(3,6) and AR(3)-EGARCH(2,2) respectively. The results of the selected models are presented in table 1. The results revealed that all the included variables were highly volatile with the estimated EGARCH terms being 0.801, 0.563, 0.872, 0.6277(= - 0.7618 + 0.1279 + 0.2308 + 0.8011 + 0.3468 - 0.1171), 0.3844 (= 0.1583 + 0.2261) and 0.7541 for Log FPI, INT, MCR, INFL, NER and Log GDP respectively. The variables also responded asymmetrically to shocks. While the short-run responses of volatility to negative shocks were 1.472 (=1.098 – (-0.374), 0.196 (= - 1.726 - 0.729 + (0.753 – (- 0.578)) + (1.748 - 0.428)), -1.396 (= -0.487 – 0.909), -2.1685 (=1.0540 - (- 0.0098) – (0.3764 + 0.5987) – (1.5866 + 0.6706)), -1.7925(= -1.6431 - 0.5323 + 0.8269 - 0.4440) and 1.3633 (=0.8605 – (-0.5028)) for Log FPI, INT, MCR, INFL, NER and Log GDP respectively, the short term responses to positive shocks were 0.724(=1.098 - 0.374), 1.354(= -1.726 + 0.729 + 0.753 - 0.578 + 1.748 + 0.428), 0.422(= - 0.487 + 0.909), 0.3505(= 1.0540 - 0.0098 - 0.3764 + 0.5987 - 1.5866 + 0.6706), 0.1601(-1.6431 + 0.5323 + 0.8269 + 0.4440) and 0.3577(=0.8605 - 0.5028) for Log FPI, INT, MCR, INFL, NER and

Log GDP respectively. These differences were also statistically significant at the conventional 5% level as indicated by the probability values except for NER where the second leverage term only became significant at 7% level and INFL where the first leverage term was not statistically significant at all. These results imply that both the Nigerian macroeconomic environment and foreign portfolio investment inflows are highly volatile and the volatilities would persist into the distant future. Furthermore, the null hypotheses of no autocorrelation for the standardized residuals were accepted for all the variables at 1% levels. Also, the Lagrange Multiplier (LM) test statistic for ARCH in residuals showed that the null hypothesis of no further ARCH effect in the residuals is accepted for all variables at the 1% level. Therefore the results of the selected AR-EGARCH models explained our data very well. The volatilities from the above models were calculated and the descriptive statistics are presented in table 2. It could be observed from table 4.2 that the mean of INT volatility was fairly high compared to other variables while the standard deviation of inflation volatility was the highest. The table also showed that whereas the volatility of INT, NER and log GDP had negative skewness that of FPI, MCR and INFL had positive skewness. While the volatility of logFPI showed minimal kurtosis estimated to be 3.860 the macroeconomic variables volatility showed relatively high levels of kurtosis far exceeding 3 except for INFL that was 3.797. In addition, the residuals normality hypotheses were all rejected at the 1% level except for logFPI and INFL. All the Jarque-Bera statistics were significant at the 1% level with only that of INFL that was not significant even at higher levels (10%) of significance. The rejection of the normality hypotheses were all due to fat-tails (the large kurtosis observed). These results strongly showed that the Nigerian macroeconomic variables are much more impulsive than FPI. For the nexus between macroeconomic uncertainty and FPI volatility the LA-VAR Granger-causality test results are presented in table 3. The estimated results showed a bi-directional causality running from GDP to FPI and vice-versa at the 10 percent level but at the conventional 5 percent level there is only a unidirectional causality running from GDP to FPI. At the conventional 5% level the relationship between INFL volatility and LogFPI volatility, and that of MCR and LogFPI showed bi-directional causality respectively. However it was volatility in INFL and MCR that causes volatility in logFPI more. Whereas a unidirectional causality was observed running from volatility in LogFPI to NER there was no relationship found between volatility in INT and LogFPI. These positions are indicated by the statistically significant (not significant) Wald statistics (see table 4.3). This implies that FPI volatility is caused by macroeconomic uncertainty in Nigerian more that as FPI volatility causes macroeconomic uncertainty. Unstable prices and GDP growth, and undeveloped nature of the Nigerian capital market have not meant well for steady FPI inflows. These results therefore predict that a stable macroeconomic environment in Nigeria would be necessary for steady FPI inflow even as a steady FPI inflow is needed for some levels of macroeconomic stability. This is a serious issue for policy formulation.

5. Conclusion and Recommendations

This paper so has examined: (i) the asymmetries of information on macroeconomic variables volatility and FPI volatility; and (ii) the nexus between macroeconomic uncertainty and FPI volatility within the Nigerian context. The findings thereof revealed that macroeconomic volatility and FPI volatility are highly persistent and responded asymmetrically to information flow. Furthermore the study showed that foreign portfolio investment volatility is more responsive to GDP volatility, inflation rate volatility and market capitalization rate volatility than these variables respond to FPI volatility. While there was no relationship found between interest rate volatility and foreign portfolio investment volatility exchange rate volatility was highly responsive to FPI volatility. We therefore come to the conclusion that for the period of study both the Nigerian economy and FPI were highly volatile responding differently to positive and negative shocks. We also conclude that foreign investors do not lead growth but follow it. Furthermore, a calm and developed capital market, sustained economic growth, stable prices are necessary ingredients for steady FPI inflows. Finally, when FPI becomes less volatile the effect will not only be on further GDP growth, it will also result in further stable prices, contribute to capital market development through risk diversification and reduced volatility in the foreign exchange rate.

Since the Nigerian capital market volatility is highly responsive to information flows as expected is recommended that insiders' activities be properly monitored. Where some persons are able to trade base on insiders' information they will be able to beat the market therefore the market will no longer be efficient. The consequence would be capital flight. This is because foreign investors would lose confidence in the trading mechanism.

Also, since foreign investors do not lead growth but follow it as the study revealed, and since growth comes with levels of sacrifices in form of higher inflation rate policy tradeoff is inevitable between higher GDP growth and

higher inflation rate on the one hand and sustained GDP growth and stable prices on the other depending on the prevailing need.

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Table 1: AR-EGARCH Estimation results

	Log(FPI)	INT	MCR	INFL	NER	Log(GDP)
Model	AR(1) EGARCH(1,1)	AR(4)-EGARCH(3,1)	AR(2)-EGARCH(1,1)	AR(3)-EGARCH(3,6)	AR(3)-EGARCH(2,2)	AR(1)-EGARCH(1,1)
Mean Equation						
C	0.356(0.0000)	-0.023 (0.512)	100.656(0.000)	0.0568(0.0000)	1.3182(0.0000)	0.1553(0.0000)
AR(1)	0.974(0.000)	1.901 (0.000)	1.298 (0.000)	1.9602(0.0000)	1.9529(0.0000)	0.9943(0.0000)
AR(2)		-0.797 (0.000)	-0.558 (0.010)	-0.9497(0.0000)	-0.9936(0.0000)	
AR(3)		-0.295 (0.000)		-0.0145(0.0000)	0.0201(0.0000)	
AR(4)		0.188 (0.000)				
GARCH						
$(GARCH)^2$						
Variance Equation						
C	-1.653 (0.002)	-1.666 (0.000)	2.243 (0.000)	-0.4604(0.0000)	1.8445(0.0000)	-2.0882(0.0183)
$\lvert\varepsilon_{t-1}/\sigma^2_{t-1}\rvert$	1.098 (0.005)	-1.726 (0.000)	-0.487 (0.000)	1.0540(0.0000)	-1.6431(0.0000)	0.8605(0.0000)
$\varepsilon_{t-1}/\sigma^2_{t-1}$	-0.374 (0.039)	0.729 (0.000)	0.909 (0.000)	-0.0098(0.9373)	0.5323(0.0316)	-0.5028(0.0029)
$\lvert\varepsilon_{t-2}/\sigma^2_{t-2}\rvert$		0.753 (0.036)		-0.3764(0.0000)	0.8269(0.0000)	
$\varepsilon_{t-2}/\sigma^2_{t-2}$		-0.578 (0.009)		0.5987(0.0000)	0.4440(0.0637)	
$\lvert\varepsilon_{t-3}/\sigma^2_{t-3}\rvert$		1.748 (0.000)		-1.5866(0.0000)		
$\varepsilon_{t-3}/\sigma^2_{t-3}$		0.428 (0.002)		0.6706(0.0000)		
$\log\sigma^2_{t-1}$	0.801 (0.000)	0.563 (0.000)	0.872 (0.000)	-0.7618(0.0000)	0.1583(0.0000)	0.7541(0.0000)
$\log\sigma^2_{t-2}$				0.1279(0.0000)	0.2261(0.0000)	
$\log\sigma^2_{t-3}$				0.2308(0.0000)		
$\log\sigma^2_{t-4}$				0.8011(0.0000)		
$\log\sigma^2_{t-5}$				0.3468(0.0000)		
$\log\sigma^2_{t-6}$				-0.1171(0.0000)		
Diagnostic						
O^*R^2	4.961 (0.291)	7.141 (0.129)	0.039 (0.9998)	2.242(0.691)	0.824 (0.9353)	0.0474(0.9997)
LM	1.240 (0.300)	1.828 (0.130)	0.009 (0.9998)	0.544(0.704)	0.1969(0.9394	0.0113(0.9997)
SBIC	-0.799	1.430	17.327	1.839	5.6298	-2.9175

Note: p-values in parenthesis ( ); LM = ARCH Lagrange Multiplier Test; SBIC = Schwarz Bayesian Information Criterion

Source: Authors' computation

Table 2: Standardized Residual Normality Test

	FPI	INT	MCR	INFL	NER	GDP
Mean	-0.071	0.233	-0.152	-0.054	-0.2145	-0.2004
Std. Dev.	1.004	1.088	1.065	1.248	1.2037	0.9824
Skewness	0.085	-0.227	6.878	0.226	-1.0429	-0.5781
Kurtosis	3.860	5.160	59.678	3.797	21.0369	15.9699
Jarque-Bera	3.265	20.304	14456.96	3.532	1387.404	720.6068
P-value	0.195	0.0000	0.0000	0.171	0.0000	0.0000

Source: Authors' computation

Table 3: LA-VAR Granger Causality Test

Hypothesized relationship	Wald statistic	p-value	Decision
Log(GDP) volatility does not granger cause Log(FPI) Volatility	10.0926	0.0015	Reject
Log(FPI) volatility does not granger cause Log(GDP) Volatility	3.356803	0.0669	Do not reject
INFL volatility does not granger cause LOG(FPI) volatility	12.78226	0.0003	Reject
Log(FPI) volatility does not granger cause INFL Volatility	11.32521	0.0008	Reject
INT volatility does not granger cause LOG(FPI) volatility	0.00009	0.9924	Do not reject
Log(FPI) volatility does not granger cause INT Volatility	1.190068	0.1389	Do not reject
MCR volatility does not granger cause LOG(FPI) volatility	20.31184	0.0000	Reject
Log(FPI) volatility does not granger cause MCR Volatility	5.761287	0.0164	Reject
NER volatility does not granger cause LOG(FPI) volatility	0.120647	0.7283	Do not reject
Log(FPI) volatility does not granger cause NER Volatility	4.561006	0.0327	Reject

Source: Authors' computation