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The Mundell-Fleming Trilemma: Implications for the CBN and the financial markets

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ABSTRACT

In this paper using monthly data for the period 1981-2018, we adopted VAR methodology to show the nexus of foreign direct investment (FDI), exchange rate (EXR) and net exports in order to reveal the effect of one variable on the other. Granger causality test, impulse response functions as well as block wald/exogeneity were used to test the given hypothesis. The results show that FDI did not granger cause exchange rate (EXR), but exchange rate granger causes exchange rate volatility, but exchange rate does not granger cause net exports and that net exports granger causes FDI, the FDI was found to granger net exports. The policy implication for the CBN can be seen in the fact that under managed capital flows and managed exchange rate regime the bank might choose to influence growth in sectors of the economy such as the financial markets. It might not be certain that the CBN cannot thus operate an independent monetary policy as the core prescriptions of the Mundell-Fleming model have been breached.

Keywords: Foreign direct investment, VAR, CBN, Mundell-Fleming,

JEL: E66, E58, E61, E62, F62, F65, F68.N27.O16, O24

Introduction

1.1 Background of Study

The world's financial systems are becoming more integrated and this might have accounted for the domino effect of the subprime crises in the US that impacted on the entire world in 2007-2009, especially the impact on corporate firms. Aizenman, Chinn, and Ito (2016) also alluded to this when he opined that the nature of the system regulates finance in the world was amply demonstrated by the turmoil in emerging market currency and on financial markets such as bond following the remarks of Fed Chairman Bernanke's that focussed on U.S. monetary policy normalisation, which was referred to as "taper tantrum". The volumes of trade and capital flows

are growing and this has been the dominant nature of the world economy for some decades now. Countries have submitted to a greater openness to trade and capital flows leading to an increased interdependence among the various economies. The Mundell-Fleming's open economy trilemma makes predictions for policy challenges of the twenty-first century. The model predicts that in a economy that is open though small, market forces restrict the ability of a country to meet three policy objectives simultaneously; free capital mobility, stability of the exchange rate and monetary independence and this has implication for firms in all sectors of the economy.

Rieber (2017, p.1) observed that the Economist magazine (2016, p.1) labelled the monetary trilemma as one of six big ideas that explains how the world works. The trilemma proclaims that a country can accomplish only two out of the following policy goals- financial integration with the global capital market, stability of the exchange rate, and monetary independence. Nigeria's economy did undergo a vigorous attempt at liberalization from 1986 and that began her journey into globalization. The exchange rate regime changed from a fixed regime to a free float exchange rate regime and a Central Bank with increasing autonomy was focussed at harnessing the benefits of a free market system.

Feenstra and Taylor (2014, p. 247) opined that the monetary trilemma "is among the topmost ideas in international finance as well as macroeconomics". Indeed, the decades in the 1980s and even in the 1990s witnessed a generalised shift in policy stance towards openness for Nigeria. Concerning the free market, Nigeria has come a long way, but unfortunately, it is still a work in progress. The economy has been variously described as a mixed economy amongst other descriptions on its unique characteristics despite being the biggest economy in Africa it is seen as one of the most successful financial markets in the continent.

1.2 The Statement of Problem

The Nigeria economy has its distinct characteristics and there is need to determine if the economic reforms have been able to achieve the anticipated benefits of liberalization as to best reveal the effectual existence of the Mundell-Fleming trilemma in the operations within the economy and specifically in a growing private sector. There is simply no purely free float exchange rate, neither is there a free capital mobility in and out of the country as various policy measures adopted by the relevant players in the economy has limited the description of the economy as regards it being purely free market economy subject to the forces of demand and supply.

Scholars such as Osundina and Osundina (2014) have opined that Mundell–Fleming model applied to an economy that is small and open such as Nigeria, which are facing perfect capital mobility, in which the domestic interest rate is not influenced strongly by the prevalent interest rate in the world and that this shows a stark difference from the economy model that is not open. There is, therefore, a need to look at the Nigerian economy to determine if the trilemma's predictions can be proven. According to Aizenman (2019) noted that there are complex country specific tradeoffs amongst policy goals because of the scarcity of policy instruments. This can also validate how the effects of the various policy reforms have had a consolidated impact on the Nigerian economy, as expressed in a growing capital market.

1.3 Research Questions

There will be an attempt to answer the following research questions;

Is there a relationship between monetary authority's (exchange rate interventions) action and foreign direct investment, Net Exports?

What is the direction of impact (from the policy rate to FDI and then to exchange rate and net exports)?

Does the position of the impossible trinity hold for the economy of Nigerian, especially its implication for firms in the financial market? Sherazi and Ahmad (2014) did document an important link connecting capital flows and market volatility, though returns for stock exchange and exchange rates were found to be insignificant. The answer to these research questions will help us infer on that nexus as it will validate the CBN's stated position on capital mobility and exchange rate policy implementation within the Mundell-Fleming framework.

1.4 Research Objectives

The research objectives specified for this study are:

To ascertain if monetary policy authority's actions via the exchange rate movement have a causal impact on movements in the Net Exports and FDI.

To determine if a causal relationship runs from FDI to exchange rate and to Net exports.

1.5 Research hypothesis

H₁ The nexus the exchange rate and foreign direct investment is not significant.

H₂ Net export has no significant nexus with the exchange rate.

H₃ Foreign direct investment has no significant link with net exports.

The sole aim of Nigeria's effort at reforms and liberalization was to achieve a free market and unfettered inflow of investment into the Nigeria economy (mostly in the financial markets) and thus increase the level of economic growth and development. The anticipated benefit as predicted in the Mundell- Fleming Trilemma and this has a prominent impact on firms in the country, necessitating this study. There is the need to determine empirically the link between exchange rate and other factors such as FDI and other macroeconomic variables. The remaining part of the study is divided into; Review of Related Literature, Methodology, Discussion of Results and Findings as well as Conclusion and Recommendations.

2.0 Review of related literature

2.1 Conceptual framework

The work of Mundell and Fleming in the 1960s gave rise to the hypothesis of the monetary trilemma in the open economy and this has focussed on the policy trade-offs that is implied the different options available such as financial openness, monetary autonomy and exchange rate stability(Aizenman et al, 2016). The trilemma as it relates to international finance is focussed on

the fact that in many nations, the goal of those in charge of economic policy is to position the country's economy to be accommodative of free mobility of capital. Ensuring free capital mobility allows a country's population to make with profitable investment opportunities abroad as well as attracting foreign investors to the local economy.

The situation of countries today seems to reinforce rather than negate the policy trilemma envisaged by Mundell and Fleming. Aizenman (2010) had viewed the trilemma as stating that a country may simultaneously choose any two, but not all of the following three policy goals – monetary independence, stability of the exchange rate and financial integration. The Trilemma is illustrated below;

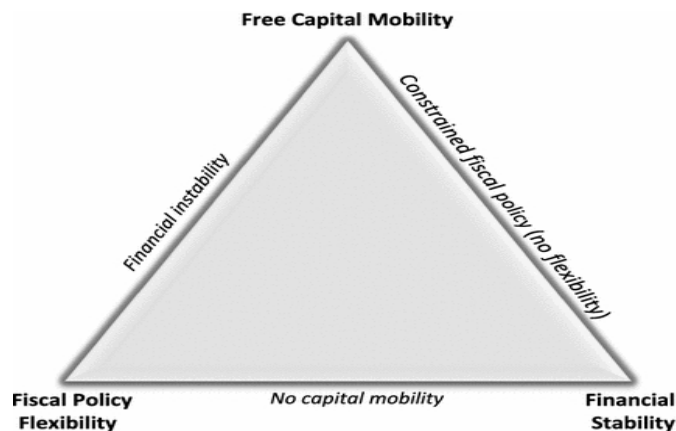


Figure 2- The Mundell-Fleming Trilemma

2.2 Theoretical Review

The prescription of the Mundell-Fleming is an improvement on the IS-LM that was based on a closed economy model. This model best describes the scenario in an open economy. The model describes the international flow of goods and services and the international flow of capital that can affect the country in profound ways (Manasseh, Asogwa, Agu & Aneke, 2014). The theoretical postulations of the model are useful tools to gauge the effect of economic policy based on the adopted exchange rate regimes in a country. Mankiw (2010) posits that the use by the monetary authority's use of monetary policy tools in order to stabilize economy can be done by the increase in money supply, which leads to a reduction in interest rates in a depressed economy, but reduction in money supply and interest rate rise when there is a spike in the inflation rate. There is also the impact of policy to exchange rate volatility.

There is an analysis of how international capital mobility alters the effects of macroeconomic policy. When there is an exchange rate regime that is free float, the position of the Mundell – Fleming model is that a fall in the rate of interest, it will cause capital outflow and the outflow of capital leads to a fall in exchange rate and a depreciation in exchange rate make net exports to increase (Asogwa, Joseph, Attamah, & Ugorji, 2016). There are any scholars that have viewed components of FCI, such as FDI, having a positive change on both the stock market and economic growth (Waheed, 2004; Baharumshah, Slesman, & Devadason, 2015 ; and Hoque, Yakob, & Kruse, 2017)

The improvement in the IS-LM model was the introduction of a balance of payment through the recognition of international capital flows. The Mundell-Fleming adopts perfect capital mobility as one of its assumptions or near-perfect capital mobility. There is a difference in policy response of the Chinese, US and European policy makers as regards the options they face and the trilemma. The Chinese adopt a firm control as regards the determination of the position of the remmumbi vis-a-vis other currencies and they have two policy options; restrict the ability of its citizens to transfer their wealth to other countries and restricting international capital flows.

But Cavallino and Sandri (2019) did opine that in the core of conventional open-economy models, movements in capital flows do not alter the power of monetary policy to ensure macro-economic stability. Yet this benevolent view of capital flows has had a growing push back from both academics and policymakers (Blanchard, Ostry, Ghosh, & Chamon (2016); IMF, 2012; Obstfeld, 2015; Rajan, 2015; Rey, 2015; 2016; Arregui, Elekdag, Gelos, Lafarguette, & Seneviratne (2018)). The scenario in Nigeria is not perfect capital mobility, but a semi or near-perfect capital mobility due to various policy measures adopted by the government. The CBN uses a plethora of interest rates in an attempt to stabilize capital flows. Table 1 below shows a typical central bank’s balance sheet, based on the Mundell–Fleming model view.

Table1. An illustrative balance sheet of the CBN (Mundell–Fleming)

Assets	Liabilities
(Net) Foreign reserves ↑ (c)	Currency in circulation ↓↑ (b/d)
Claims on domestic government ↓ (a)	Bank reserve balances

Adopted from Körner and Ehnts(2013)

The money supply in the economy in its broadest definition is represented by currency in circulation and bank reserves. The CBN can contract the money supply by selling government securities in open market operation and the effect of scarcity in loanable funds is an increase in the rate of interest that attracts increased FDI flows into Nigeria. The forgoing is the stated position in the Mundell-Fleming model.

There will be an increased demand for the Naira if there is a serious spike in the interest rate and this demand might be excessive in reality. Where the CBN to increase the money supply, it will be seen as an attempt to normalize the rate of exchange in the event of the increasing demand for naira by foreign currency due to the higher interest rate. The CBN might thus print more money to meet the demand by forex holders for naira and this impact on the local interest rate by reducing its value. The effects of the international capital flows seem to skew the macroeconomics variables out of the expectations of the Central Bank of Nigeria.

The reintroduction of flexible exchange rate by the CBN in 2016 was to stop the fall in the country’s foreign reserve as was observed during a pegged regime, There was however the allowance for the CBN’s intervention, periodically. The foregoing shows that though this was not a fixed exchange rate regime, it was neither a pure float but rather a managed or dirty float (Jhingan, 2009). There is no predetermined exchange rate path as well as the absence of a specific

exchange rate target (CBN, 2016). Though, Kalemli-Ozcan (2019) discovered empirically that domestic monetary policy transmission was imperfect, and that consequently, emerging markets' monetary policy actions designed to limit exchange rate volatility can be counterproductive. The managed float is specifically an exchange rate targeting policy option, quite different from the two corner solutions of a pure float exchange rate regime and an exchange rate that is fixed (Bofinger & Wollmershäuser, 2001).

Korner and Ehnts(2013) observed that a central bank operating fixed exchange rates and semi-open capital accounts therefore neither has discretionary control over the interest rate nor the money supply. What this elucidates is the real exposition of "Mundell's trilemma" that a particular country can only target at most only two of the three possible desirable attributes. These options are; open capital accounts, monetary policy that is independent and fixed exchange rates (Mundell 1960; Korner & Ehnts, 2013). Ramanathan and Teng (2013) looking at the Mundell-Fleming model in relations to emerging Asia economies management of capital mobility observed that monetary authorities and instructional regulators in emerging market economies in Asia actually practice a version of the model that is modified in that it uses a policy-driven and a market-driven approach that moves in tandem the amount of with amount of capital flow and that the monetary policy shocks has impact on the value of the exchange rate.

2.2 Empirical review

There has been some serious research on the various aspects of the trilemma and the macroeconomic impact of the feasible implementation as well as existence in practice of the model. Huh (1999) investigated how well the Australian macroeconomic data follows the postulations of the trilemma after the Breton woods system came to an end. The finding based on a VAR model indicates that most of the data is in line with the postulations of the trilemma.

Ncube et al, (2012) researched on the effect of unanticipated United States (US) bond yield increases, federal funds rate hike, and monetary impact on the economy of South Africa using VAR models. The results of the study show that where there is stimulus from the US, the consequences are; weak consumer price inflation, rand-dollar appreciation, real stock price revaluation, bond yield declines, and the decline in monetary aggregates and real interest rates in South Africa. Though the evidence on the trade channel was weak, yet other findings are consistent with postulations of the trilemma. Also positive unanticipated US medium-term bond yield shock might cause rand-dollar depreciation, but rising bond yields in line with the predictions of the portfolio balance exchange rate model as well as leading to significant real stock price declines, which is consistent with portfolio re-allocation driven by a change in US bonds yields. Also in the case of unanticipated US federal funds rate hike leads to significant increases in South African bond yields, rand-dollar depreciation and delayed consumer price inflation.

The empirical study by Osundina and Osundina (2014) examined the link between the rate of interest and decision's on investment in Nigeria adopting the multiple linear regression models. They adopted a modified Mundell – Fleming model where the interest rate was the dependent variable and other variables such as; Gross domestic product, investment level, Government spending, debt and exchange rate were independent variables. The findings from the study reveals there is no strong empirical evidence as regards a link between the rate of interest and

decisions on investment in Nigeria.

Asogwa et al.(2016) carried out a study driven by the constant deficit in the economy of Nigeria and consistent outflow of capital and the possibility of policy ineffectiveness based on the Mundell-Fleming model. The study was thus an attempt at determining the validity of this model when tested and to see if the model can be truly effective on the Nigerian economy. The study was carried out using data obtained from the CBN spanned from 1970 to 2012. A VAR model and the test for causality (Granger) were used. The findings of the study revealed through the impulse – response function using VAR shows that the postulations of the Mundell-Fleming theory holds and its policy postulations can be useful for the Nigerian economy. Yet the study further reveals that the causality test showed that net exports granger causes FDI without feedback, and no causality in other variables.

Hoque et al.(2017) re-examined the nexus between stock market development and economic growth. They focussed on investigating, the stabilizing effect of FDI inflows and exchange rate on the connection between stock market development and economic growth of Malaysia spanning the period 1981-2016. The study used Granger test, the approach adopted was ARDL (with bound testing). They also used a multivariate regression approach to examine both the extent and direction of the relationship among variables. The findings from the ARDL model indicates that, both in the short run and long run, stock market promotes the economic growth of Malaysia which is consistent with causality test(Granger). FDI inflows and exchange rate were found to have significant positive and negative that have moderating effects respectively, on the link connecting the stock market development to economic growth. They concluded that, when both foreign capital flows and exchange rate interact with each other, there is a joint positive effect on the relationship between stock market development and economic growth. There is the need to determine that nexus for the Nigerian economy.

Frenzel Baudisch (2018) noted that increases in inflows of FDI into a buoyant sector creates an increase in the real rate of exchange causes increased inflows of capital and subsequent increased pressure on the real exchange rate and this can cause an abrupt reversal of the capital (Botta, 2015). Based on the fact that macroeconomic instability of such boom-and-bust cycles is detrimental to economic growth, as is the appreciated real exchange rate. The study applied dynamic system generalized methods of moments (GMM) estimation techniques to empirically find different effects of foreign direct investment (FDI) inflows into the main economic sectors on the real exchange rate in a panel of 66 developing and developed economies. While the effect of FDI in the primary sector appears to be insignificant, FDI in the manufacturing and in the service sector lead to a real depreciation and a real appreciation respectively. The study found further evidence that suggests that financial sector development may help in dampening the real exchange rate movements based on FDI flows in the latter two sectors, as well as distinctly attenuates the real appreciation effect of other capital inflows. The conclusion was that, deep financial markets seem to have impact in reducing macroeconomic instability in consequence of capital inflows. Our current study takes a country specific approach, looking at the Nigeria application.

The empirical study Asmae and Ahmad (2019) examined empirically the effect of price as well as the volatility of the real rate of exchange on flows of FDI. The research focussed on two Mediterranean countries; Turkey and Morocco for the period that covered 1990-2017. The results

from Morocco for both the short and long runs, volatility of the real exchange rate was found to be negative and highly significant. The observed price volatility reflects a positive effect, and this shows that greater inflation rate volatility could lead to profitability increases that are rather marginal in terms of capital and this leads to an increase in investment. But for Turkey, the FDI inflows show greater causality, impacting on domestic price fluctuations. The exchange rate volatility indicated a positive but insignificant effect. In addition, they also saw that the potential market size rate, institution quality and infrastructure appear to be the key factors in attracting foreign capital in both countries. The evidence on trade openness reveals positive effect on FDI flows in Morocco. In conclusion it was observed that Turkey was able to take care of negative economic situations facing it via structural reforms it adopted and not necessarily sticking to the prescriptions of the trilemma.

Hsing (2019) utilized an extended the trilemma to Australian data. The research discovered that in the adoption of fiscal policy that is that expansionary does not affect output whereas monetary policy that is expansionary increases the level of output. The results further revealed that there was a higher real value of the stock price; a lower real oil price or a lower expected inflation rate would increase output. The findings were a validation of the postulations of the Mundell-Fleming model as regards the Australian economy

Tümtürk (2019) investigated the validity of the trilemma hypothesis and various trilemma policy configurations among the exchange rate stability, financial openness and monetary autonomy in Turkey covering the period of 1970-2014. The results show that trilemma constraint is valid, and the policy-makers in Turkey pursue a policy combination of capital mobility and monetary autonomy between 2001 and 2014. It was observed that the trilemma's prescriptions were violated by the CBRT and pursued policies to stabilize the exchange rates.

Qin(2019) using an interacted panel vector autoregression (PVAR) model, tested the validity of the trilemma, and potential remedial effects of capital control and macroprudential policies, for 45 key advanced and emerging economies during 1999-2016. The study found that exchange rate flexibility remain effective in lowering the domestic monetary response to US interest rate shocks, especially in emerging economies, and capital controls are not necessary. It further discovered that macroprudential policies also provide policy autonomy in advanced economies by reducing the domestic monetary sensitivity to U.S. shocks. This research supported the validity of the trilemma even in the time of financial globalization, and show that sensitivity to the global financial cycle can be handled with macroprudential policies. The Nigerian scenario has a managed capital flow due to macroprudential policies as well as a managed exchange rate a deviation from the corner solutions the original Mundell-flemming model policy prescription.

The study by Eregha (2020) adopted the Panel Correction for Serial Correlation (Arrellano) and heteroscedasticity for five of the WAMZ countries, which were selected based on data availability for the period 1980-2014. The results reveal the presence of uncertainty in the exchange rate, which hindered FDI flow, but that inflation expectation had a fleeting effect on FDI flow to WAMZ. The research concluded that an exchange rate policy regime that is fixed did hinder FDI flow in the zone, while policy regime that is different from corner solutions (managed exchange rate regime) had a strongly positive effect in facilitating FDI flow, in occurrences current account imbalances and changes in the reserves of foreign exchange as the channels, because many of these countries use their reserves from the restricted export earnings to intervene in the foreign

exchange market to maintain the official rate. The conclusions of this study makes bare the pivotal role of the monetary authority and what that portends for stabilizing the financial markets as regards guided role as regards FDI flows and the stabilization of the exchange rate. This study is epochal in this study, though our consideration is on one single country, specifically, Nigeria and the inferred implication on the financial markets.

This current study is an attempt at establishing if this modified approach has nexus in order to infer on its impact on the financial markets in Nigeria.

3.0 Methodology

3.1 Study design

The research adopts an ex post facto research design as the data is utilized after the occurrence of the event. The data spanned the period the period 1981 to 2018.

3.2 Population of study

Annual time series data for the FDI, net exports, interest rate and the annual average exchange rate for the study period covered from 1981 to 2018, which is a period of 36 years. The study period covered from 1981 to 2018, which is a period of 36 years. The times series data that formed the population of study was for net exports, nominal interest rate, foreign direct investment and the exchange rate.

3.3 Sample

The sample taken was secondary data, sourced after the event must have occurred, hence the researcher cannot influence its occurrence.

3.4 Source of data

Data was sourced from the CBN statistical bulletins and the National Bureau of Statistics as well as the IMF data base.

3.5 Model development and variable description

The vector autoregressive (VAR) methodology was used; to measure the effect and response to the impulse response function of the rate of exchange on the price of stocks as adopted by Nwani (2011). Vector autoregressive (VAR) captures the movement and interconnectedness in a model, adopted to show multiple time series interconnectedness and their evolution as a given model. The variables are all treated using each of them with its lags in an equation as well as lags of other variables considered in the investigation as expressed in the given model.

3.5.1 Exchange Rates (EXR)

It refers to the exchange rate variable. Exchange rate is a key determinant of international finance as the world economies are globalised ones. There are a number of factor which affect the exchange rate viz. government policy, competitive advantages, market size, international trade,

domestic financial market, rate of inflation, interest rate etc. Annual rates of the variable have been taken from the year 1982-2018.

3.5.2 Net exports

The variable referred to as net-exports is the difference between exports and imports of a country within a specified relevant period. If the price level is high in a given country, it will cause an increase in the relative price of domestic exports to other countries, but it will decrease the relative price of foreign imports from other countries. There will thus be a fall in exports, while the value of imports will increase and thus a fall in net exports. The impact of FDI growth can be seen in an expansion of the capital market.

3.5.3 Foreign direct investment

The function of FDI as a tool that genders growth in developing countries is well entrenched in finance literature (Falki, 2009). The impact of FDI as positive stimulus to growth has also been well documented (Younus, Sohail, & Azeem, 2014. Melnyk, Kubatko, & Pysarenko (2014) saw the transfer of technology and capital from other developed and developing countries as FDI.

3.6 Model Specification

The Vector Autoregressive model is specified as;

$$\Delta NX_t = \alpha_0 + \sum_{i=1}^n \alpha_{1i} \Delta NX_{t-i} + \sum_{i=0}^n \alpha_{2i} \Delta IR_{t-i} + \sum_{i=0}^n \alpha_{3i} \Delta FDI_{t-i} + \sum_{i=0}^n \alpha_{4i} \Delta EXR_{t-i} + \mu_{1t} \dots \dots \dots (1)$$

$$\Delta IR_t = \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta IR_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta NX_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta FDI_{t-i} + \sum_{i=0}^n \beta_{4i} \Delta EXR_{t-i} + \mu_{2t} \dots \dots \dots (2)$$

$$\Delta FDI_t = \gamma_0 + \sum_{i=1}^n \gamma_{1i} \Delta FDI_{t-i} + \sum_{i=0}^n \gamma_{2i} \Delta NX_{t-i} + \sum_{i=0}^n \gamma_{3i} \Delta IR_{t-i} + \sum_{i=0}^n \gamma_{4i} \Delta EXR_{t-i} + \mu_{3i} \dots \dots \dots (3)$$

$$\Delta EXR_t = \delta_0 + \sum_{i=1}^n \delta_{1i} \Delta EXR_{t-i} + \sum_{i=0}^n \delta_{2i} \Delta NX_{t-i} + \sum_{i=0}^n \delta_{3i} \Delta IR_{t-i} + \sum_{i=0}^n \delta_{4i} \Delta FDI_{t-i} + \mu_{4i} \dots \dots \dots (4)$$

- Where IR is the nominal interest rate,
- FDI is the Foreign Direct Investment
- EXR is the nominal exchange rate
- NX is the Net Export
- D is the difference operator.

3.6 Method of data analysis

Following the specification of Nwani (2011) for the causality test as follows;

$$\gamma_t = \alpha + \sum_{i=1}^n \beta_i \gamma_{t-1} + \sum_{i=1}^n \gamma_i X_{t-1} + \mu \dots\dots\dots (5)$$

$$X_t = \alpha + \sum_{i=1}^n \beta_i X_{t-1} + \sum_{i=1}^n \gamma_i \gamma_{t-1} + \mu \dots\dots\dots (6)$$

4.0 Data presentation, analysis and discussion

The section provides the descriptive statistics, the correlation analysis, Granger causality test, the results of the estimated VAR model, impulse response functions and forecast error decomposition.

4.1 Data presentation

4.1.1 Data

	EXR	FDI	NX
1981	0.610000	0.334700	-1.800000
1982	0.672900	0.290000	-2.600000
1983	0.724100	0.264300	-1.400000
1984	0.764900	0.360400	1.900000
1985	0.893800	0.434100	4.700000
1986	2.020600	0.735800	2.900000
1987	4.017900	2.452800	12.50000
1988	4.536700	1.718200	9.700000
1989	7.391600	13.87740	27.10000
1990	8.037800	4.686000	64.20000
1991	9.909500	6.916100	32.00000
1992	17.29840	14.46310	62.50000
1993	22.05110	29.66030	53.10000
1994	21.88610	22.20000	43.30000
1995	21.88610	75.90000	195.5000
1996	21.88610	111.3000	746.9000
1997	21.88610	110.5000	395.9000
1998	21.88610	80.70000	-85.60000
1999	92.69340	92.80000	326.5000
2000	102.1052	116.0000	960.7000
2001	111.9433	132.4000	509.8000
2002	120.9702	225.2000	231.5000
2003	129.3565	258.4000	1007.700
2004	133.5004	248.2000	2615.700
2005	132.1470	654.2000	4445.700
2006	128.6516	624.5000	4216.200
2007	125.8331	759.4000	4397.800
2008	118.5669	971.5000	4794.500
2009	148.8802	1273.800	3125.700
2010	150.2980	905.7000	3847.500
2011	153.8616	1360.300	4240.800

2012	157.4994	1113.500	5372.800
2013	157.3112	875.1000	5822.600
2014	158.5526	738.2000	2421.700
2015	193.2792	602.1000	-2230.900
2016	253.4923	1124.100	-644.8000
2017	305.7901	1069.400	3183.300
2018	306.1000	-3729.000	1900.000

4.1.2 Descriptive Statistics

	EXR	FDI	NX
Mean	88.66295	260.3314	1371.200
Median	97.39930	110.9000	279.0000
Maximum	306.1000	1360.300	5822.600
Minimum	0.610000	-3729.000	-2230.900
Std. Dev.	87.19397	797.6251	2004.890
Skewness	0.799168	-3.148674	0.771519
Kurtosis	2.964388	17.70121	2.399694
Jarque-Bera	4.046917	404.9887	4.340444
Probability	0.132197	0.000000	0.114152
Sum	3369.192	9892.593	52105.60
Sum Sq. Dev.	281303.2	23539617	1.49E+08
Observations	38	38	38

4.2 Analysis

4.2.1 Descriptive Statistics

Descriptive statistics show the summary of data and other basic characteristics within the series. The descriptive statistics for variables of the study are reported in Table 4.1.

Table 2: Descriptive Statistics

	<i>Mean</i>	<i>Max.</i>	<i>Min.</i>	<i>Std. Dev.</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>Jarque-Bera</i>	<i>Prob.</i>
FDI	260.33	1360.30	-3729	797.63	-3.15	17.70	404.99	< 0.01
EXR	88.66	306.10	0.61	87.19	0.80	2.96	4.05	0.13
NX	1371.20	5822.60	-2230.9	2004.89	0.77	2.40	4.34	0.11

Source: Extract from E-views 8.0

As depicted Table 1, foreign direct investment (FDI) has an average value of \$260.33 million over the period 1981 to 2018 with a standard deviation of 797.63. The highest amount of FDI inflows for the period is \$1,360.3 million while that of maximum outflows is \$3,729 millio. The value of skewness for FDI is -3.15. This means that the distribution of FDI is skewed negatively in favour of outflows. Its kurtosis value of 17.7 indicates that the distribution of FDI is peaked.

Jarque-Bera value of 404.99 with probability value less than 1% indicates that FDI is not normally distributed.

The average value of exchange rate (EXR) for the period under review is 88.66. The maximum and minimum values are 306.1 and 0.61 respectively. The skewness value (0.80) shows that EXR is positively skewed. Its Kurtosis (2.96) indicates that the distribution is neither peaked nor flat. The Jarque-Bera value of 4.05 with probability value of 13% suggests that the variable is normally distributed.

Net export has a mean of \$1,371.2 million for the period under review. The maximum and minimum values are \$5822.6 million and \$(2230.9) million respectively. The skewness value (0.77) shows that net export is slightly skewed to the right. Its Kurtosis (2.40) indicates that the distribution is flat. The Jarque-Bera value of 4.34 with probability value of 11% suggests that the variable is normally distributed.

4.2.2 Pair-wise Correlation

The correlation matrix for all the variables in the study is reported in Table 2.

Table 3: Pair-wise Correlation Matrix

	Foreign Investment	Direct	Exchange Rate	Net Export
Foreign Investment	1.00			
Direct	0.07	1.00		
Exchange Rate	0.36	0.49	1.00	
Net Export				1.00

Source: Author's computation (2019) using E-views 8.0

As presented in Table 2, the correlation statistic between foreign direct investment and each of the other endogenous variables in the model is positive. Particularly, the correlation coefficient between foreign direct investment and exchange rate is 0.07 indicating that they are positively correlated with each other. In the same vein, foreign direct investment is positively correlated with net export. The correlation coefficient between exchange and net export is positive as well.

4.2.3 Analysis of Granger Causality Tests

The results of the Granger causality test are reported in Table 3 below.

Table 4: Pairwise Granger Causality Tests

Null Hypothesis:	Obs.	F-Statistic	Prob.
FDI does not Granger Cause EXR	36	0.03	0.97
EXR does not Granger Cause FDI		3.32	0.05
NX does not Granger Cause EXR	36	9.16	< 0.01
EXR does not Granger Cause NX		1.67	0.20
NX does not Granger Cause FDI	36	9.2	< 0.01
FDI does not Granger Cause NX		5.67	0.01

Source: Results extract from E-views 8.0

4.2.4 Analysis of Vector Autoregressive Model Results

The results of the estimated VAR model are reported in Table 4 below.

Table 5: Estimated VAR Model

	FDI	EXR	NX
FDI(-1)	1.58 (0.66) [2.40]	0.02 (0.01) [1.92]	1.42 (1.08) [1.32]
EXR(-1)	-6.82 (2.94) [-2.32]	1.04 (0.06) [18.25]	0.50 (4.80) [0.10]
NX(-1)	-0.02 (0.09) [-0.24]	-0.007 (0.002) [-3.99]	0.54 (0.15) [3.53]
C	280.71 (181.98) [1.54]	5.49 (3.54) [1.55]	115.54 (297.57) [0.39]
R-squared	0.20	0.97	0.66
Adj. R-squared	0.13	0.97	0.63
F-statistic	2.82	413.67	21.31

Source: Author's computation using E-views 8.0

Notes: Standard errors are in () represents and t-statistics are in [].

4.2.5 Block Exogeneity Wald Test

The results of the Vector Autoregressive (VAR) causality/ block exogeneity Wald tests are reported in Table 5.

Table 6 VAR Granger Causality/Block Exogeneity Wald Tests Results

Dependent variable: FDI			
Excluded	Chi-sq	Df	Prob.
EXR	5.40	1	0.02
NX	0.06	1	0.81
All	5.52	2	0.06

Source: Results extract from E-views 8.0

4.2.6 Impulse Response Functions

The results of the Impulse Response Functions (IRFs) of the VAR model in graphical form are reported in the Fig. 2 below.

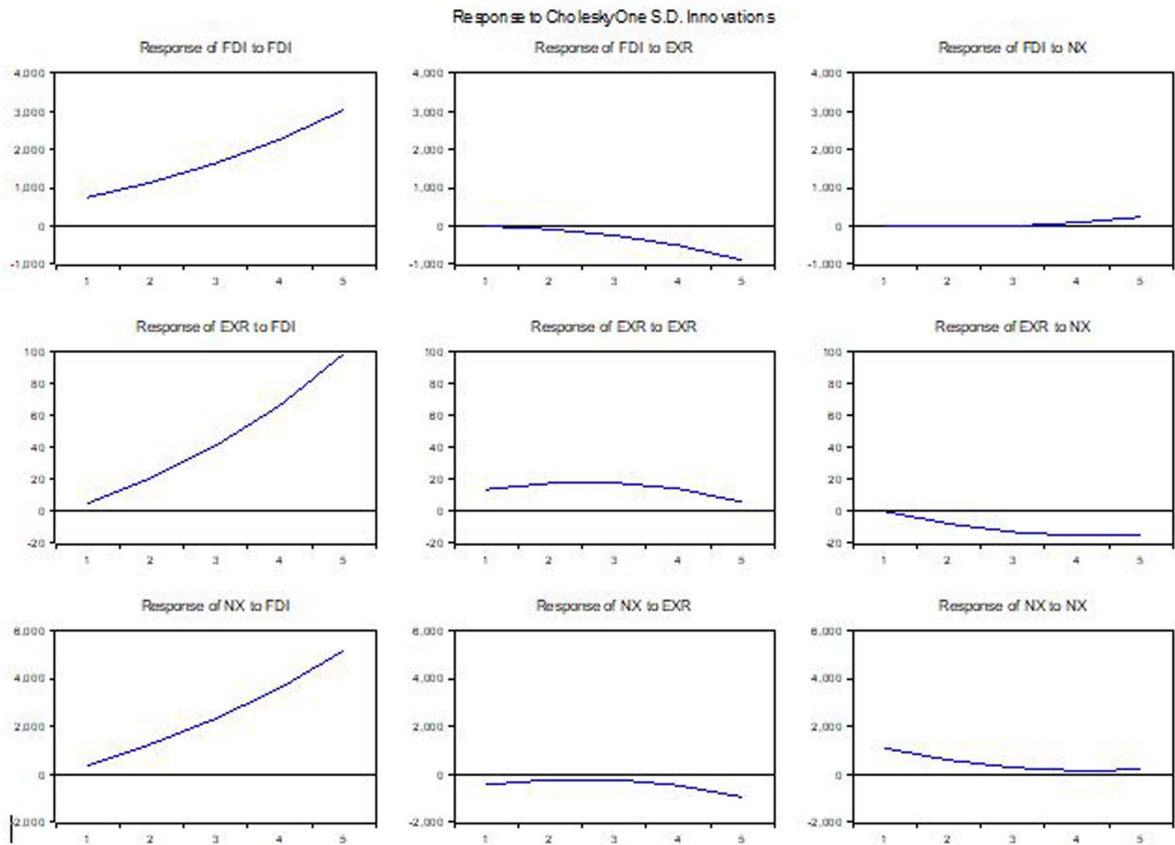


Fig. 2: Impulse Response Functions

4.2.7 Forecast Error Variance Decomposition Functions

The graphs of the forecast error variance decomposition functions are presented in Fig. 2 below.

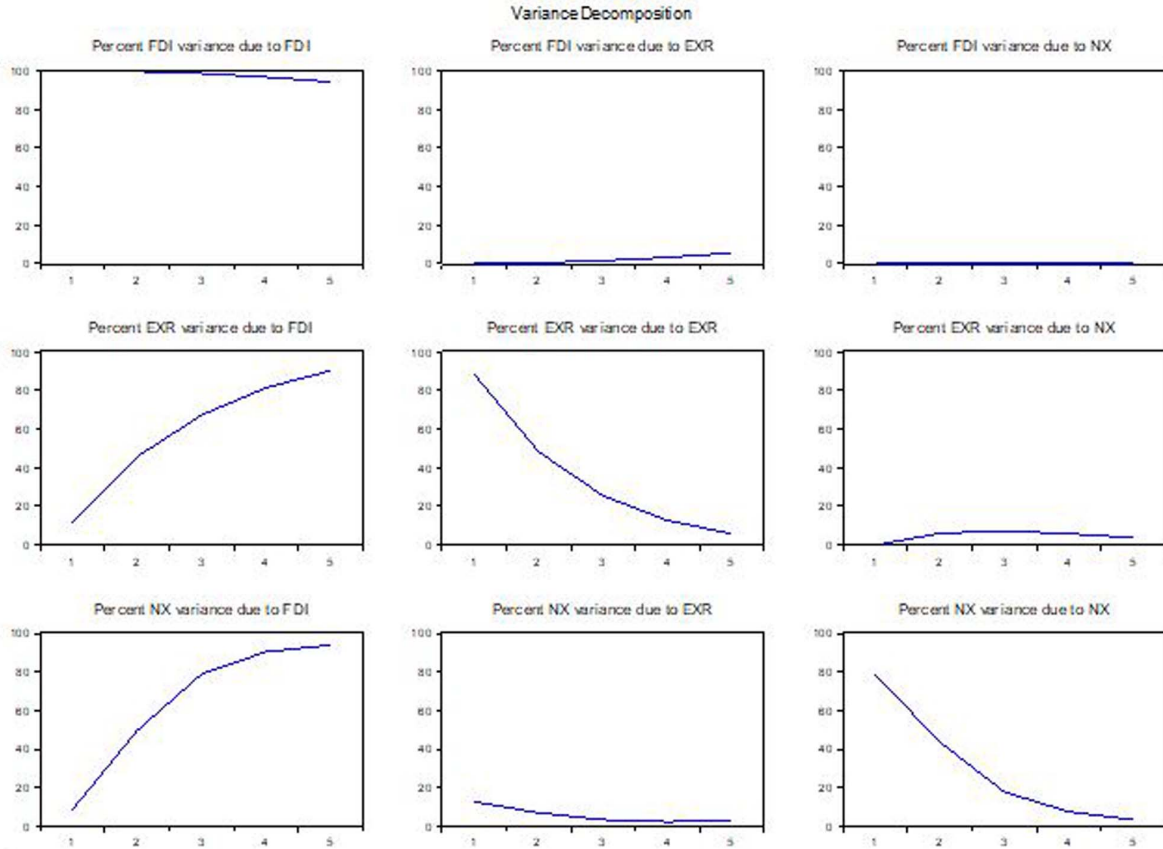


Fig. 3: Forecast Error Decomposition Functions
 Source: Results extract from E-views 8.0

4.2.8 Correlation Matrix

	EXR	FDI	NX
EXR	1.000000	0.074396	0.488440
FDI	0.074396	1.000000	0.365669
NX	0.488440	0.365669	1.000000

4.2.8 Granger Causality Tests

Table 7

Pairwise Granger Causality Tests
 Date: 01/17/20 Time: 10:05
 Sample: 1981 2018
 Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
FDI does not Granger Cause EXR	36	0.03211	0.9684

EXR does not Granger Cause FDI		3.32032	0.0494
NX does not Granger Cause EXR	36	9.16143	0.0007
EXR does not Granger Cause NX		1.67420	0.2040
NX does not Granger Cause FDI	36	9.25751	0.0007
FDI does not Granger Cause NX		5.66932	0.0080

4.3 Test of hypothesis

H₁ There is no significant relationship between the exchange rate and foreign direct investment.

H₂ Net export has no significant nexus with the exchange rate.

H₃ Foreign direct investment has no significant link with net exports.

The pair wise granger causality test invalidates the null hypothesis as there is a significant nexus between the variables as expressed in null hypotheses H₁ and H₂. But validity was confirmed for the null hypothesis H₃. The test from the impulse response function further elucidates the presence of a significant nexus between the variables as given in the alternative hypotheses.

4.4 Discussion of findings

The coefficient of determination (R²) for the foreign direct investment (FDI) equation is approximately 0.20. This indicates that the regressors in the equation account for about 20 percent of the systematic variations in foreign direct investment. Similarly, 97 percent of systematic variations in exchange rate are attributed to the regressors while 66 percent of the variations in net export are explained by the regressors.

From Table 3, the pair-wise Granger causality tests revealed that foreign direct investment (FDI) does not Granger cause exchange rate (EXR). However, exchange rate Granger causes foreign direct investment. This, therefore, implies that there exists unidirectional causal relationship between foreign direct investment and exchange rate. Also, the test showed that net export (NX) Granger causes exchange rate but exchange rate does not Granger cause net export. It, therefore, indicates that a unidirectional relationship exists between net exports and exchange rate. Lastly, the test showed that net export Granger causes foreign direct investment and vice versa. Hence, there is a bidirectional relationship between net export and foreign direct investment.

The results of the block exogeneity Wald test for the foreign direct investment (FDI) equation revealed that one lagged values of exchange rate and net export jointly explain foreign direct investment in Nigeria. In other words, exchange rate and net export both Granger cause foreign direct investment in Nigeria. This is because the Chi-square test statistic (5.52) for joint significance is significant at the 10 percent level.

The impulse-response function of foreign direct investment in the VAR model to a shock in itself shows that foreign direct investment reacted positively to its innovations all through the five years of forecast. However, it responded negatively to innovations in exchange rate throughout the five years of forecast. Again, foreign direct investment showed no response to impulses in net export in the first year of forecast. It responded negatively in the second year but positively in the

third year through the fifth year of the forecast. Hence, the impulse response functions reveal that foreign direct investment reacted to shocks in exchange rate and net export with some variations from its mean.

As shown in Fig. 3, it can be observed from the variance decomposition of foreign direct investment that own shocks contributed most to variations in foreign direct investment in the early years of forecast but declined marginally in the later years. Shocks to exchange rate accounted for about 0.37% of variations in foreign direct investment in the second year of forecast but increased minimally to about 5.55% in the fifth year. Similarly, net export accounted for small variations in foreign direct investment all through the forecast periods. The contribution of net export to variations in foreign direct investment was much smaller than that of exchange rate throughout the periods of forecast. To this end, the variance decomposition of foreign direct investment show that own shocks predominantly determined variations in foreign direct investment while exchange rate and net export accounted for less than a total of 15% in the entire periods of forecast.

5.0 Summary, conclusion and recommendation

5.1 Summary

From the foreign direct investment equation, one year lagged value of foreign direct investment has a positive significant effect on its current value. Also, exchange rate lagged one year has a negative significant effect on foreign direct investment. However, net exports granger causes foreign direct investment and this is agreement with the empirical findings of Asogwa et al (2016) that found net exports granger causing FDI though without feedback, while we found a bidirectional relationship. The current policy position of the CBN concerning capital mobility is managed capital flows accompanied by a managed exchange rate policy which was not envisaged by the policy prescriptions of the Mundel- Flemming trilemma. The link between the capital controls proxied here by FDI gives the CBN an advantage far beyond the trilemma's prescriptions. The exchange rate policy has thus made the exchange rate a monetary policy tool. The big picture is the impact of such policy options of the CBN on the financial markets based on these findings. The implication is that the CBN might have a far more effective influence in attracting FDI through its policy stance in line with the conclusions of Eregha(2020) the monetary authority and what that portends for stabilizing the financial markets as regards guided role as regards FDI flows and the stabilization of the exchange rate in the WAMZ. These conclusions also fit into the evidence from Hoque et al (2017) on the Malaysian economy that when both foreign capital inflows and exchange rate interact with each other, there is a joint positive effect on the relationship between stock market development and economic growth.

5.2 Conclusion

The Mundell-Fleming model's policy prescriptions may not hold in absolute terms, yet the Nigerian experience is rather a modified case as there are no corner solutions of a fixed exchange rate or a free float exchange rate or free capital mobility. This has great implications for the stock market as the CBN's policy stance can greatly improve the FDI flows, the bulk of which might be directed towards the country's growing financial markets. These results might also give clue to the reasons behind the CBN's various policy moves to maintain managed capital mobility as well as managed exchange rate regime.

5.3 Recommendations

The Central Bank of Nigeria must evaluate the impact of its modified Mundell-Fleming model as regards its impact on the financial markets and the real economy. There is the need to attract more FDI into the non oil export oriented companies in order to enhance growth in foreign exchange receipts. The Nigeria stock exchange can also create avenues for cross listing of firms from other African countries to widen the reach of the NSE. Researchers can also study the impact of FDI in the growth of the Nigeria stock exchange and other financial markets in the country.

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APPENDIX

4.2.9VAR

Results

Vector Autoregression Estimates

Date: 01/17/20 Time: 10:12

Sample (adjusted): 1982 2018

Included observations: 37 after adjustments

Standard errors in () & t-statistics in []

	FDI	EXR	NX
FDI(-1)	1.580176 (0.65919) [2.39714]	0.024584 (0.01283) [1.91595]	1.419876 (1.07793) [1.31723]
EXR(-1)	-6.822253 (2.93460) [-2.32477]	1.042453 (0.05712) [18.2498]	0.501975 (4.79874) [0.10461]
NX(-1)	-0.022337 (0.09296) [-0.24029]	-0.007220 (0.00181) [-3.98988]	0.536872 (0.15201) [3.53174]
C	280.7131 (181.975) [1.54259]	5.487815 (3.54210) [1.54931]	115.5370 (297.570) [0.38827]
R-squared	0.203784	0.974097	0.659581
Adj. R-squared	0.131400	0.971743	0.628634
Sum sq. resids	18687350	7080.243	49969543
S.E. equation	752.5180	14.64762	1230.540
F-statistic	2.815341	413.6667	21.31315
Log likelihood	-295.4509	-149.7024	-313.6468
Akaike AIC	16.18653	8.308239	17.17010
Schwarz SC	16.36069	8.482392	17.34425
Mean dependent	267.3583	91.04276	1408.308
S.D. dependent	807.4341	87.13660	2019.272

Determinant resid covariance (dof
adj.) 1.28E+14

Determinant resid covariance	9.06E+13
Log likelihood	-752.0360
Akaike information criterion	41.29924
Schwarz criterion	41.82170

4.2.10 VAR Granger Causality/Block Exogeneity Wald Tests

VAR Granger Causality/Block Exogeneity Wald Tests

Date: 01/17/20 Time: 10:14

Sample: 1981 2018

Included observations: 37

Dependent variable: FDI

Excluded	Chi-sq	df	Prob.
EXR	5.404542	1	0.0201
NX	0.057737	1	0.8101
All	5.518825	2	0.0633

Dependent variable: EXR

Excluded	Chi-sq	df	Prob.
FDI	3.670870	1	0.0554
NX	15.91913	1	0.0001
All	16.51330	2	0.0003

Dependent variable: NX

Excluded	Chi-sq	df	Prob.
FDI	1.735084	1	0.1878
EXR	0.010942	1	0.9167
All	5.085431	2	0.0787

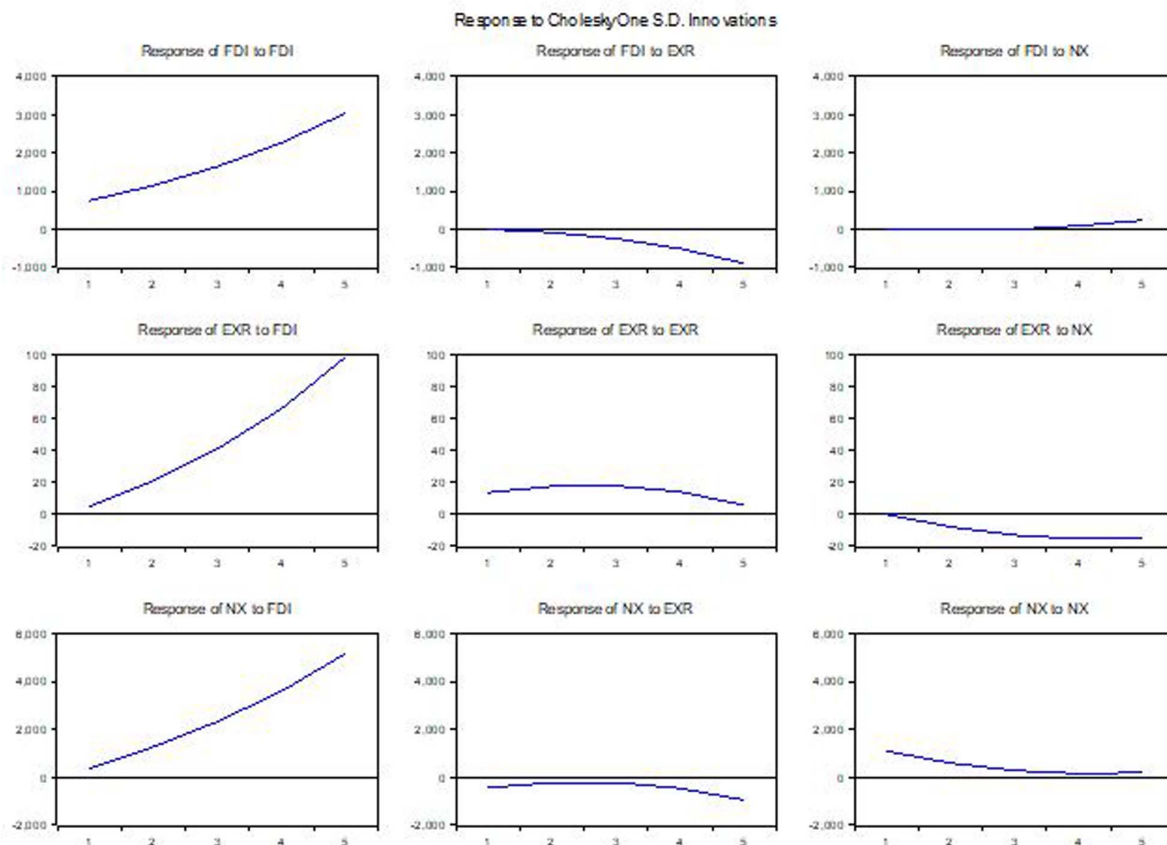


Fig. 3 Impulse Response Functions Graphs

4.2.11 Impulse Response Functions Tables

Response of FDI:

Period	FDI	EXR	NX
1	752.5180	0.000000	0.000000
2	1146.870	-84.14488	-24.35524
3	1640.193	-247.3757	2.142193
4	2260.176	-507.4118	86.12566
5	3038.635	-888.2532	238.7609

Response of EXR:

Period	FDI	EXR	NX
1	4.996464	13.76910	0.000000
2	21.07287	17.51830	-7.871798
3	41.01476	17.84252	-13.03086
4	66.33426	14.20303	-15.52210
5	98.76240	5.707454	-15.10726

Response of NX:

Perio

d	FDI	EXR	NX
1	365.0256	-438.3438	1090.339
2	1266.962	-228.4226	585.3721
3	2319.188	-233.3151	275.7367
4	3594.565	-467.5466	144.5357
5	5172.288	-964.3448	192.0932

Cholesky Ordering: FDI EXR NX

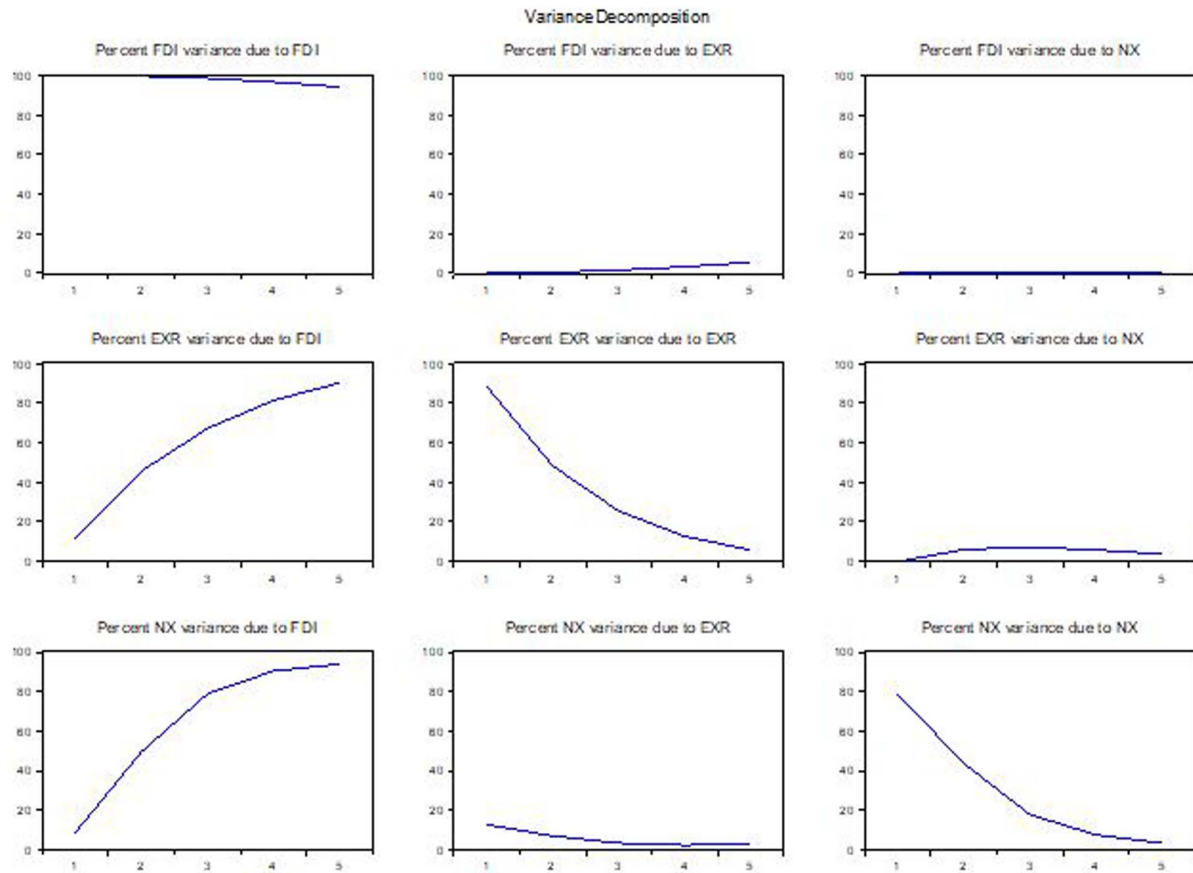


Figure 4 Variance Decomposition Functions Graphs

Variance Decomposition Functions Tables

Variance Decomposition of FDI:

Period	S.E.	FDI	EXR	NX
1	752.5180	100.0000	0.000000	0.000000
2	1374.507	99.59384	0.374767	0.031397
3	2154.228	98.51590	1.471224	0.012881
4	3164.487	96.66709	3.252871	0.080042
5	4482.554	94.12860	5.547801	0.323601

Variance Decomposition of EXR:

Period	S.E.	FDI	EXR	NX
1	14.64762	11.63567	88.36433	0.000000
2	32.05424	45.64886	48.32031	6.030826

3	56.54949	67.27161	25.48074	7.247649
4	89.67018	81.47851	12.64262	5.878862
5	134.3710	90.30731	5.810597	3.882092

Variance Decomposition of NX:

Period	S.E.	FDI	EXR	NX
1	1230.540	8.799442	12.68932	78.51124
2	1874.636	49.46809	6.952308	43.57960
3	3003.891	78.87384	3.310941	17.81522
4	4709.962	90.32724	2.332149	7.340607
5	7064.217	93.76264	2.900254	3.337105

Cholesky Ordering: FDI EXR NX