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The Mundell-Fleming Trilemma: Implications for the CBN and the Financial Markets

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Abstract

In this paper, data from 1981-2018 has been used that was recovered on monthly basis. The study adopted VAR methodology to show the nexus linking FDI, net exports, and the rate of exchange (EXR) 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 hypotheses. The results show that FDI did not granger cause the rate of exchange (EXR). The rate of exchange granger causes volatile movements in the rate of exchange, though the rate of exchange did not granger cause net exports .Net exports granger cause FDI, yet FDI was found to granger cause net exports. The policy implication for the CBN can be seen in the fact that under managed capital flows and a managed exchange rate regime, the bank might choose to influence growth in the different segments of the economy; especially in the financial markets. It might not be certain that the CBN cannot operate in 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 Classification: E66, E58, E61, E62, F62, F65, F68, N27,O16, O24

Paper Classification: Research Paper

Introduction

Background of Study

The world's financial system is becoming more integrated and this might have accounted for the domino effect of the subprime crises in the US that impacted the entire world in 2007-2009, especially the effect on public/private companies in the economy. Aizenman, Chinn, and Ito (2016) also alluded to this when they opined that the nature of the system that regulates finance in the world was amply demonstrated by the turmoil in the emerging market currencies and financial markets such as bonds following the remarks of Fed Chairman Bernanke that focussed on U.S. monetary policy normalisation, which was referred to as "taper tantrum". The volume of capital flows and trade is growing and this has been the dominant nature of the world economy for some decades now. Countries have submitted to greater openness to trade and capital flows

leading to an increased interdependence among the various economies. The Mundell-Fleming (trilemma) open economy makes predictions for solving policy challenges of the current century. The model predicts that in an economy that is open though small, market forces seem to limit a country's capacity to meet the stated policy options simultaneously; free capital mobility, stability of the exchange rate and monetary independence and this has implication for firms in all sectors of the economy.

The Economist magazine (2016) as cited in Rieber (2017) labelled the monetary trilemma as one of the six big ideas that explain how the global economy works. The trilemma proclaims that out of three policy options; only two can be adopted at any point of time in the face of a country's financial integration with the global capital market, stability of the rate of exchange, and monetary independence. Nigeria's economy did undergo a vigorous attempt at liberalization from 1986 and that began her journey into globalization. The rate of exchange regime changed from a fixed regime to a free float rate of exchange regime and a Central Bank with increasing autonomy was focussed at harnessing the possible rewards from operating a free market.

Feenstra and Taylor (2014) opined that the monetary expositions of the trilemma are among the topmost ideas in international finance as well as in macroeconomics. Indeed, in the decades from the 1980s to even in the 1990s, there was an observed movement towards openness in Nigeria. Concerning the free market, Nigeria's economy has followed a long but winding part, 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 and grouped amongst the most successful financial markets in the continent.

The Statement of Problem

The Nigerian 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 when growth is being experienced in the non public sector. There is simply no purely free float rate of exchange regime, neither is there 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 a purely free market economy subject to the forces of demand and supply.

Scholars such as Osundina and Osundina (2014) have opined that the trilemma model applied to an economy that is small and open such as Nigeria; experiencing complete capital mobility, in which the domestic rate of interest is influenced strongly by the prevalent rate of interest for the globe. This shows a stark difference from the economic 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) there are tradeoffs that are complex though country specific; amongst policy goals because of the limitations of policy instruments. This can also validate how the various policy reforms have had a consolidated impact on the Nigerian economy, as expressed in a growing capital market.

Research Questions

There will be a systematic process to provide answers for the following research questions;

Is there a nexus between monetary authority (exchange rate interventions) actions and FDI, Net Exports?

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

Does the trilemma's position of an impossible trinity hold for the economy of Nigeria, 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 as given in the trilemma's policy prescription.

Research Objectives

The research objectives specified for this study are;

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

To examine the possible causal link, that runs from FDI to the rate of exchange and to Net exports.

Research Hypothesis

H_1 The nexus linking the exchange rate and FDI is not significant.

H_2 Net export has no significant nexus with the exchange rate.

H_3 FDI 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 Nigerian economy (mostly in the financial markets) and thus increase development and output growth. The anticipated benefit as predicted in the Mundell- Fleming's trilemma has a prominent impact on firms in the country, necessitating this study. There is the need to determine empirically the connection between the rate of exchange and factors such as FDI and other macroeconomic variables.

Review of Relevant Literature

Conceptual Framework

Independent research by Mundell and Fleming in the 1960s gave rise to the monetary trilemma's hypothesis for an open economy and this focussed on the policy trade-offs that is implied in the different options available; such as financial openness, monetary autonomy and stability in the rate of exchange. The trilemma as it relates to international finance is focussed on the perception that in many nations, the goal of those in charge of economic policy is to position the country's economy for it to be accommodative of free mobility of capital. Ensuring free capital mobility allows a country's population to make profitable investment opportunities abroad as well as attract 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) did view the trilemma as stating that two out of three policy positions such as; stability of the rate of exchange, monetary independence, and financial integration can be chosen by a country at any given point of time. The trilemma is illustrated below;

Figure 1- Mundell-Fleming Trilemma

Theoretical Review

The prescription of the Mundell-Fleming model is an improvement on the IS-LM that was based on a closed economy model. This model best describes the scenario for an economy that can be considered to be open. The model's international perspective describes the flow of services and goods as well as capital flows of an international dimension that can affect a 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 monetary authority's use of monetary policy tools to stabilize the economy can be done by a deliberate spike in money supply, which leads to a fall in the rate of interest in a depressed economy, but there is a drop in money supply and interest rate rise, when there is a spike in the inflation rate. Still, there is also the impact of policy on volatile movements in the rate of exchange.

In finance literature, 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 trilemma is that where there is a fall in the rate of interest, it will cause capital outflow and this outflow of capital leads to a reduced rate of exchange and this depreciation in the rate of exchange makes net exports to increase (Asogwa, Joseph, Attamah, &Ugorji, 2016).There are many scholars that have viewed parts of the FDI, such as FDI, having a positive change on both the stock market and consequent 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 Chinese, the 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; which assists to attain stability of a country's economy. Yet this favourable perspective on capital mobility has had a growing push back from both the academia 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 shows a typical central bank's balance sheet, based on the trilemma.

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

Assets	Liabilties
(Net) Foreign reserves ↑ (c)	Fait currency in circulation ↓↑ (b/d)
Claims on domestic government ↓ (a)	Reserve balances(Bank)

Source: Adopted from Körner and Ehnts(2013)

The supply of money in the economy in its broadest definition is represented by currency in circulation and bank reserves. The CBN can reduce 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 foregoing 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. Should the CBN 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 for foreign currency transactions as a result of spikes in the rate of interest. The CBN might thus print more money to meet the demand by forex holders for naira and this impacts on the local interest rate by reducing its value. The effects of the international capital flows seem to skew the macroeconomic variables out of the expectations of the monetary authority in Nigeria.

The reintroduction of the 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 to intervene 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 was no predetermined exchange rate path as well as no specified target for the rate of exchange to follow in Nigeria (CBN, 2016). Though, Kalemli-Ozcan (2019) discovered empirically that the transmission of domestic monetary policy was not perfect, and that consequently, monetary policy actions of the emerging economies were designed to limit volatile movements in the rate of exchange; this may become counterproductive. The managed float in Nigeria is specifically an exchange rate targeting policy option, quite different from the two corner solutions of a pure float exchange rate regime and a rate of exchange that is fixed (Bofinger & Wollmershäuser, 2001).

Korner and Ehnts(2013) observed that where the central bank operates fixed rate of exchange and semi-open capital accounts; they no longer have discretionary control over the rate of interest, neither the money supply. What this elucidates is that the real exposition of "trilemma" that a particular country can only target is at most two of three possible desirable attributes or possible combinations, seem to be tenuous. These options are; open capital accounts, monetary policy that is independent and fixed exchange rates (Mundell 1960; Korner & Ehnts, 2013). Ramanathan and Teng (2013) looked at the trilemma in relation to the management of capital flows by Asia's emerging economies; observed that monetary authorities and instructional regulators in the 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 with the amount

of capital flows and that the shocks from monetary policy impact on the value of the rate of exchange.

Empirical Review

There have been some serious researches on the various aspects of the trilemma and the macroeconomic impact of the feasible implementation as well as its actual existence. 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 the VAR model indicates that most of the selected data is in line with the postulations of the trilemma.

Ncube et al. (2012) researched on the effect of unexpected US bond yield increases, due to 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 a stimulus from the US, the consequences such as low consumer price inflation, rand-dollar appreciation, revaluation of real stock price; causes decline in bond yield, monetary aggregates and rates of real interest for South Africa. Though the evidence on the trade channel was weak, yet other findings are consistent with postulations of the trilemma. Also a positive unanticipated shock in medium-term US bond yield might cause rand-dollar depreciation. But rising bond yields in line with the predictions of the given model called a portfolio balance as regards the rate of exchange and this leads to very serious decline in the price of real stock. This is emblematic of the conditions in a portfolio re-allocation process that is influenced by a change in US bonds yields. It was observed that when there is an unanticipated hike in the federal funds rate; the yield in South African bond increases, while there is a reduction in the value of rand vis-a-vis the American dollar. The foregoing causes delayed inflation due to consumer price.

The empirical study by Osundina and Osundina (2014) examined the link between the rate of interest and decisions on investment in Nigeria adopting multiple linear regression models. They adopted a modified Mundell – Fleming model where the rate of interest was adopted as the dependent variable, while the investment level, GDP, government spending, debt and the rate of exchange were independent variables. The findings from the study revealed 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 the consistent outflow of capital and the possibility of policy ineffectiveness based on prescriptions. The study was thus an attempt at determining the derived model's validity when tested and to see it can be truly effective on the Nigerian economy. This study sourced data from the CBN that spanned from 1970 to 2012. A VAR model and the test for causality (Granger) were used. The findings of the study revealed the VAR methodology and the derived impulse response function shows that the postulations of the trilemma is validated and that these policy postulations can be useful for the economy. The study further reveals that the test for causality revealed that FDI is granger caused by net exports and that there is no feedback in that nexus, though causality does not exist concerning the other variables considered.

Hoque et al.(2017) re-examined the nexus of development in the stock market and its impact on a country's GDP. They focussed on investigating, the stabilizing effect in inflows of FDI and the rate of exchange on the connection between the development of the stock market and output growth for Malaysia spanning the period 1981-2016. The study used Granger test, the approach adopted was ARDL (utilizing the bound testing approach). They also examined both the magnitude and direction of the nexus among variables via a multivariate approach. The

finding from the ARDL model indicates that, when considered in the short and long term; the stock market has impact on Malaysia's economic growth and this correlates with the findings of the causality test (Granger). FDI inflows and the rate of exchange were found to be significantly negative as well as positive in their moderating effects respectively; on the link connecting development in the stock market to growth in output. They concluded that, when both foreign capital flows and the rate of exchange had a definite nexus, there are links connecting the stock market expansion and financial deepening to the growth in the economy. There is the need to determine that nexus for the Nigerian economy.

Frenzel-Baudisch (2018) noted that increase in inflows of FDI into a buoyant sector creates the real rate of exchange to rise and this causes increased inflows of capital and subsequently an increased strain on the real rate of exchange and this can lead to a sudden reverse flow in capital movements (Botta, 2015). There is a fact that boom and bust cycles as well as the impact of an appreciated rate of interest causes macroeconomic instability and this is detrimental to economic growth. The study applied dynamic system GMM estimation techniques to empirically find different effects of FDI inflows into the major parts of the economy and its nexus with the real rate of exchange in a set of countries that comprise of developing and developed economies. While an insignificant link is found between FDI and the primary sector; the link observed connecting it and manufacturing as well as service sectors leads to real depreciation for the former and real appreciation for the latter. The study found further evidence that indicates that financial sector development; possibly leads to a limitation of the impact of movements in the real rate of exchange based on FDI flows in the two sectors. This seriously reduces the effect of a real increase in capital flows other than the FDI. The conclusion was that, deep financial markets seem to have impact in reducing macroeconomic instability in consequent effects on capital inflows. The current study takes a country specific approach, looking at the Nigeria application.

The empirical study by 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 result from Morocco for both the short term and long term indicates that volatility of the real rate of exchange was found to be highly significant, but negative. The observed volatility of price 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 increases investment. But for Turkey, the FDI inflows show greater causality, impacting on domestic price fluctuations. The volatile movements in the real rate of exchange indicated an insignificant though a positive effect. In addition, they also saw that the possible future market size, institution quality and infrastructure appear to be the key factors in attracting foreign capital in both countries. The evidence on trade openness reveals that the influence on FDI flows in Morocco was positive. In conclusion, it was observed that Turkey was able to take care of negative economic situations facing it via the structural reforms it adopted and not necessarily sticking to the prescriptions of the trilemma.

Hsing(2019) extended the trilemma to Australian data. The research discovered that in the adoption of fiscal policy; an expansionary move does not affect output whereas monetary policy that is expansionary causes a growth in output. The results further revealed that there was a higher real value of the price of stock; hence when there is a lower real oil price or drop in the expected inflation rate, output growth occurs. The findings were a validation of the postulations of the trilemma as regards the Australian economy

Tümtürk (2019) investigated the factual soundness of the trilemma's postulations and various trilemma policy arrangements among the rate of exchange stability, capital mobility and the

autonomy of the monetary authority for Turkey covering the period that elapsed from 1970-2014. The results show a valid constraint for the trilemma, and that 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 it pursued policies to stabilize the exchange rate.

Qin(2019) made use of a mutual relationship determining the panel vector autoregression model, and tested the validity of the trilemma, and potential mitigating influence of capital control and policies that are of a macroprudential nature, in 45 major economies that are advanced and emerging for a span that covered the period 1999-2016. The study found that the flexibility of the rate of exchange remains effective in lowering the domestic monetary response to US interest rate shocks, especially in emerging economies; hence it is not necessary to adopt capital controls. It further discovered that these policies such as policy autonomy are provided by macroprudential policies in advanced economies; by reducing the domestic monetary policy reflection of U.S. shocks. This research supported the trilemma's validity; such as in the time of financial globalization, and shows that global financial cycle sensitivity is mitigated by the adoption of policies that are macroprudential in nature. The Nigerian scenario has a managed capital flow due to macroprudential policies as well as managed exchange rate; which is a deviation from the corner solutions in the original Mundell-Fleming model policy prescription.

The study by Eregha (2020) adopted the panel correction for serial correlation (Arrellano) and heteroscedasticity for five of the WAMZ countries, depending on data availability for the selection of sample countries from 1980-2014. The results reveal the presence of uncertainty in the exchange rate, which hindered FDI flow, but 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 inflows in the sub region. While a policy regime that is different from corner solutions (regime of managed exchange rate) had a strongly positive effect in enhancing flows of FDI; occurrences of imbalances in current account and changes in the reserves of foreign exchange as the channels. The foregoing is because the official rate is maintained by adopting restricted foreign exchange earnings in their reserves to intervene in the exchange rate market. The conclusions of this study makes bare the pivotal role of monetary authority and what that portends for stabilizing the financial markets; as regards guided role in terms of FDI flows and the stabilization of the rate of exchange. This study is epochal in that, though our consideration is on one single country, specifically Nigeria; there are inferred implications 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.

Methodology

Study Design

This research adopts an expost facto research design as the data is utilized after the occurrence of the event.

Population of Study

Annual times 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 rate of interest, foreign direct investment and

the rate of exchange.

Sample

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

Source of Data

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

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 in the model derived. 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.

Exchange Rates (EXR)

It refers to the exchange rate variable. The rate of exchange is a key determinant of international finance as the world economies are globalised ones. There are a number of factors that impact on the rate of exchange namely; government policy, competitive advantage, market size, international trade, domestic financial market, rate of inflation, interest rate etc. The periodic consideration for the collection of data was annual; as regards the variables adopted from the year 1980-2018.

Net Exports

The variable referred to as net-exports is the gap observed between exports and imports of a country within a specified relevant period. In any given country, where the level of price is high, it will cause an increase in the price of domestic exports to other countries in relative terms, but it will decrease the actual price of foreign imports in relative terms from outside the country. There will thus be a fall in exports, while the value of imports will increase and thus a fall in net exports. The influence of FDI on growth may seem to correlate with an expansion in the capital market.

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), these saw the transfer of technology and capital from countries that are developed and developing countries as FDI.

Model Specification

The Vector Autoregressive model is specified as;

$$\Delta NX_t = \alpha_0 + \Sigma^n_{i=1} + \alpha_{1i} \Delta NX_{t-I} + \Sigma^n_{i=0} \alpha_{2i} \Delta IR_{t-1} + \Sigma^n_{i=0} \alpha_{3i} \Delta FDI_{t-1} + \Sigma^n_{1=0} \alpha_{4i} \Delta EXR_{t-1} + \mu_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$\Delta IR_t = \beta_0 + \Sigma^n_{i=1} \beta_{1i} \Delta IR + \Sigma^n_{i=0} \beta_{2i} \Delta NX_{t-1} + \Sigma^n_{i=0} \beta_{3i} \Delta FDI_{t-1} + \Sigma^n_{i=0} \beta_{4i} \Delta EXR_{t-1} + \mu_{2t} \quad (2)$$

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

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

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 are the specification of Nwani (2011) for the causality test ;

$$\gamma_t = \alpha + \Sigma^n_{i=1} \beta_i \gamma_{t-1} + \Sigma^n_{i=1} \gamma_i \quad X_{t-1} + \mu \quad (5)$$

$$X_t = \alpha + \Sigma^n_{i=1} \beta_i X_{t-1} + \Sigma^n_{i=1} \varnothing_i \gamma_{t-1} + \mu \quad (6)$$

Data Presentation, Analysis and Discussion

This 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.

Data Presentation

Data

Table 2

	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

Descriptive Statistics

Table 3

	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

Analysis

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.

Table 4: Descriptive Statistics

	Mean	*Max.*	*Min.*	*Std. Dev.*	*Skewness*	*Kurtosis*	*Jarque-Bera*	*Prob.*
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 in Table 4, 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 million. 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.

Pair-wise Correlation

The correlation matrix for all the instruments in the study is reported in Table 5.

Table 5: Pair-wise Correlation Matrix

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

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

As presented in Table 5, the correlation statistic between FDI and all the other endogenous variables in the model is positive. Particularly, the correlation coefficient between FDI and exchange rate is 0.07 indicating that they are positively correlated with each other. Also, the foreign direct investment is positively correlated with net export. The coefficient of correlation between exchange and net export is positive as well.

Analysis of Granger Causality Tests

The results of the causality test are provided in Table 6 .

Table 6: 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

Analysis of Vector Autoregressive Model Results

The results of the estimated VAR model are reported in Table 7.

Table 7: Estimated VAR Model

	FDI	**EXR**	**NX**
FDI(-1)	1.58	0.02	1.42
	(0.66)	(0.01)	(1.08)
	[2.40]	[1.92]	[1.32]
EXR(-1)	-6.82	1.04	0.50
	(2.94)	(0.06)	(4.80)
	[-2.32]	[18.25]	[0.10]
NX(-1)	-0.02	-0.007	0.54
	(0.09)	(0.002)	(0.15)
	[-0.24]	[-3.99]	[3.53]
C	280.71	5.49	115.54
	(181.98)	(3.54)	(297.57)
	[1.54]	[1.55]	[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 () and t-statistics are in [].

Block Exogeneity Wald Test

The results of the Vector Autoregressive (VAR) causality/ block exogeneity Wald tests are reported in Table 8.

Table 8: VAR Granger Causality/Block Exogeneity Wald Tests Results

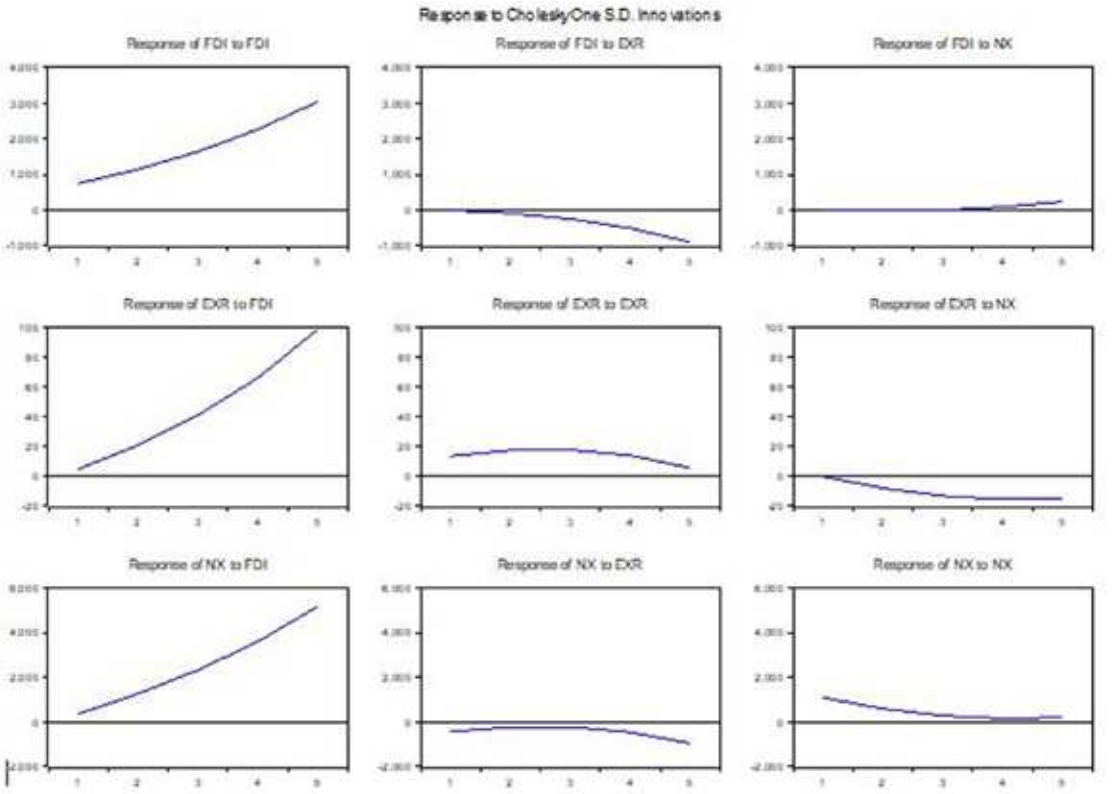
Dependent variable: FDI			
Excluded	Chi-sq	Df	Prob.
EXR	5.40	1	0.02
NX	0.06	1	0.81
All	5.52	2	0.06

Source: Results extract from E-views 8.0

Impulse Response Functions

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

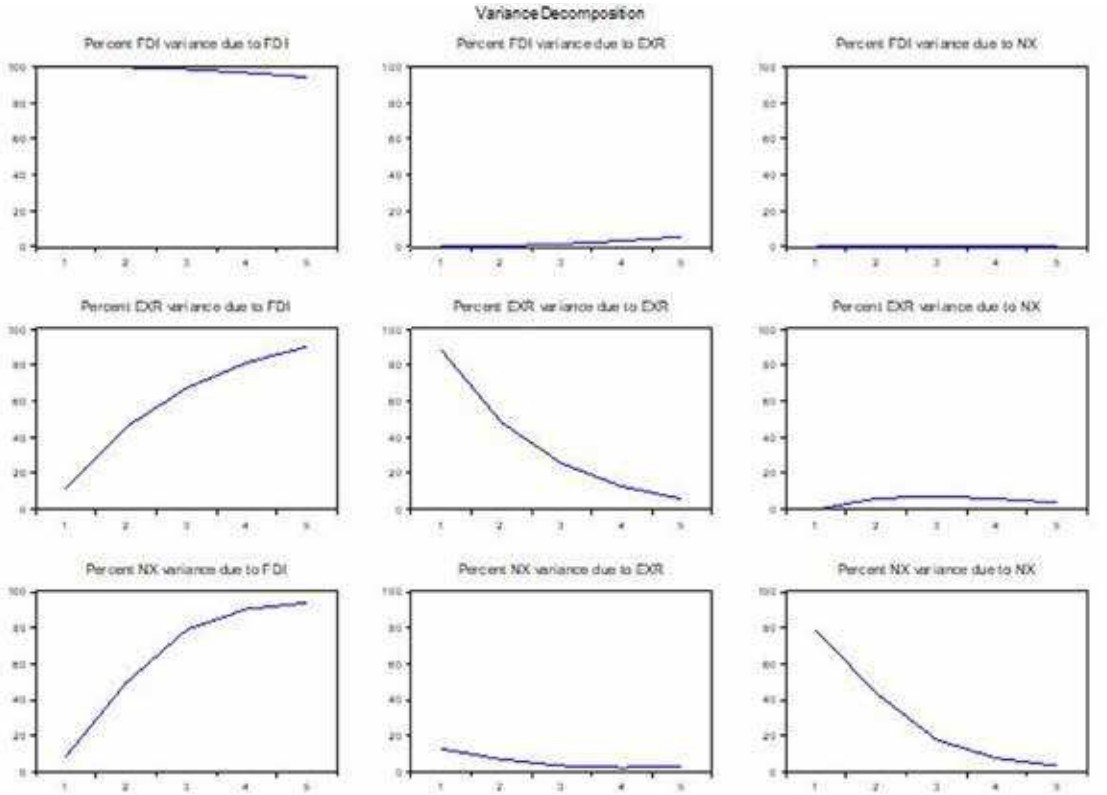
Fig. 2: Impulse Response Functions



Forecast Error Variance Decomposition Functions

The graphs of the forecast error variance decomposition functions are presented in Fig. 3 .

Fig. 3: Forecast Error Decomposition Functions



Source: Results extract from E-views 8.0

Correlation Matrix

Table 9: 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

Granger Causality Tests

Table 10: Pairwise Granger Causality Tests

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

Test of Hypothesis

H_1 The nexus of the exchange rate and FDI is not significant.

H_2 Net export has no significant nexus with the exchange rate.

H_3 FDI 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 H_1 and H_2. But validity was confirmed for the null hypothesis H_3. The test from the impulse response function further elucidates the presence of a significant nexus between the variables as given in the alternative hypotheses.

Discussion of Findings

The coefficient of determination () for the 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 6, the pair-wise granger causality tests revealed that FDI does not Granger cause exchange rate (EXR). However, exchange rate Granger causes FDI. The implication from this is; there exists unidirectional causal nexus linking FDI and the rate of exchange. Also, the test results indicate that net export (NX) granger causes exchange rate, but exchange rate does not granger cause net export. It therefore further, indicates that a unidirectional relationship exists and links net exports and the rate of exchange. Lastly, the test revealed that net export granger causes FDI and vice versa. Hence, the nexus is bidirectional between net export and FDI.

The findings from 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 FDI in Nigeria. In other words, exchange rate and net export both granger cause FDI in Nigeria. This is because the Chi-square test statistic (5.52) for joint significance at a 10 per cent as regards the degree of significance.

The impulse-response function of FDI 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, FDI 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.

From the illustration in Figure 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 FDI all through the forecast periods. The contribution of net export to variations in FDI was much smaller than that of exchange rate throughout the periods of forecast. To this end, the variance decomposition of foreign direct investment shows 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.

Summary

From the FDI equation, one year lagged value of FDI has a positive significant effect on its current value. Also, exchange rate lagged one year has a negative significant effect on FDI. However, net exports granger cause FDI and this is in agreement with the empirical findings of Asogwa et al. (2016) that found net exports granger cause FDI though without feedback, while here a bidirectional relationship is found. 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 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 can thus be stated as functioning as policy tool; thus making 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) for the monetary authority; that portends for stabilizing the financial markets in a 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 inflows of foreign capital and the rate of exchange interact with each other, there is a joint positive effect on the relationship between the development of the stock market and Nigeria's economic growth.

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 rate of exchange or free float rate of exchange 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 as to the reasons behind the CBN's various policy moves to maintain managed capital mobility as well as managed exchange rate regime.

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 Nigerian 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 Nigerian stock exchange and other financial markets in the country.

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Appendix

VAR

Table-11-Results

Vector Autoregression Estimates

Sample (adjusted): 1982 2018

Included observations: 37 after adjustments

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

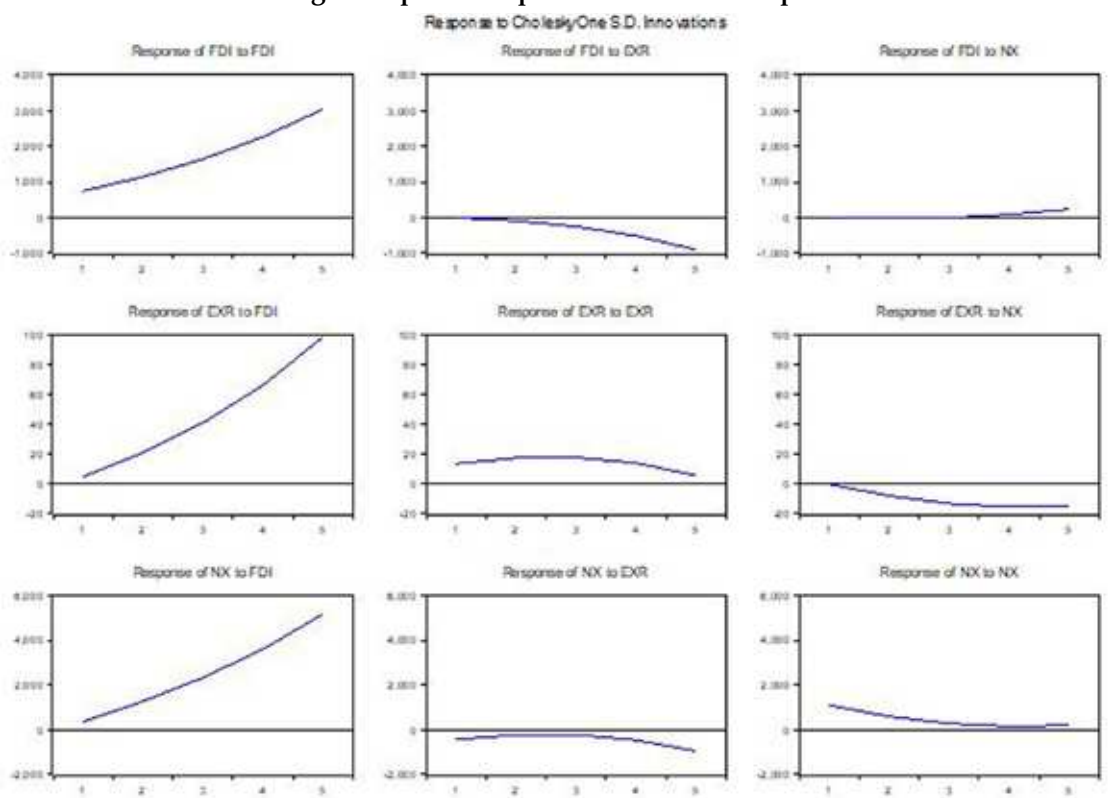
	FDI	EXR	NX
FDI(-1)	1.580176	0.024584	1.419876
	(0.65919)	(0.01283)	(1.07793)
	[2.39714]	[1.91595]	[1.31723]
EXR(-1)	-6.822253	1.042453	0.501975
	(2.93460)	(0.05712)	(4.79874)
	[-2.32477]	[18.2498]	[0.10461]
NX(-1)	-0.022337	-0.007220	0.536872
	(0.09296)	(0.00181)	(0.15201)
	[-0.24029]	[-3.98988]	[3.53174]
C	280.7131	5.487815	115.5370
	(181.975)	(3.54210)	(297.570)
	[1.54259]	[1.54931]	[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	

VAR Granger Causality/Block Exogeneity Wald Tests

Table 12

VAR Granger Causality/Block Exogeneity Wald Tests			
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 Grraphs

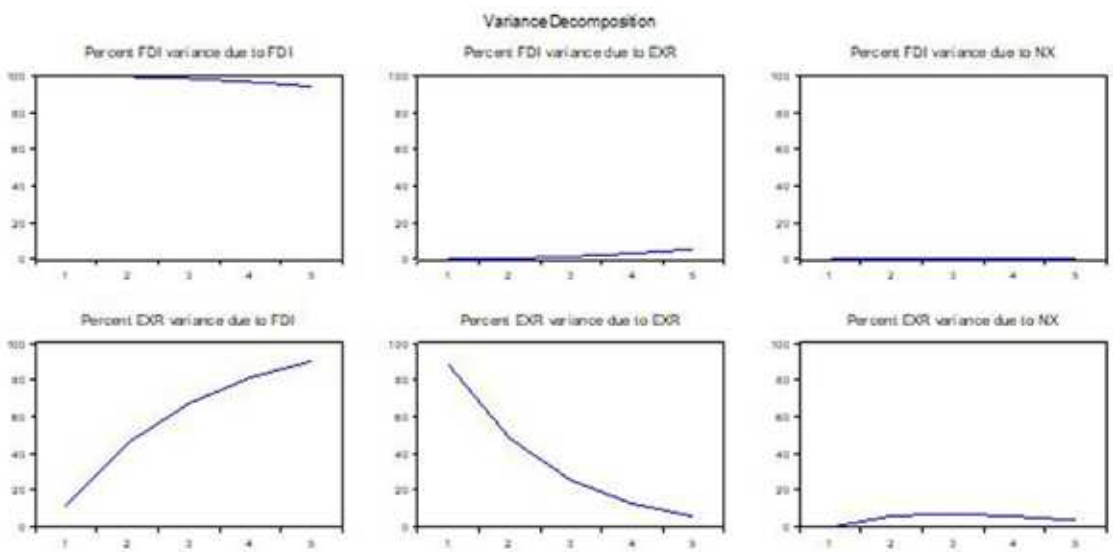


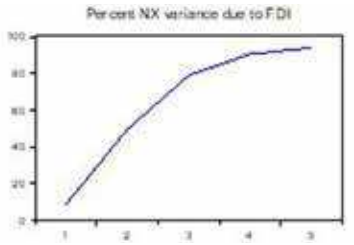
Impulse Response Functions Tables

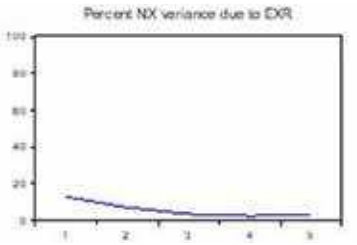
Table 13

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:			
Period	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







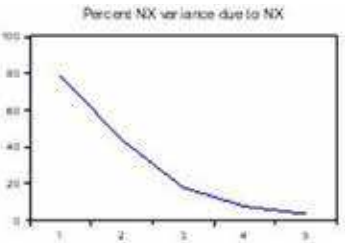


Table 14: Variance Decomposition Functions Tables

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				

Author's Profile

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