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ARTICLE

A SVEC Model of Monetary Policy and International Trade in Nigeria

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Abstract

The development of the monetary theory of balance of payment was from the balance of payment theory which is mainly in the context of a closed economy. Whereas, the Mundel-Fleming model was coined from the IS-LM model for an open economy. Mundel- Fleming model argues that to achieve economic stabilization by adopting fiscal or monetary policies can be done based on the exchange system adopted. This study examines the effects of monetary policy shocks, aggregate demands, and exchange rate shocks on international trade in Nigeria with monthly data from 2008m1 to 2019m12 sourced from the Central Bank of Nigeria (CBN). The study adopts a SVEC model to examine the short-run, long-run, and contemporaneous relationships that exist among trade, interest rates, consumer price index (CPI), and exchange rate. Having confirmed evidence of two co-integrating vectors in the system by adopting the Johansen tests, the study further finds that a rise in domestic price brings about a rise in international trade, the study also shows that loosing of naira power against dollar discourages international trade in the long-run and charging of one percent additional rate of interest will drastically reduce international trade in the long-run. In a nutshell, the study shows that monetary policy shock could not significantly explain the proportion of the forecast error variance of international trade in Nigeria compared to the aggregate and exchange rate shocks. Based on the findings, the study recommends that the government should ensure the implementation of monetary policies that will assist in improving international trade.

Keywords: Monetary Policy, International Trade, Shocks, SVECM, Co-integration

JEL classification: E00, E42, E47, E52, E59

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1. Introduction

The apex banks in every country play prominent roles in the regulation of monetary variables using monetary policy for the social and industrial welfare of the country (Mahmood & Shahab, 2012; Adelakun & Karima, 2020). The achievement of full employment equilibrium, rapid industrial growth, price stability, sustainable economic growth, and external balance are desired goals of every economy in the world. These goals are usually anchored on the use of the monetary policy. Monetary policy is one of the macro-economic instruments used in managing the economy (Mahmood & Shahab, 2012; Adelakun & Karima, 2020). Specifically, it is a deliberate effort by the monetary

authorities to control the money supply and credits conditions, and to ensure general economic stability to achieve desired macroeconomic objectives (Ajie & Nenbee, 2010). Nnana (2002) opined that macroeconomic policies in developing countries like Nigeria are designed to stabilize the economy, stimulate growth, and reduce poverty. This is supported by Sanusi (2012) that emphasized that the primary objective of monetary policies in Nigeria is the maintenance of domestic price and exchange rate stability since these are extremely important for the achievement of sustainable growth and external sector viability. Thus, in the pursuit of macroeconomic stability, monetary policymakers have often set targets on policy tools which include the short term interest rate, growth of money supply, and exchange rate. The exchange rate among these monetary policy tools unarguably has the most significant impact on the economy because of its effect on the value of the local currency, domestic price changes, macroeconomic credibility, capital flows, and financial stability.

The causes of economic growth and wealth differential among countries have been a long debate among economists, which prompted the postulation of several theories in this regard. In the literature, one of the factors responsible for the variations, is the increase in activities of international trade which is regarded as one of the major macroeconomic objectives (Eze & Atuma, 2017). Foreign trade has existed throughout history, it's economic, social, and political importance has been on the rise in recent years. According to Obadan (2004), foreign trade provides both foreign exchange earnings and market stimulus for accelerated economic growth. In this respect, many countries around the globe have achieved growth in an export-led strategy. Nigeria, for instance, is an open economy with international transactions constituting a significant proportion of her gross domestic products. Nigeria's economic development depends on the prospects of her export trade with other nations. Nigeria's domestic market is not sufficient enough to achieve growth at the rates needed to alleviate poverty without tapping into the large market through external trade. Therefore, it can be said that Nigeria's economy will continue to rely on external trade.

Policy challenges, low oil prices, delays in exchange rate adjustments, and the fall in the share of extractive products can be considered reasons for the recession experienced in Nigeria during 2016. This can be deduced from the immediate turnaround experienced in subsequent years with increased production from the recovery of oil prices and better performance from agricultural production. The naira, Nigeria's currency, was also stable with improved foreign currency liquidity for the better part of 2017, which was achieved through the adoption of administrative measures by the Central Bank of Nigeria in the same year. The administrative measures include the introduction of the Nigerian autonomous foreign exchange rate fixing, where the commercial banks are allowed to quote forex rates at rates that are not far from the parallel market rates, and market-determined rates of trading windows for portfolio investors (African Development Bank 2018). Changes in interest rates also have international implications, resulting in changes in the supply and demand for foreign currencies in the foreign exchange markets. The changes in exchange rates consequently affect general exports and imports, which also influence the prices of goods and services, thereby affecting the overall demand for goods and services. This implies that the adopted monetary policies of other countries affect the economy of Nigeria. Monetary policy measures of Nigeria are, therefore, aimed at controlling the inflationary pressure, ensuring a favourable balance of payment position, strengthening the naira exchange rate to other currencies, and ensuring an increase in foreign exchange inflow (Nwankwo 1988).

The formulation and implementation of policy instruments and strategies in Nigeria are therefore yet to achieve the appropriate desired level of economic stability. The unappreciative performance of the economy in recent years, despite different strategies, adopted, merit such attention to their monetary policy. Nigeria has witnessed a series of structural reforms in the last two decades aimed at repositioning the economy from several crises that affected the economy during those periods (Donli 2004). The problems can be attributed to structural imbalances in the Nigerian economic system, and various monetary policies were set up to correct the imbalances. The literature contains

very few studies conducted on the influence of monetary policy on international trade, especially concerning Nigeria. Most of the studies are old, and simple regression analyses were mostly used as a methodology to analyse the available data. We consider the SVEC model as more reliable than the other approaches as it accounts for the long-run impact analysis and accounts for the dynamics of international trade fluctuations. Additionally, most of the studies did not emphasise or focus on the effects of monetary policy tools, such as interest and exchange rates, on trade, either in the long term or in the short term. The monetary transmission mechanisms behind the monetary policy effects on trade were neglected. This study is, therefore, an improvement on other related studies. The current study was motivated by the need to fill this knowledge gap. It is against this background that this article intends to answer three salient questions, namely: What are the effects of monetary policy shocks on the international trade of Nigeria? What are the impacts of aggregate demand on the international trade of Nigeria? What are the effects of exchange rate shocks on Nigeria's international trade? This study aims to answer these salient questions by adopting the structural vector error correction (SVEC) econometric approach to determine the extent that monetary policy affects economic stability and foreign trade in Nigeria. This study differs from previous studies as it adopts different econometric analyses, such as the long-term impact analysis, impulse response and forecast error decomposition techniques from an identified structural vector error model, and using more recent figures.

The remainder of the paper will be presented thus: Section 2 presents a related empirical literature review, Section 3 presents the methodology, Section 4 presents the data analysis and interpretation of findings, and finally, Section 5 concludes this study.

2. Literature review

Several researcher have adopted different theories in the analysis of monetary policy and international trade ranging from the traditional theories and monetary policies of balance of payment (Cushman & Zha, 1997; Bonitsis & Malindretos, 2000; Frenkel & Johnson. 2013; Fontana 2019). The monetary policies of balance of payment was developed since the 1930s from the balance of payments theory. This approach is based on the methods of adopting the monetary strategy to ensuring a stable money economy and to solving the problem of balance of payment disequilibrium. The monetary approach emphasizes on three different assumptions or points. Firstly, the balance of payment (BOP) problems and the monetary problems cannot be separated as the BOP problem is one of the targets of the monetary authorities. Secondly, Money is not a flow but a stock, however, the analysis of the stock equilibrium conditions or adjustment process is adopted to review the monetary equilibrium and disequilibrium. Lastly, in a fixed-rate system of exchange rate, the exchange of goods and services for currencies of other nations, the expansion of domestic credit, and the exchange of domestic currencies for foreign currencies are done through the monetary authorities of nations. In the three scenarios, it is only the first that affects the BOP (Johnson, 1977).

The US. Monetary policymaking unit adopts the external strategy that the system adopting official dollars convertibility into gold from the fixed exchange rates of Bretton Woods (Eichengreen 2013; Obstfeld, 2019). The fixed exchange rate system was overtaken by the floating exchange rates and pure fiat money in U.S as a result of macroeconomic priorities of different U.S administration that were not in support of the fixed exchange rate system.

Another very important and influential contributor to the tradition of monetary policy and international trade are J. Marcus Fleming and colleague Robert Mundell in the early 1960s that extended the Keynesian Open-economic macroeconomic model in accordance to James Meade's idea of the Keynesian model. Meade's approaches to the fiscal and monetary policies is concerned primarily in knowing the effect of the internal and external balances saw the differences between the monetary and fiscal policies as not primary but secondary in determining the status of the capital account (Obstfeld, 2001; Boughton, 2003; Danladi et al., 2015) . The Mundel-Fleming

model is developed in accordance to the IS-LM model for an open economy. In the model a clear explanation of how the exchange rate is determined is done through integrating the capital and goods market into the foreign market. Therefore, it can be concluded that the Mundel-Fleming model is a macroeconomic model that combines the international trade and finance (Obstfeld, 2001; Boughton, 2003; Danladi et al., 2015). It is important to review existing literature on the effect of monetary policies on international trade.

Reviewing the related literature from the international perspective, authors such as Aristotelous (2001) uses a gravity equation specification to estimate the impact of exchange rate volatility on trade, and his empirical findings suggest that exchange rate volatility does not affect export volumes. Marquez and Schindler (2006) investigate the real exchange rate effects on the People's Republic of China's (PRC) share in world trade. The findings from the panel study suggest that appreciation of the renminbi lowers the PRC's share in aggregate exports and increases its share in aggregate imports with a smaller impact. Appuhamilage and Senanayake (2010) study the bilateral exports of Sri Lanka and the People's Republic of China's (PRC) and conclude that the depreciation of Sri Lankan's rupee against the Chinese renminbi has a significant positive effect on exports from Sri Lanka to the PRC, while the depreciation has negative effects on its imports from the People's Republic of China's (PRC). In the work of Huchet-Bourdon and Korinek (2011), they find that exports are more sensitive to changes in real effective exchange rate (REER) levels than their volatility and the effect is more pronounced in the agriculture sector exports.

Thorbecke and Kato (2011) investigate the effect of the Japanese exchange rate on exports, basically on consumption with goods composition. Their estimates suggest that an appreciation of the Japanese yen leads to a reduction in consumption exports of Japan. Alessandro (2013) investigates the effect of exchange rate misalignment which is the difference between the observed real effective exchange rate (REER) and that rate adjusted for the Balassa-Samuelson effect. After adopting a simple panel analysis, their results confirmed that undervaluation results in the promotion of exports and the restriction of imports. Hooy, Law, and Chan (2015) also investigate the impact of the Chinese renminbi on the exports of the ASEAN as a major trade partners in the global supply chains of the People's Republic of China. They used sector-level data in their study, and the results point to the significant positive impact of real exchange rate depreciation on exports of high-technology and medium-technology final and intermediate goods. Hossein & Bahram (2015) studied the impact of monetary and fiscal policies on the trade balance of Iran for the period 1979-2012 by employing an Autoregressive technique and vector error correction method (VECM). The results obtained from the study show that monetary and fiscal policies impact negatively on the balance of payments in the long term.

However, some studies have also been conducted relating to Nigeria. Authors such as Chukuigwe and Abili (2008) investigated the impact of monetary and fiscal policies on non-oil exports in Nigeria for the period 1974-2003 through the application of ordinary least squares (OLS) estimation method. The study shows that both interest rate and exchange rate have a negative influence on nonoil exports, while budget deficits harmed non-oil exports of Nigeria.Onyeiwu (2012) examined the impact of monetary policy on the Nigerian economy using ordinary least square (OLS) technique to analyze data for the period 1981-2008. The result shows that monetary policy through money supply exerts a positive impact on gross domestic product (GDP) growth and balance of payment while the results revealed that money supply exerts a negative influence on inflation rate in the economy. Anthony, Lekan, and Bosco (2013) examine the effect of monetary policy on Nigeria's payments balance stability for the period from 1980 to 2010. The research employed the method of OLS in the analysis and finds that interest rate and supply of money have a significant and positive impact on the payments balance position of Nigeria.

Danmola and Olateju (2013) investigate the influence of monetary policy on the components of the current account from 1970 to 2010 in Nigeria through the applications of Johansson Cointegration,

error correction model (ECM), and ordinary least square (OLS) technique. The results indicate evidence of a long-run relationship between money supply and the components of the current account employed in the country. The study also revealed that money supply has positive influence on all the variables, while exchange rate influenced them negatively. The study finds that money supply has a significant effect on imports, exports, and industrial output in Nigeria. Imoughele and Ismaila (2015) investigate the effect of monetary policy on balance of payment in Nigeria for the period 1986–2013 using error correction model (ECM). The study shows that exchange rate, credit to the private sector, and money supply are the key determinants of balance of payments in Nigeria. Hence, the study concluded that monetary policies and implementation capacity are crucial to the growth of the Nigerian economy and that monetary policy variables are very special in the determination of the provision of interest rate to the private sector that produces for export which will have a spillover effect on balance of payment and economic growth. Udude (2015) examines the effect of monetary policy on balance of payment in Nigeria for the period 1980–2010 using Ordinary Least Squares (OLS) method and Johansen technique. The variables employed in the study include the balance of payments, interest rate, money supply, exchange rate, and gross domestic product. The data were obtained from the Central Bank of Nigeria (CBN) publications. The study showed evidence of a long-run relationship among the variables. Similarly, the results indicated that money supply and exchange rate had a positive impact on the balance of payments in Nigeria while interest rate and gross domestic product (GDP) had a negative influence on the balance of payments in Nigeria.

Chen et al. (2017) adopt the global vector error-correction model (GVECM) to review and compare the unconventional monetary policy of the domestic and cross-border effects of both Euro area and the US for 24 advanced and emerging countries. The study established a stronger domestic and international impacts for US unconventional monetary policy compared to euro area non-standard measures. The study also find the presence of varying responses for emerging economies by adopting the monetary policy, exchange rate pressures, and credit growth measures, and a differing cross-border transmission channel strength for US and euro policies to emerging economies.

The literature has enjoyed very few studies conducted to examine the impact of monetary policy on international trade, especially in Nigeria. Most of the studies are not recent, and simple regression analysis were mostly used as a methodology to analyze the available data (Danmola & Olateju, 2013). Most of the studies did not also emphasize on the effects of monetary policy tools such as interest rate and exchange rates on trade either in the long-run or in the short-run. The monetary transmission mechanisms behind the monetary policy effects on trade were neglected (Miranda-Agrippino, Nenova, & Rey, 2020; Danmola & Olateju, 2013). Therefore, this study is an improvement on other studies carried out on the topic under study.

3. Methodology

The theoretical framework that will be used in the course of this study is the Mundel-Fleming model. However the Mundel Flaming model in relation to the analysis above and in accordance to Danladi et al., (2015), and Adeyemi, & Ajibola,(2019) can be stated in the equation below where interest rate is responsible for the equilibrum of the money and good markets:

$$\text{IS curve is} \quad Y = C(Y - T) + I(r^*) + G + NX(\varepsilon) \tag{1.1}$$

$$e = \frac{(1 + i)E^e}{1 + i^*} \tag{1.2}$$

$$\varepsilon = \frac{ep}{P^*} \tag{1.3}$$

$$r = i - E\pi \tag{1.4}$$

Increase in rate of interest or lower income or GDP results to lower demand for money or money demand. The r^* determines the interest rates in the world and strongly depends on the exchange rate. The Mundell- Flaming model holds that the real exchange rate and nominal exchange rate are the same as it is assumed that the price level at home and abroad are fixed. From the equations above, Y is the income or GDP, C stands for consumption, I is investments, M is importts, T is tax. and X represents exports.

The first equation (1.1) depicts the equilibrium that exist in the goods market and it is the total income or the GDP. The equation 1.2 shows the foreign exchange market equilibrium, and the equation 1.3 defines the real exchange rate and equation 1.4 represents the Fisher's equation which shows the relationship that exist between the expected inflation, real interest rate, and the nominal interest rate. The combination of the four equations narrates the relationship that exists among income (Y), real interest rate (r), nominal interest rates (e)), and the real exchange rate ε).

Fleming (1962) argued against the monetary policy that it is only effective for the floating exchange rate and showed how the fiscal policy is also effective with the floating exchange rate. The argument is based on Keynesian expenditure (IS-LM) model of a small open economy when carrying out a comparative static analysis of the economy. Mundel was also of the view that monetary and fiscal policies are more useful to ensure internal balance by adopting the flexible and fixed exchange rate system but more with greater advantage with the monetary policies and in a situation of perfect capital mobility the fiscal policy will not be useful in ensuring internal balances. (Mundel, 1960; Mundel 1968; Fleming, 1962; Boughton, 2003).Generally the Mundell- Flaming mopdel implies that the effectivenivess of any of the economic policies whether fiscal or monetary policies to achieve a desired macroeconomic objective is dependeent on the type of exchange system being adopted.

The identification restriction of the SVEC is similar to the SVAR but by decomposing the identification into three different components of which two are for long-run restriction. Firstly, assume that all the variables are $I(1)$, in a model of K endogenous variables, there are$r(r < K)$ possible cointegrating vectors and this implies that there is/are $k^*(k^* = K - r)$ permanent shock(s) and r temporary or transitory shock(s). The column(s) corresponding to the transitory shock(s) is/are restricted to be zero and it represents for k^* in nt restrictions. Given the transitory shocks, the corresponding zero columns implies k^*r independent restrictions only. $k^*(k^* - 1)/2$ additional restrictions are needed to strictly identify the permanent shocks .

King et al (1991) stress that $r(r-1)/2$ additional contemporaneous restrictions are needed to identify the transitory shocks. The sum of these restrictions is identical to the SVAR way of identification. Together these are a total of $k^*r + k^*(k^* - 1)/2 + r(r - 1)/2 = K(K - 1)/2$restrictions. Within this framework, we identify four types of underlying disturbances, respectively a trade, aggregate demand (spending), exchange rate, and monetary policy shocks; = (, , ,),. In this study a long-run vector for trade is assumed. Following the above descriptions, $K = 4, r = 1, k^* = K - r = 3, k^*r = 3, k^*(k^*1)/2 = 3, r(r - 1)/2 = 0$. The contemporaneous ($B$) and long-run ($\Xi B$) restrictions used in this study is presented below;

$$B = \begin{bmatrix} * & * & * & * \\ 0 & * & * & * \\ 0 & 0 & * & * \\ * & * & * & * \end{bmatrix}, \Xi B = \begin{bmatrix} * & * & * & 0 \\ * & * & * & 0 \\ * & * & * & 0 \\ * & * & * & 0 \end{bmatrix} \tag{1.5}$$

The last column in ΞB matrix corresponds to the transitory shock attributed to the interest rate, and the other first three columns are permanent shocks to trade, price, and exchange rate respectively. The three additional zero restrictions are however imposed on the contemporaneous matrix B to separate the trade shock from the aggregate demand shock.

The SVEC model described above is estimated with monthly historical data on trade, consumer price index, exchange rates, and interest rates covering the periods of January 2008 to December

2019, and is sourced from the CBN statistical database. Total trade is measured in billion Naira units, the price is the consumer price index, the interest rate is measured as the prime lending rate, and the exchange rate is the relative price of the dollar to naira

4. Data Analysis and Interpretations

Table 1. Descriptive statistics

	Mean	SD	CV	J – B	Pairwise correlation			
Trade	10402.51	2943.31	0.28	5.05*	1			
Interest rate	0.96	0.63	0.66	125.12***	–0.13	1		
CPI	167.63	64.26	0.38	12.11***	–0.36***	0.01	1	
Exchange rate	233.47	103.56	0.44	18.88***	–0.61***	0.14	0 .88***	1

Source: Authors computation *** p < 0.001; ** p < 0.01; * p < 0.05

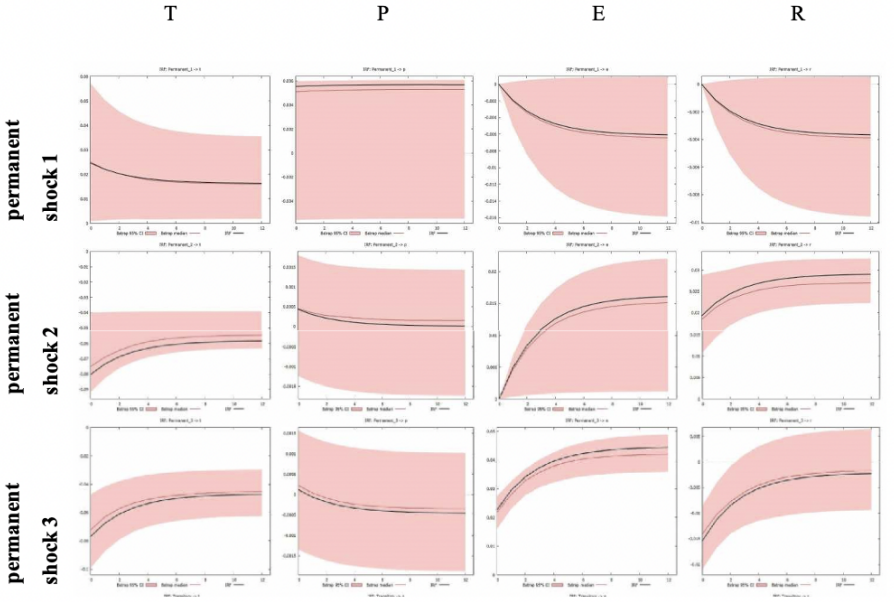
Table 1 shows the descriptive statistics for trade, interest rate, consumer price index, and exchange rate respectively. The first column shows the mean values for the variables and is all positive. The second column shows the standard deviations while the third column shows the coefficient of variation which shows the relative dispersion of the variables. It can be deduced from the coefficient of variation that trade has little variation than the other variables follows by the consumer price index. A high degree of volatility in interest rate is predicted by the coefficient of variation. The Jarque-Bera probability values in the fourth column are significant; this signifies that none of the variables follows a normal distribution. The last segment of the table shows the pairwise correlation between the variables. It can be seen that the interest rate, consumer price index, and exchange rate correlate negatively with trade but insignificant with the interest rate. Whereas for interest rate, consumer price index, and exchange rate correlate positively with it but are insignificant. A high degree of significant positive correlation exists between the consumer price index and exchange rate; this suggests that the appreciation of the dollar against the domestic currency will have a negative effect by reducing the purchasing power of the domestic consumer. In another word, depreciation of the naira in the international market will bring about a rise in the prices of domestic goods and services. This finding is consistent with (Momodu, & Akani, 2016; Anagun, 2022)

Table 2. Long-run and adjustment coefficients

	Variables			
	t	P	E	R
β	1	-0.77 * * *	1.10 * * *	1.38 * * *
		(-5.297)	-0.093 * * *	-0.056 * *
α	-0.127 * *	0.002	(8.360)	(3.847)
	(-2.073)	(0.848)	(-5.487)	(-3.807)

Table 2 shows the long-run and adjustment coefficients. From the long-run and adjustment coefficient result, it is shown that if price increases by one percent, the average value of trade goes up by 0.77% in the long-run. Abolagba, et al (1996), Adubi, and Okunmadewa, (1999), and Akanni, et al. (2008) affirm the positive relationships between domestic prices and foreign trade. The result also shows that the depreciation of the domestic currency by a value equivalent to one percent reduces trade by 1.10% on the average in the long-run. In consistent with the result of the study, Kalyoncu et al., 2009 and Ogundipe et al., 2013 also found that devaluation of currency reduces trade. Likewise, if the interest rate is raised by one percent, the average value of trade goes down by

1.38% in the long-run. The result is in line with aprori expectation that interest rate usually has a negative influence on trade volume and consistent with results of Ng et al., (2008) and Danladi et al., (2015). The alpha row shows the speed of adjustment coefficients towards the long-run path. It can be seen from the table that the long-run trade equation contributes significantly to the short-run movements of trade, exchange rates, and interest rates respectively. As such, the contemporaneous change in trade is about 12.7%, which implies that about 12.7% error is corrected within a year of any deviation from the long-run trade equilibrium. The contemporaneous change in price does not respond to deviation from the long-run trade equilibrium, and therefore has a weak exogenous effect on it. For exchange rate, contemporaneous change in it is below 9.3% of any deviation from the long-run trade equilibrium and for interest rate, it is below 5.6% of any deviation from the long-run trade equilibrium respectively.



Source: Authors computation

Figure 1. SVECM impulse response

The respective columns show the response of trade, price, exchange rate and interest rate to the shocks to trade price, exchange rate and interest rate accordingly in the respective rows as discussed in the methodology section. In the first column, it can be seen that the immediate effect of trade shocks on trade is positive and significant. It can also be seen from the figure that the immediate effect of aggregate demand shock to price on trade is negative and significant. Likewise, the contemporaneous effect of exchange rate shock on trade is negative and significant. However, the immediate response of trade to monetary policy shock to the interest rate on trade positive and significant. The responses of price to the first three shocks are found to be insignificant; however, the immediate response of price to monetary policy shock is negative and significant. The response of the exchange rate to trade shock is found to be insignificant. The immediate response of exchange rate to aggregate demand shock is zero but the lag effect is positive and significant. Also, the contemporaneous effects of the exchange rate and monetary policy shocks on the exchange rate are positive and significant. Similar to the exchange rate, the response of interest rate to trade shock is found to be insignificant. As depicted in the figure, interest rate responds positively and significantly to the aggregate demand

shock on the immediate effect. However, the response of interest rate to exchange ate shock is only significant for the first three months. Interest rate is found to respond positively to monetary policy shocks.

Table 3. SVECM forecast error variance decomposition

	Proportions of forecast error in t			
	Accounted for by;			
Forecast horizon	T	p	E	R
1	0.04	0.46	0.42	0.07
4	0.04	0.50	0.41	0.04
8	0.04	0.52	0.40	0.03
12	0.05	0.54	0.40	0.02
	Proportions of forecast error in p			
	Accounted for by;			
Forecast horizon	T	p	E	R
1	0.98	0.01	0.00	0.01
4	0.99	0.00	0.00	0.01
8	0.99	0.00	0.00	0.00
12	0.99	0.00	0.00	0.00
	Proportions of forecast error in e			
	Accounted for by;			
Forecast horizon	T	p	E	R
1	0.00	0.00	0.48	0.52
4	0.01	0.04	0.76	0.19
8	0.01	0.08	0.83	0.08
12	0.01	0.09	0.85	0.05
	Proportions of forecast error in r			
	Accounted for by;			
Forecast horizon	T	p	E	R
1	0.00	0.46	0.29	0.25
4	0.00	0.71	0.16	0.12
8	0.01	0.84	0.09	0.06
12	0.01	0.89	0.06	0.04

Source: Authors computation

Table 3 above shows the SVECM forecast error variance decomposition of the variables. It is easily seen that trade shocks initially contributed about 4% of the variation in trade while there was a slight increase to about 5% at the end of the 12th period. It can also be seen that aggregate demand shocks initially contributed about 46% of the variation in trade while there was an increase to about 50% in the 4th period before an eventual marginal increase to 54% at the end of the 12h period. The initial contribution of exchange rate shocks to variation in trade is about 42% and slightly decreases to about 41% in the 4th period before an eventual marginal decrease to 40% at the end of the 12th period. Likewise, the initial contribution of monetary policy shock to variation in trade is about 7% and slightly decreases to about 4% in the 4th period before an eventual marginal decrease to 2% at the end of the 12th period. In consistent with result of this study Fratzscher et al., (2009) find a substantial impact of monetary policy shocks on trade balance in United states, although not of the same magnitude as 100 basis flows reduces trade by !% and explains about 20-25 % variation in trade.

This is evident from the table as the variation in the domestic price is majorly influenced by trading activities as almost the variations in price over the horizons are caused by the trade shocks. Exchange rate variation is majorly caused by its shock; it accounts for about 48% initially and 85% at the end of the 12th period. Trade and price shocks have zero accounts in trade variation on the impact and their overtime effects account for just 10% by the end of the 12th period. However, monetary policy shocks initially contributed about 52% of the variation in exchange rate while there was a very sharp decrease to about 19% in the 4th period before an eventual drastically decrease to 5% at the end of the 12th period. Adeoye and Saibu (2014) also find that the variation in the monetary policy is responsible for the variation in exchange rate in Nigeria. One intriguing result in the table is that the forecast error variance decomposition reveals that the major variation in interest rate is caused by the aggregate demand shock of price. In essence, trade shock has zero accounts in interest rate variation in the first and the fourth periods but later contributed a very small amount of 1% in the 12th period. Aggregate demand shock initially contributed about 46% of the variation in interest rate while there was an increase to about 71% in the 4th period before an eventual sharp increase to 89% at the end of the 12h period. Exchange rate shocks initially contributed about 29% of the variation in interest rate while there was a very sharp decrease to about 16% in the 4th period before an eventual drastically decrease to 6% at the end of the 12th period. Likewise, monetary policy shock initially contributed about 25% of the variation in interest rate while there was a very sharp decrease to about 12% in the 4th period before an eventual drastically decrease to 4% at the end of the 12th period.

5. Conclusion and Policy Recommendations

Several studies have been conducted on trade, this study explicitly take into account several dynamics such as the long-run impact analysis, impulse response and forecast error variance decomposition from an identified structural vector error model. From the long-run and adjustment coefficient result, it is evident that a rise in domestic price brings about a rise in the volume of international trade. In this case, two scenarios are likely to occur. First, a rise in domestic price brings about a rise in import but below the export. On the other hand, a rise in domestic price brings about an equal proportional rise in export and import. The result also shows that loosing of naira power against dollar discourages trade in the long-run. Also, charging of one percent additional rate of interest will drastically reduce international trade in the long-run; domestic producers are forced to either move out to countries with a low-interest rate or rather cut productions. The findings show that the impact of monetary policy shock on international trade in Nigeria is at best minimal. Specifically, the results of the impulse response functions and variance decomposition analysis to a large extent confirmed that monetary policy shock is only able to explain a small proportion of the forecast error variance of international trade. The monetary policy shock, as revealed by variance decomposition, accounted for less than 5% of the variations in trade. The most striking finding is how the aggregate demand and exchange rate shocks explain a larger proportion (94%) of the forecast error variance of international trade in Nigeria. This study thus finds evidence of a muted effect of monetary policy shock on international trade in Nigeria.

Biographical Notes

Oyebanji Julius Ibitoye is an astute researcher at the prestigious North-West University, Potchefstroom, South Africa. He received a PhD in Economics at Nelson Mandela University, South Africa (2018), a master's in Economic analysis (2014) at University of Limerick, Ireland, a master's in Business Administration from Ekiti State University and a bachelor's in Economics from Lagos State University, Nigeria. He is a peer-review member of UK Research and Innovation. He is a senior lecturer at the Department of Economics, Federal University at Oye-Ekiti and authored several international journal articles and conference proceedings. His research covers Trade, Development and Renewable Energy Economics.

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Conflicts of interest

The authors declare no conflict of interest.

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6. Appendix

The Experimental procedure and Instruction

The monthly historical data on trade, consumer price index, exchange rates, and interest were sourced from the Central Bank of Nigeria statistical database for the period 2008-2019. First, the variables were described statistically using Eviews 10 and their log-transformed are checked for unit root also with Eviews 10 econometrics package. The variables were transformed into log form for a better interpretation of elasticity and also to reduce the level of variability in the data. The ADF unit root test results were achieved using Eviews 10 with various data generating assumptions shows that all the variables are I(1). The variables were then tested for cointegration with an underlying VAR (1) using the Johansen method in Eviews 10. The subsequent analyses were performed with the JMulTi and Gretl software due to their capabilities to handle a SVEC model; the SVEC model package by Sven Schreiber can be downloaded from the Gretl on-server. The long-run elasticities and the structural impulse response result were produced by the Gretl software while the SVEC forecast error variance decomposition result was produced by the JMulTi software. Although, the two produced the same result but the SVEC forecast error variance decomposition produced by Gretl are mainly graphs. So, the table for the SVEC forecast error variance decomposition result was copied from the JMulTi software.