The external sector shocks and macroeconomics in Nigeria

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Abstracts

The study examines the relationship between some key macroeconomic indicators in Nigeria and the external sector. During the period under review, it was discovered that crude oil had a lion's share of Nigeria's export earnings and the international demand for the country's non-oil exports was unimpressive due to the development of synthetic alternatives, discriminative tariffs and new entrants in the global market (Central Bank of Nigeria, 2008). Consequently, most of the research on this topic hinged their framework on shocks from the oil sector (see Lukman and Olomola, 2016). In contemporary times, however, the contribution of crude oil to Nigeria's gross domestic product has been dwindling. As at 2019, the entire oil and gas industry contributed less than 10% of Nigeria's gross domestic product (Central Bank of Nigeria (CBN), 2019). There was the need to examine the external sector from a more comprehensive approach and framework. Therefore, this study evaluated the impact of shocks from Nigeria's terms of trade and major foreign stock market index on macroeconomics in Nigeria. The methodology adopted for this study is the vector autoregressive technique, impulse response function and the error variance decomposition method. The findings show that the gross domestic product, price level and interest rate respond strongly in the short run (1-2 years), gradually fluctuates in the medium term (3-5 years) and become stable in the long run (6-10 years) due to shocks from the Dow Jones index and Nigeria's terms of trade. Thus, intervention policies should focus on mitigating the impact of external sector shocks on macroeconomics in the short and medium terms when the impact is enormous.

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1. Introduction

The external sector performance of any economy reflects the economic transactions between the residents of an economy and the rest of the world. The sector can be in equilibrium or disequilibrium (surplus or deficit). A deficit outcome represents a situation where receipts are insufficient to accommodate payments, while a surplus position reflects a situation where receipts are in excess of out payments. Anything that throws the external sector performance into imbalance or disequilibrium constitute a shock and this shock could be favorable or unfavorable. An ideal external sector is one that is stable and in equilibrium over time (Jhingan, 2010). Equilibrium is achieved when external receipts and payments are equal, the exchange rate is stable and external reserves are adequate. However, in more practical terms, such a perfect system rarely exists. Apart from the balance of payment, other major

indicators of external sector performance are exchange rate, external reserves and external debt. The efficient management of these aggregates is critical in ensuring a stable balance of payment.

Nigeria's major exports in the pre-1960s and early 1970s were non-oil agricultural produce. Oil exports began in 1958 and over the years, the proportion of crude oil exports in total exports had increased remarkably to become the dominant export commodity. During 1970-1985, crude oil exports accounted for about 93 per cent of total exports; it increased to 96 per cent in 1986-1998. Conversely, the share of non-oil exports in total export declined from an average of 7 per cent from 1970-1985 to 4 per cent between 1986 and 1998 and dropped further to 2.4 per cent from 1999-2006 (CBN, 2008). Within the non-oil exports' category, cocoa accounted for the largest share. In the 1970s, cocoa exports as a proportion of total non-oil exports averaged 61.1 per cent. From 1986-1998, its share declined to about 30 per cent but increased slightly averaging about 45 per cent between 1986 and 1987 due to the liberalization of trade and exchange regimes (CBN, 2006). As of 2019, the non-oil exports' performance, however, remained largely unimpressive, even though it expanded to include non-traditional commodities such as fish and shrimps, cotton yarn, pineapples, etc. In the manufacturing sub-sector, exports were soaps, textiles, pharmaceuticals and beverages. While the non-oil export's sector expanded, though slowly, a regrettable development was the disappearance of some traditional exports such as palm oil, groundnut, ginger, and hides and skins (CBN, 2019). Ironically, Nigeria that was a major exporter of palm oil in the 1960s had become a major importer of the commodity. Although part of the reasons for this development may be traced to increased local consumption, it is doubtful if production itself had been adequate due to the low level of domestic production caused by low technological base and infrastructural bottlenecks. In addition, the international demand for non-oil products remained low due to the development of synthetic alternatives, discriminatory tariffs and the new entrants into the international commodity market (CBN, 2019). Manufacturing exports have become low implying that there had been no significant shift from the primary to the industrial sector.

In more recent times, the contribution of the agricultural and service sectors to Nigeria's gross domestic product was overwhelming. In 2019, for instance, the gross domestic product (GDP) of Nigeria was N144, 210.49 trillion. Of this amount, the oil and gas industry contributed about N12, 549.22 trillion, the agricultural sector made N31, 904.14 trillion while the service sector's share of the GDP was N72, 426.66 trillion. This implied that the oil and gas industry contributed about 8.7% of Nigeria's gross domestic product, the agricultural sector had 22.1% and the service sector earmarked 50.2% (CBN, 2019). Given these statistics, there was the need for researchers (in Nigeria) to start perceiving the external sector from a broader view as the earnings from crude oil constituted less than 10% of the nation's GDP. Unfortunately, prominent research on the external sector and macroeconomics in Nigeria hinged their framework on crude oil earnings as the prime mover of the external sector (see Lukman et. al., 2016). This study, thus, fills the vacuum of previous research by taking a comprehensive and robust view of the external sector as crude oil contributed less than 10% of Nigeria's gross domestic products. This was what informed the study's examination of the country's terms of trade which comprised the oil and gas sector as well as other vital sectors of international importance. Generally, the study aims to find out whether there are shocks from the external sectors of Nigeria and the extent to which these shocks (if any) affect macroeconomic variables in the country. Additionally, major stock market index is integrated into the framework to decipher its impact (if any) in the short, medium and long terms on macroeconomic variables in Nigeria.

Nigeria's external reserves over the past had been tilted in favor of one convertible currency. In the early 1960s and 1970s, the pound sterling was the prominent external reserve currency; however, from the 1980s, the United States (US) dollar became the dominant currency. Nigeria's external reserves at end of 1980 were US$5,462 million. Due to the poor economic performance of the Structural Adjustment Programme (SAP) era, the external reserves depleted continuously particularly from the late 1980s to mid-1990s. At US$2,386.6 million in 1986, it rose marginally to US$3,047.62 million in 1989. By 1990, it was

US$4,541.45 million. Although the reserves dropped from 1992 to 1993, it rose gradually to US$7,222.2 million by the end of 1997, due to favorable external position. The external reserves dwindled to US$5,450 million in 1999 but later rose to US$10,415.6 million in 2001. Following severe shock witnessed in the external sector, the external reserves fell to US$7,467.8 million in 2003, however it rose to US$28,280 million in 2005 and this was attributable to the improved performance of the oil sector (CBN, 2006). After banking consolidation, the CBN reached a decision to allow deposit money banks to partner with foreign reputable management concern in order to increase earnings from investment of the external reserves. Consequently, by the end of December 2007, the external reserves had increased to US$51.33 million from US$42.29 million earmarked in 2006. In 2008, the external reserves rose to more than US$60 billion but fell to about US$48 billion in 2009. This declining trend continued in 2010 with a record of US$42,382.49 million, US$ 26, 990 million in 2016 and US$38, 092 million in 2019 (CBN, 2019).

2. Literature Review

2.1 The Structure of Nigeria's External Sector

The structure of the external sector has been relatively unchanged since the 1960s. For instance, the export sector has been characterised by the dominance of one export commodity-oil. According to the Central Bank of Nigeria (CBN) (1979), palm oil was the dominant exporting commodity in the sixteenth century into the nineteenth century. From 1900, rubber, timber, cocoa, groundnut and columbite started featuring in the list of cash crops in Nigeria. Other primary agricultural commodities that were exported into the early 1970s were cocoa and groundnuts. A drift occurred following the oil price shock in the international market in the mid-1970s, following which crude oil export dominated the external sector. The import structure of the external sector had not shown any significant shifts over the years, as capital goods and raw materials remained the bulk of total imports. The current account was persistently in deficit from 1955 when imports exceeded exports by N43 million. The deficit widened over the years to N139 million with the growth of imports to N431.8 million and exports to N331.2 million in 1960.This deficit was a reflection of the unimpressive performance of the service and income account. The overall balance of payments (BOP) was financed in the early years by draw-down in reserves and accumulation of external debt arrears. However, in 2000-2007, the overall balance of payment's position showed remarkable improvement recording surpluses following another positive oil price shock (CBN, 2008). In 2010, the overall balance of payment deficit represented 6.0 percent of the gross domestic product (GDP) while the current account surplus narrowed from 8.0 percent of GDP in 2009 to 1.5 percent. The surplus in capital and financial account reduced by 6.1 percentage point to 1.8 percent of GDP in 2010.These developments, notwithstanding, there was a rebound in the oil sector, occasioned by remarkable improvements in crude oil production and international prices. The resurgence was driven by renewed oil demand by Nigeria's major trading partners as a result of global recovery as well as the relative stability of the oil-rich Niger Delta region (CBN, 2018).

The debt profile of the country showed that the economy was largely under-borrowed from 1960s to late 1970s. In the 1980s, the external sector was under pressure partly because of Nigeria's external debt overhang and from the decline in foreign exchange receipts. A turn-around occurred in 2002 when a series of carefully orchestrated economic reforms, positive terms of trade's shock occasioned by sustained high international crude oil price as well as fiscal prudence by the government which moderated massive outflows from the economy. The strong economic fundamentals and commitments to continue with reforms under the National Economic Empowerment Development Strategy (NEEDS) earned the country external debt forgiveness which culminated in the total exit from the Paris Club creditors in 2006 and the London Club of creditors in 2007 (CBN, 2008). In 2015, the stock of national debt went on the increase. For instance, external debt was US$ 10.72 billion in 2015. In 2016, this debt stock rose US$ 11.41 billion and

later increased to US$18.91 billion in 2017, US$ 25.27 billion in 2018 and US$ 26.94 billion in 2019 (CBN, 2019).

The directional flow of Nigeria's exports showed that prior to the 1970s, the United Kingdom (UK) was the main importer of Nigeria's scheduled agricultural produce dominated commodity exports. With the commercial exploitation of crude petroleum that became the major export commodity in volumes and values, the United State of America became the major importer of Nigeria's crude oil, followed by Western Europe, with France, Germany, Netherlands, and Italy as leading importers. This development resulted in significantly low volume of trade between Nigeria and Eastern Europe as well as Africa. From 1999 to 2007, the direction of crude oil exports remained unchanged. The foreign trade statistics in 2007 showed that America had retained the dominant position followed by the Western Europe (CBN, 2008). The share of Africa in Nigeria's trade remained low and unstable due to non-complementarities of goods. In recent times, the share of the US on Nigeria's crude oil import had started to dwindle, given the discovery of oil, it's preservation as well as technological advancement in the former country (CBN, 2018).

The direction of imports had a semblance of exports as industrialised countries accounted for 58.3 per cent in 2007, an increase of 0.7 percentage points over 2006. In 2010, available data (CBN, 2010) revealed that industrialized countries remained the dominant source of Nigeria's import and accounted for 35.0 percent of the aggregate. This was followed by Asia (excluding Japan) with a share of 30.7 percent while others accounted for the remainder. On country basis, China accounted for the highest share of 16.9 percent, followed by the US, UK, India and Germany with 9.9, 5.0, 4.8 and 4.6 percent respectively. Further analysis revealed that imports from Africa as a group recorded the lowest share of import in Nigeria. This import trend still holds currently as China tops the list of countries that Nigeria sourced her imports. The US, UK and India also ranked high as sources of Nigeria's imports (CBN, 2019).

On the movement of exchange rate, from an average exchange rate of N0.8938/US$1 in 1985, the naira exchange rate depreciated by 55.9 per cent to N2.0206/US$1 in 1986. The continued pressure on the foreign exchange market which informed the adoption of a market based foreign exchange regime led to further depreciation of the naira exchange rate to an average of N4.0179/US$1 in 1987. During this period, the parallel exchange rate averaged N5.5500/US$1, showing a premium of 38.1 per cent. By 1989, the pressure on the foreign exchange market intensified, reflecting a shortfall in foreign exchange supply and excess liquidity in the financial system. Thus, the official rate averaged N7.3916/US$1 in 1989 whilst the exchange rates at the bureau-de-change and the parallel market were N10.1340/US$1 and N10.545/US$1, respectively (CBN, 2008). Thus, the BDC and parallel market premium expanded to 37.1 and 42.7 per cent, respectively. With the large and growing premium, the official exchange rate became exponentially overvalued, thus putting increased pressure on the official exchange rate. Although, it depreciated in 1993 to N22.0468/US$1, the other rates depreciated faster such that by 1996, the parallel market premium increased to 281.7 per cent from 64.6 per cent in 1993. However, the relative stability in the Autonomous Foreign Exchange Market (AFEM) in 1997 and 1998 brought down the premium to 3.6 and 4.1 per cent respectively. Prior to the introduction of the Inter-bank Foreign Exchange Market (IFEM) in 1999, the average exchange rate at the AFEM was N91.80 to a dollar between January and October 1999. After the commencement of IFEM operations on October 25, 1999, the exchange rate of the naira depreciated to N97.42/US dollar in December 1999. It further depreciated to N111.94 to a dollar in 2001. In order to stem the depletion of external reserves and realign the exchange rate of the naira, the Dutch Auction System (DAS) of foreign exchange management was re-introduced in July 2002 and by the end of December in this same year, the official exchange rate depreciated by 0.07 per cent to N120.97/US$1. The premium between Official and Bureau de Change (BDC) and parallel market narrowed from 18.3 per cent in 2001 to 13.5 per cent in 2002. In 2005, the foreign exchange market received a boost as the exchange rate appreciated by 1.0 and 2.7 per cent over the level at end 2004 to N132.2 and N128.65 per dollar in 2005 and

2006, respectively. This was as a result of a combination of factors which included among others, the moderation in the demand pressure at the foreign exchange market owing to the non-accommodating monetary policy stance of the CBN, prudent fiscal policy measures adopted by the government and improvement in the capital flow (CBN, 2006). The CBN further liberalised the foreign exchange market in 2006 with the introduction of Wholesale DAS (WDAS) to deepen the market and closed the wide premium. Consequently, many parallel market operators were brought into the BDC segment. The naira exchange rate stabilised and, for the first time in two decades of foreign exchange management, the official and parallel market converged in July 2006 and at end-December 2006, the premium marginally fell short of the internationally acceptable limit of 5.0 per cent by 0.08 per cent. In 2007, the average exchange rate of the naira under the WDAS segment of the foreign exchange market appreciated by 2.2 per cent over the level in the preceding year to N125.83 per dollar as against N128.65 per dollar in 2006. Similarly, at the Inter-bank and BDC segments, the naira appreciated by 2.3 and 7.6 per cent to N125.75 and N127.41 per dollar, over their levels in the preceding period, respectively. The average exchange rate of the naira in all segments of the market appreciated throughout the year. In 2008, the exchange rate of the naira against the dollar depreciated at N130.75/US$1 from what was recorded in the preceding year (CBN, 2008). The average exchange rate of the naira fell to N148.5/US$1 in 2009 while in 2010, it was in the neighborhood of N150.3/US$1. In 2016, the official exchange rate was N305 = US$ 1. In 2017, it rose to N307 = US$ 1 and as of April 2021, traded at about N381.25 = US$ 1 (CBN, 2019).

The bulk of Nigeria's external reserves were held in the British pound sterling (given our ties with our former colonial ruler) between 1960 and 1975. From 1976-1980, the Dutch mark (as a per cent of currency position of reserves) rose significantly because of our perceived need to diversify but from 1981, the United States dollar became the dominant currency for liquidity and safety reason. By January 1999, the Dutch mark and French franc ceased to exist as they became part of the Euro, the common currency for the Euro zone (see CBN, 2008).

2.2 Empirical Review

Otto (2003) found that exogenous increased in the terms of trade faced by a small open economy leads to improvement in such a country's trade balance.

Lukman and Olomola (2016) examined the impact of oil price shocks and macroeconomic shocks from developed trading partners (the US, EU, China and Japan) on Nigeria's macroeconomic performance. The study found that oil price shock had direct impact on Nigeria's gross domestic product and the real exchange rate, but inflation and short-term interest rate did not respond quickly to the oil price shock.

Hoffmaister and Roldos (1997) examined business cycles in Asia and Latin America. The study found that trade balance contributed a relatively smaller portion of macroeconomic fluctuations in these regions.

3. Methodology

3.1 Methodological Review

Otto (2003) examined the relationship between trade balance and shocks in the terms of trade for a large number of open economies using the vector autoregressive model. The model made use of the impulse response function (IRF) to analyse whether there was any systematic pattern in the responses of trade balance to the terms of trade's shock

There had been growing research program examining the link between domestic economic activities and trade shocks. Deaton and Miller (1996) employed VAR and Hoffmaister and Roldos (1997) made use of structural VAR model in small open economy. While the former study concluded that trade shock played important role in driving macroeconomic fluctuations in the concern, the latter found that trade disturbances accounted for only a small fraction of this variation.

Lukman and Olomola (2016) adopted a Global Vector Auto-Regression (GVAR) model to estimate the relationship between external sector shock and macroeconomics in Nigeria. The GVAR consisted of the US, European Union, China, Japan and Nigeria (as reference country). The study sourced its data from the World Bank.

3.2. Model Specification

This study makes use of the vector autoregressive (VAR) model to analyse the impact of the external sector shocks on macroeconomics in Nigeria. The research focuses on terms of trade shocks and flucuations in major foreign stock market index. Macroeconomics in Nigeria is represented by domestic interest rate, inflation and the gross domestic product. Sim (1980) proposed a multi-equation model called the Vector Autoregressive (VAR) model. The general form of the VAR model can be written as

$X_t = A_1X_{t-1} + A_2X_{t-2} + \ldots\ldots\ldots\ldots + A_kX_{t-k} + \Psi D_t + e_t,\ t = 1,2\ldots\ldots\ldots T$ ..... (1)

X_t = vector containing each of the n variables of the model viz $X_t = [X_{1t}, X_{2t}, \ldots\ldots\ldots, X_{nt}]$. This includes terms of trade, interest rate, major foreign stock market index, domestic price level and the gross domestic product.

D_t = vector of deterministic components such as intercepts, linear tend, dummy variables or non-stochastic regressors.

Ψ = vector of variables D_t parameters exclusive of zero elements.

A_i = Matrices of parameters of lagged variables of X_t, not inclusive of zero elements.

e_t = vector of stationary random disturbances (like $e_t = e_{1t}, e_{2t}, \ldots\ldots\ldots, e_{nt}$).

This e_t must have independent Gaussian distribution with zero average and variance $\sum$. Also, error term from particular equation must not exhibits serial correlation. That is,

$Cov\ (e_{it}, e_{jt}) \neq 0$.

It follows from equation (1) that the vector autoregressive model is a multi-equation model in which each variable is explained not only by its own lag but also the lags of other explained variables. The structural VAR model is of the form.

$B_{xt} = \Gamma_0 Dt + \Gamma_1 X_{t-1} + \Gamma_2 X_{t-2} + \ldots. + \Gamma_k X_{t-k} + \varepsilon_t$ ..... (2)

The equation (2) is multiplied by matrix B^{-1} to give

$x_t = B^{-1}\Gamma_0 Dt + B^{-1}\Gamma_1 X_{t-1} + B^{-1}\Gamma_2 X_{t-2} + \ldots. + B^{-1}\Gamma_k X_{t-k} + B^{-1}\varepsilon_t$ ..... (3)

The equation (3) implies that

$\Psi = B^{-1}\Gamma_0$ ..... 3 (i)

$A_i = B^{-1}\Gamma_1$ ..... 3 (ii)

$e_t = B^{-1}\varepsilon_t$ .....3 (iii)

Equation 3 (i) – (iii) translates to

$X_t = \Psi D_t + A_1X_{t-1} + A_2X_{t-2} \ldots\ldots\ldots\ldots A_kX_{t-k} + e_t$ ..... (4)

The model represented by equation (1) can be converted to a structural form by orthogonal innovations such that its random components are not correlated. This can be achieved by utilising the relationship between variance-covariance matrices of equation (1) and (2).

$\sum\varepsilon_t = B\sum\varepsilon B^T$

Where :

$\sum\varepsilon_t$ = diagonal matrix of variance- covariance of model represented in equation (2) disturbances.

$\sum\varepsilon$ = matrix of variance-covariance of equation (1) distubances.

3.2.1 Impulse Response Function

The process of analysing the effect of known random shock on the whole system is called the Impulse Response Function (IRF). In modelling an IRF, the study relies on the fact that VAR models can be like AR models, and it is presented as a vector moving average in satisfying certain criteria. A representation of the vector moving average for equation (1) when k=1 is in the form

$X_t = \mu + \sum_{i=0}^{\infty} A_1^i e_{t-1}$ ..... (5)

Where μ is the vector of average values of variables included in the VAR model.

Since the relationship between the traditional classical VAR model as shown by equation (1) and the structural form is given by $e_i = B^{-1} \varepsilon_t$, the variable X_t using random term of the structural model is represented as

$X_t = \mu + \sum_{i=0}^{\infty} A_1^i B^{-1} e_{t-1}$ ..... (6)

Or

$X_t = \mu + \sum_{i=0}^{\infty} \emptyset_i \varepsilon_{t-1}$ ..... (7)

Where $\emptyset_i = A_1^i B^{-1}$.

The coefficients $\emptyset_i$ can be used to generate the effects of random shocks $\varepsilon_t$on time paths of variable X_t.

To find the individual values of impulse response function, there is the need to know the values of parameters of matrix *B*. This is calculated based on equation (1) estimates. However, the parameter estimates of the structural model cannot be calculated without imposing additional restrictions. This identification problem is solved by imposing as many zero restrictions as the number of differences between known and unknown parameter estimates of matrix *B*. In a general model with *n* variable, it is necessary to impose $\frac{(n^2-n)}{2}$ zero restrictions in the model. Quite often than not, matrix *B* is limited to a triangular matrix that results in a decomposition of equation (1) residuals termed Choleski decomposition. This decomposition method imposes certain assumptions on the structural relationship between variables (variable ordering).

3.2.2 The Variance Decomposition of the Model

Recalling that $\emptyset_i = A_1^i B^{-1}$in equation (7) of the specified model, it can be used to build forecast of variables. For example, in the first future period, a forecast of variables included in the vector X_t is written as $X_{t+1} = \mu + \sum_{i=0}^{\infty} \emptyset \varepsilon_{t+1-i}$ while forecast error is given as

$X_{t+1} E_t X_{t+1} = \emptyset_0 \varepsilon_{t+1}$ ..... (8)

Where E_t is the expected value of the variables included in the vector X_t. The forecast of n periods ahead is usually stated as

$X_{t+n} = \mu + \sum_{i=0}^{\infty} \emptyset_i \varepsilon_{t+n-i}$ ..... (9)

with an error of $X_{t+n} = \mu + \sum_{i=0}^{\infty} \emptyset_i \varepsilon_{t+n-i}$

If the vector X_t is in this form $X_t = [W_t \ Y_t \ Z_t]$, the forecast error of the first variable is written as

$W_{t+n} - E_t W_{t+n} = \emptyset_{11}(0) \varepsilon_{wt+n} + \emptyset_{11}(1) \varepsilon_{wt+n-1} + \ldots\ldots + \emptyset_{11}(n-1) \varepsilon_{wt+1} +$

$\emptyset_{12}(0) \varepsilon_{yt+n} + \emptyset_{12}(1) \varepsilon_{yt+n-1} + \ldots\ldots + \emptyset_{12}(n-1) \varepsilon_{yt+1} +$

$\emptyset_{13}(0) \varepsilon_{st+n} + \emptyset_{13}(1) \varepsilon_{st+n-1} + \ldots\ldots + \emptyset_{13}(n-1) \varepsilon_{st+1} +$ ..... (10)

The error variance of variable W_{t+n} forecast is represented as

$\delta_w(n)^2 = \delta_w^2 [\emptyset_{11}(0)^2 + \emptyset_{11}(1)^2 + \ldots\ldots\ldots + \emptyset_{11}(n-1)^2] + \delta_y^2 [\emptyset_{12}(0)^2 + \emptyset_{12}(1)^2 + \ldots\ldots\ldots +$

$\emptyset_{12}(n-1)^2] + \delta_s^2[\emptyset_{13}(0)^2 + \emptyset_{13}(1)^2 + \ldots\ldots + \emptyset_{13}(n-1)^2]$ ………………………………… (11)

The variance of the stochastic term rises as n increases, given that all the values of $\emptyset_{jk}(i)^2$ are positive. The error variance of the forecast can also be decomposed based on successive shocks like ε_w, ε_y and ε_s. In equation (11), $\delta_w(n)^2$ can be separated, given the shares of shocks in ε_w, ε_y and ε_s in the variance such that

$$\frac{\delta_w^2\,[\emptyset 11(0)2 + \emptyset 11(1)2 + \cdots \ldots\ldots + \emptyset 11(n-1)2]}{\delta_w(n)^2} \quad \ldots\ldots \quad (12)$$

$$\frac{\delta_y^2[\emptyset 12(0)2 + \emptyset 12(1)2 + \cdots \ldots\ldots + \emptyset 12(n-1)2}{\delta w(n)2} \quad \ldots\ldots \quad (13)$$

$$\frac{\delta_s^2[\emptyset 13(0)2 + \emptyset 13(1)2 + \cdots \ldots\ldots + \emptyset 13(n-1)2]}{\delta w(n)2} \quad \ldots\ldots \quad (14)$$

When the forecasted error variance is decomposed, it shows the shares of other variables of interest in explaining the principal variable being analysed.

3.3 Scope of Study

The study sourced its data from the World Bank and the Central Bank of Nigeria. The scope of the data is between the periods of 2001 to 2019. The gross domestic product, inflation and interest rate are used to represent macroeconomics in Nigeria while the terms of trade of Nigeria with her trading partners and major foreign stock market index mirror the external sector.

4.1 Findings

The Table 1 of the group unit root test gives a probability value of more than 5 per cent, using the Levin, Lin and Chu t* test. This shows that the study should reject the null hypothesis that opines that unit root exists across the variables. This finding is corroborated by the individual unit root test of Im., Pesaran and Shin W-statistics with a probability value of 0.0724 which is greater than 5 per cent. All these suggest that the series are stationary; that is, the gross domestic product of Nigeria, price level, interest rates, changes in the terms of trade between Nigeria and her trading partners and the average annual change in major foreign stock market index have constant mean, variance and standard deviation. This result is validated by the general VAR stability result in Table 2. Since all the roots of the modulus are far from 1, this strongly suggests the stability of the entire series and model. Consequently, there is no need to estimate whether or not the series exhibit long run relationship. In the first, second and third equations of the system of equations estimates in Table 6 in the appendices, the Durbin Watson (DW) statistics are 2.267 which fall within the threshold of 2. This shows that there is no serial correlation in the models. This is also seen in the fourth equation in which the term of trade is the dependent variable. Here, the DW statistics is 1.997. The Table 4 shows the normality test estimates and the joint probability of Jarque Bera is 98.30 which is greater than the 5% threshold.

The optimal lag length of the model is unveiled using the Akaike Information Criteria (AIC) and Schwarz Information Criteria (SIC). Both criteria concur that the maximum lag length of the study is lag 2. This is shown in Table 3 where the values of the AIC and SIC with asterisks fall in lag 2 period.

To find out which of the variables is significant in the models, Table 6 which is the system of equation models shows that all the variables in equation (1) consisting of the GDP (as dependent variable) and other endogenous variables like inflation, interest rate, terms of trade and the annual changes of Dow Jones index are statistically significant in explaining the former (GDP) at lag 1 and 2 periods. This means that changes in these variables will cause significant variations in the gross domestic product of Nigeria. In equation (2) and (3) of the system of equation model, none of the endogenous variables significantly

affects the price level and interest rate variables respectively. A similar trend occurs in equation (4) where the terms of trade of Nigeria with her trading partners stand as the dependent variable in Table 6. However, changes in all the itemized endogenous variables in equation (5) have significant effects on annual variations in Dow Jones index. Alternatively, disturbances or shocks in Dow Jones performances stimulate significant impacts on domestic interest rates, price level, terms of trade and the gross domestic products of Nigeria.

The vector autoregressive (VAR) estimates in Table 5 are usually explained by the impulse response function. This is shown in Table 7, and it indicates the extent to which the variable of interest viz Nigeria's gross domestic product, interest rate, and inflation respond to a one standard deviation drift in major stock market index (in abroad) and the terms of trade (of Nigeria) with her trading partners. The first graph on the list of multiple graphs in Table 7 shows how the gross domestic product of Nigeria responds to a one (1) standard deviation or shock in Dow Jones which represents a major foreign stock market index. When this disturbance occurs, the gross domestic product (GDP) of Nigeria initially starts from a steady state in period one and rises exponentially until it gets to its peak in period two and afterwards, it declines sharply to a minimum in period three. The GDP is stable between the third and tenth periods.

In the second graph of the first row, a one standard deviation disturbance in the terms of trade of Nigeria causes its gross domestic product to gradually soar from period one until it gets to the second period. After the second period, the rate of increase in the GDP plummets up to the third period. Similar to the first graph that shows the response of the gross domestic product to shock in Dow Jones index, the GDP becomes stable as a result of shock in the terms of trade between the third and tenth periods.

The first graph of the second row shows the response of inflation to shocks in Dow Jones. The former depicts the domestic price level in Nigeria while the latter represents disturbances from the external sector. Given a one standard deviation or shock in Dow Jones, inflation decreases sharply from a steady state in the first year to a negative zone in the graph. This trend lingers till the second year after which the response variable starts to rise until the third year. It is noticeable that the rate of growth in inflation dwindles between the third and fourth year. The price level gets to a steady state in the fourth year and increases above this level. However, inflation declines between the fourth and fifth year even though it is still in the positive region of the graph and later gets to a steady state between the fifth and tenth year.

The next graph on the second row indicates the response of inflation in Nigeria to shock in the country's terms of trade with her trading partners. A one standard deviation drift of the latter causes inflation to rise astronomically from the first year and gets to a climax in the second year. This movement is antithetical of the response of inflation due to a one standard deviation of Dow Jones where the response variable exhibits decreasing motion in the negative region of the graph between the first and second year. In the current graph, inflation dwindles after the second year in the positive zone of the graph. In the third year, the price level drifts further to the negative axis and, however, gradually increases up to the fourth year. Inflation gets to a steady state between the fourth and tenth year.

In the first graph of the last row in Table 7, the response of interest rate to a one standard deviation or shock in Dow Jones is astronomical from the first to the second year. Interest rate gets to its peak in the second year and falls afterward to a steady state prior to the third year. All these movements in interest rate occur in the positive axis of the graph. Soon before the third year, interest rate falls into the negative axis and this trend continues in the third year. After this period, the response variable starts to rise from the negative axis to the positive region of the graph. This scenario thrives until the fourth year when interest rate becomes stable and remain in this position till the tenth year.

The response of interest rate to a one standard deviation or shock in Nigeria's terms of trade is within the positive region of the second graph of the last row in Table 7. Initially, interest rate soars exponentially due to the shock in the terms of trade. This movement continues till the second year. The rate of increase

in interest rate declines between the second and third year. Interest rate rises to its peak in the third year and falls strongly until the fourth year. The response variable becomes stable and above the steady state from the fourth to the tenth year.

From the variance decomposition estimates in Table 8 in the appendices, the first table which represents the variance decomposition the gross domestic product (GDP) shows that the main variable (GDP) has strong forecasting power on itself in the first year. Its value is 100%. This means that other variables like interest rates, inflation, disturbances in Dow Jones and the terms of trade are strongly exogenous in forecasting the gross domestic product. In the middle of the selected forecasting years (fifth year), the predictive ability of GDP (on itself) falls marginally to 98.8%. Inflation has 51.3% of the less than 1.2% of the unaccounted forecasting strength of the main variable, the estimate of interest rate is 41.6%, Dow Jones is 19.1% and the terms of trade shock is 0.016%. Therefore, other variables' contribution to the predictive ability of the gross domestic product is weak in the fifth year. The forecasting trend is similar on the tenth year as the gross domestic product remains within the 98% estimate whilst the values of interest rates, inflation, Dow Jones and the terms of trade shocks grow marginally from the estimates in previous years. When we compare these values to the vector autoregressive (VAR) estimates in Table 5, the gross domestic product in lag 1 and lag 2 positively and significantly influence the gross domestic product in the current period as its *t* values are 16.1960 and 4.0717 respectively. Thus, the gross domestic product significantly predicts itself, meaning that it is strongly endogenous. The lags (1 and 2) of other variables like interest rates, inflation, disturbances in Dow Jones and the terms of trade are insignificants in predicting the gross domestic product. The *t* values of these variables fall below the threshold of 2.

The second table (of Table 8) shows the variance decomposition of inflation. In the first year, inflation has strong forecasting power of itself as it earmarks 98.33%. Apart from the gross domestic product that has a predictive strength of 1.67% of the main variable (inflation), other variables like interest rate, shocks in Dow Jones and the terms of trade have contemporaneous influence in predicting the price level in the first year. On the fifth year, inflation can forecast itself by 98.14%, implying that its forecasting strength dwindles marginally from what it obtains in the first year. Other variables of interest marginally increase their forecasting abilities of the price level. The gross domestic product is 1.71%, interest rate is 0.44%, annual change of Dow Jones earmarks 0.065% and the figure for the terms of trade is 0.04%. A similar trend in the predictive strength of inflation occurs on the tenth year. Thus, inflation displays strong forecasting strength of itself both in the short, medium and long term. Other variables' influence is strongly exogenous.

The third table (on Table 8) represents the variance decomposition of interest rate. In the first year, interest rate has a forecasting strength of 92.6% of itself, implying that it is strongly endogenous. Inflation and the gross domestic product could forecast interest rate by 2.12% and 5.28% respectively. Shocks in Dow Jones and the terms of trade of Nigeria with her trading partners have contemporaneous forecasting abilities of interest rate in the first period. In the fifth year, interest rates can forecast itself by 89.55%, meaning that there is a fall in its predictive power relative to what it obtains in the first year. The predictive estimates of the gross domestic product and inflation soar to 8.15% and 2.26% respectively. Disturbances in major foreign stock market index and the terms of trade of Nigeria are negligible or have exogenous forecasting strength of the main variable (interest rate). In the tenth year, the predictive power of interest rate deepens further to 86.17%, implying relative strong forecasting abilities of other variables with respect to interest rate: GDP 11.57%; inflation 2.21%; shocks in Dow Jones, 0.33%, and the terms of trade shock, 0.016%.

4.2 Conclusion

Findings from the study indicate that the gross domestic product responds positively and strongly from shocks in major foreign stock market index (Dow Jones) in the short run (1-2 years), decreases in the second and fourth year and become stable between the fourth and tenth years. In the case of disturbances from the terms of trade, the response of the gross domestic product is gradual and not spontaneous in the short run (1-2 years), the rate of growth is relatively slower between the third and fourth years and it becomes stable between the medium and long term (4-10 years). It is also seen from the error variance decomposition that the gross domestic product has strong forecasting ability (strongly endogenous) of itself in the short, medium and long run.

Inflation falls sharply as a result of shocks from Dow Jones whereas it rises strongly from shocks in the terms of trade at the initial level. This finding is tangential with that of Lukman and Olomola (2016) whose study found that inflation did not show immediate response to the external sector shocks (i.e oil price shock). In this study, the price level soars between the second and third year in the former shock (Dow Jones) but falls in the case of the latter (terms of trade). The rate of growth in inflation decreases between the third and fourth year from disturbances in the major foreign stock market index. Similarly, the price level runs into the deep (becomes negative) consequent on shocks from Nigeria's terms of trade between the third and fourth year. In both cases (shocks from Dow Jones and terms of trade), the growth in the price level is stable between the medium and long term. In terms of forecasting strength, inflation has stronger potential in the short, medium and long term. Generally, the influences of shocks from the external sector in predicting the growth in the price level is weakly endogenous.

Similarly, the response of interest rate as a result of shocks from both the major foreign stock market index and the term of trade rises exponentially at the initial level, falls between the second and fourth year and it is stable from the fourth and tenth years. The distinction in the response of interest rate is that it declines strongly into negativity as a result of disturbances from Dow jones between the mid part of the second and third year whereas it falls and remains positive between the second and fourth year because of shocks from the terms of trade of Nigeria. In comparison with earlier literature (Lukman and Olomola, 2016), interest rate's variable responds strongly in the short-term period irrespective of whether the shock metamorphoses from the terms of trade or major foreign stock market index. This finding is in sharp contrast with the cited literature whose empirics opined that interest rate did not show immediate response to the oil price shock. In this study, interest rate has relatively less forecasting potential of itself in the medium and long term. The share from shocks in Dow Jones index in predicting interest rate gradually becomes stronger in the medium and long term.

In sum, there is the need for policy makers to come up with efficient and effective policies that can mitigate the influence of shocks from major foreign stock market index and Nigeria's terms of trade especially in the short and medium term (1-5 years) as the impact of these disturbances equilibrates from the medium to long term (5-10 years). The monetary and fiscal policies will be very useful in this regard.

4.3 Limitation

The initial blueprint was for the study's scope to be inclusive of the year 2020. The external sector in the globe came to a halt in most part of this period as a result of the outbreak of Covid 19. This circumscribed the scope of the study.

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Appendices

Table 1. Stationarity Test
Series: GDP, INFLATION, INTEREST RATE,

TERMS OF TRADE SHOCK, DOW JONES SHOCK

Sample: 1 20
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	4.39130	1.0000	5	82
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.45841	0.0724	5	82
ADF - Fisher Chi-square	42.3411	0.0000	5	82
PP - Fisher Chi-square	43.4203	0.0000	5	82

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.
Source: Author's Calculation

Table 2. VAR stability condition

Root	Modulus
0.991969	0.991969
-0.189379	0.189379
3.21e-06 - 0.143425i	0.143425
3.21e-06 + 0.143425i	0.143425
0.003607 - 0.098171i	0.098237
0.003607 + 0.098171i	0.098237

-0.067458 - 0.019359i	0.070181
-0.067458 + 0.019359i	0.070181
0.041741 - 0.028977i	0.050813
0.041741 + 0.028977i	0.050813

Source: Author's Calculation

Table 3. Lag Order Selection Criteria
Endogenous variables: GDP, INFLATION, INTEREST RATE,TERMS OFTRADE SHOCK, SHOCK IN DOW JONES
Exogenous variables: C
Sample: 1 20

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-309.1223	NA	4.39e+18	57.11315	57.29401	56.99914
1	-222.9470	78.34119*	1.26e+14*	45.99036	47.07553	45.30631
2	1354.524	0.000000	NA	-236.2772*	-234.2877*	-237.5312*

Source: Author's Calculation

Table 4. VAR Normaliy Residual Test

Component	Skewness	Chi-sq	df	Prob.*
1	0.682736	0.854568	1	0.3553
2	0.361413	0.239469	1	0.6246
3	0.055816	0.005712	1	0.9398
4	-0.366372	0.246085	1	0.6198
5	0.601932	0.664257	1	0.4151
Joint		2.010090	5	0.8477

Component	Kurtosis	Chi-sq	df	Prob.
1	2.917779	0.003098	1	0.9556
2	2.270472	0.243930	1	0.6214
3	2.917275	0.003137	1	0.9553
4	2.864493	0.008416	1	0.9269
5	1.798141	0.662046	1	0.4158
Joint		0.920627	5	0.9687

Component	Jarque-Bera	df	Prob.

1	0.857666	2	0.6513
2	0.483399	2	0.7853
3	0.008848	2	0.9956
4	0.254501	2	0.8805
5	1.326303	2	0.5152
Joint	2.930718	10	0.9830

Source : Author's Calculation

Table 5. Bayesian VAR Estimates

	GDP	INFLATION	INTEREST RATE	SHOCKS IN TERMS OF TRADE	SHOCKS IN DOW JONES
GDP (-1)	0.799240	-1.07E-05	8.89E-05	-0.002592	0.000125
	(0.04935)	(6.3E-05)	(8.5E-05)	(0.01061)	(0.00032)
	[16.1960]	[-0.16987]	[1.04201]	[-0.24433]	[0.38984]
GDP (-2)	0.184085	1.51E-05	2.56E-05	-0.000650	3.47E-05
	(0.04521)	(5.8E-05)	(7.8E-05)	(0.00970)	(0.00029)
	[4.07173]	[0.26137]	[0.32903]	[-0.06706]	[0.11855]
INFLATION(-1)	56.52186	0.015270	0.043586	5.860074	0.260585
	(72.8124)	(0.09452)	(0.12676)	(15.7722)	(0.47598)
	[0.77627]	[0.16155]	[0.34383]	[0.37155]	[0.54747]
INFLATION (-2)	18.04938	-0.009947	-0.001400	-1.508235	-0.020939
	(37.9781)	(0.04934)	(0.06612)	(8.22658)	(0.24826)
	[0.47526]	[-0.20161]	[-0.02117]	[-0.18334]	[-0.08434]
INTEREST_RATE (-1)	49.06290	-0.002344	-0.012024	-2.275675	-0.098365
	(55.8720)	(0.07188)	(0.09822)	(12.1021)	(0.36522)
	[0.87813]	[-0.03262]	[-0.12242]	[-0.18804]	[-0.26933]
INTEREST_RATE (-2)	2.146336	0.001359	-0.001722	0.072401	-0.022768
	(28.3265)	(0.03644)	(0.04981)	(6.13590)	(0.18517)
	[0.07577]	[0.03729]	[-0.03457]	[0.01180]	[-0.12296]
TERMS OF TRADE(-1)	0.067618	0.000153	4.35E-05	-0.016820	0.000232
	(0.44035)	(0.00057)	(0.00077)	(0.09628)	(0.00288)
	[0.15356]	[0.27001]	[0.05671]	[-0.17470]	[0.08074]
TERMS OF TRADE(-2)	0.019858	-1.47E-05	6.19E-05	-0.001282	0.000129
	(0.22628)	(0.00029)	(0.00039)	(0.04950)	(0.00148)
	[0.08776]	[-0.05066]	[0.15719]	[-0.02590]	[0.08739]

SHOCKS IN DOW JON. (-1)	11.03232	-0.007245	0.002868	-1.780475	-0.027291
	(14.5959)	(0.01878)	(0.02541)	(3.16165)	(0.09631)
	[0.75585]	[-0.38586]	[0.11286]	[-0.56315]	[-0.28337]
SHOCKS IN DOW JON. (-2)	-0.904608	-0.000439	-0.001605	0.106156	-0.009480
	(7.50135)	(0.00965)	(0.01306)	(1.62490)	(0.04952)
	[-0.12059]	[-0.04547]	[-0.12289]	[0.06533]	[-0.19142]
C	9643.277	11.95453	4.068131	496.5286	-5.628080
	(2334.87)	(3.00504)	(4.06333)	(505.534)	(15.2554)
	[4.13011]	[3.97816]	[1.00118]	[0.98219]	[-0.36892]
R-squared	0.990148	0.069130	0.585224	0.176846	0.160959
Sum sq. resids	79856983	100.8674	80.29682	2056918.	2364.580
F-statistic	0.000000	0.000000	0.000000	0.000000	0.000000
Mean dependent	79906.28	12.18273	12.40273	277.9091	6.677273

Table 6. System of Equation Estimates

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.738693	0.091320	8.089065	0.0013
C(2)	0.301826	0.097554	3.093939	0.0364
C(3)	-132.3832	27.25307	-4.857551	0.0083
C(4)	719.7222	80.86007	8.900835	0.0009
C(5)	170.1060	35.26852	4.823169	0.0085
C(6)	468.2995	22.16435	21.12850	0.0000
C(7)	-1.537771	0.371727	-4.136827	0.0144
C(8)	2.470323	0.117965	20.94107	0.0000
C(9)	-69.37413	7.293557	-9.511702	0.0007
C(10)	-145.4737	10.37103	-14.02693	0.0001
C(11)	-4323.514	205.0692	-21.08319	0.0000
C(12)	-0.002688	0.001181	-2.274965	0.0853
C(13)	0.002794	0.001262	2.213492	0.0913
C(14)	0.194812	0.352590	0.552518	0.6100
C(15)	1.109714	1.046137	1.060773	0.3486
C(16)	0.013804	0.456291	0.030253	0.9773
C(17)	0.119753	0.286754	0.417617	0.6977
C(18)	2.98E-06	0.004809	0.000620	0.9995
C(19)	0.002363	0.001526	1.548392	0.1964
C(20)	-0.145155	0.094361	-1.538291	0.1988
C(21)	0.173201	0.134176	1.290845	0.2663
C(22)	9.444155	2.653108	3.559657	0.0236
C(23)	0.001237	0.003129	0.395147	0.7129
C(24)	-0.001201	0.003343	-0.359258	0.7376
C(25)	0.558437	0.933936	0.597940	0.5821

C(26)	-1.848571	2.770995	-0.667115	0.5412
C(27)	0.201207	1.208617	0.166477	0.8759
C(28)	0.141590	0.759550	0.186413	0.8612
C(29)	0.005581	0.012739	0.438148	0.6839
C(30)	0.002852	0.004043	0.705558	0.5194
C(31)	0.240667	0.249943	0.962889	0.3901
C(32)	-0.051716	0.355405	-0.145513	0.8913
C(33)	5.842087	7.027520	0.973613	0.3854
C(34)	-0.342578	NA	NA	NA
C(35)	0.349813	NA	NA	NA
C(36)	359.4155	NA	NA	NA
C(37)	125.2721	NA	NA	NA
C(38)	-178.9216	NA	NA	NA
C(39)	-257.7897	NA	NA	NA
C(40)	-0.711737	NA	NA	NA
C(41)	-1.664064	NA	NA	NA
C(42)	34.40334	NA	NA	NA
C(43)	102.1958	NA	NA	NA
C(44)	1516.020	NA	NA	NA
C(45)	0.011595	0.002701	4.292461	0.0127
C(46)	-0.011522	0.002886	-3.993001	0.0162
C(47)	-4.685289	0.806139	-5.812014	0.0044
C(48)	-6.854948	2.391820	-2.865997	0.0457
C(49)	4.118951	1.043234	3.948254	0.0168
C(50)	-0.219217	0.655616	-0.334369	0.7549
C(51)	-0.008433	0.010996	-0.766907	0.4859
C(52)	0.019357	0.003489	5.547274	0.0052
C(53)	-1.005215	0.215741	-4.659348	0.0096
C(54)	-2.956936	0.306772	-9.638862	0.0006
C(55)	22.62804	5.065894	3.730372	0.0203

Determinant residual covariance	0.000000

Equation: GDP__N_BILLION_ = C(1)*GDP__N_BILLION_(-1) + C(2)
*GDP__N_BILLION_(-2) + C(3)*INFLATION(-1) + C(4)*INFLATION(-2) +
C(5)*INTEREST_RATE__MPR_(-1) + C(6)*INTEREST_RATE__MPR_(
-2) + C(7)*TERMS_OF_TRADE(-1) + C(8)*TERMS_OF_TRADE(-2) +
C(9)*ANNUAL___CHANGE_OF_DOW_JONES(-1) + C(10)
*ANNUAL___CHANGE_OF_DOW_JONES(-2) + C(11)

Observations: 12

R-squared	0.999999	Mean dependent var	35264.97
Adjusted R-squared	0.999990	S.D. dependent var	32885.15
S.E. of regression	102.4258	Sum squared resid	10491.04
Durbin-Watson stat	2.267322		

Equation: INFLATION = C(12)*GDP__N_BILLION_(-1) + C(13)
*GDP__N_BILLION_(-2) + C(14)*INFLATION(-1) + C(15)*INFLATION(
-2) + C(16)*INTEREST_RATE__MPR_(-1) + C(17)*INTEREST_RATE__
MPR_(-2) + C(18)*TERMS_OF_TRADE(-1) + C(19)
*TERMS_OF_TRADE(-2) + C(20)*ANNUAL___CHANGE_OF_DOW_JO

NES(-1) + C(21)*ANNUAL___CHANGE_OF_DOW_JONES(-2) + C(22)

Observations: 12			
R-squared	0.983800	Mean dependent var	12.16583
Adjusted R-squared	0.821800	S.D. dependent var	3.139136
S.E. of regression	1.325146	Sum squared resid	1.756012
Durbin-Watson stat	2.267322		

Equation: INTEREST_RATE__MPR_ = C(23)*GDP__N_BILLION_(-1) + C(24)*GDP__N_BILLION_(-2) + C(25)*INFLATION(-1) + C(26) *INFLATION(-2) + C(27)*INTEREST_RATE__MPR_(-1) + C(28) *INTEREST_RATE__MPR_(-2) + C(29)*TERMS_OF_TRADE(-1) + C(30)*TERMS_OF_TRADE(-2) + C(31)*ANNUAL___CHANGE_OF_DOW_JONES(-1) + C(32)*ANNUAL___CHANGE_OF_DOW_JONES(-2) + C(33)

Observations: 12			
R-squared	0.936604	Mean dependent var	12.32750
Adjusted R-squared	0.302640	S.D. dependent var	4.203222
S.E. of regression	3.510031	Sum squared resid	12.32032
Durbin-Watson stat	2.267322		

Equation: TERMS_OF_TRADE = C(34)*GDP__N_BILLION_(-1) + C(35) *GDP__N_BILLION_(-2) + C(36)*INFLATION(-1) + C(37)*INFLATION(-2) + C(38)*INTEREST_RATE__MPR_(-1) + C(39)*INTEREST_RATE__ MPR_(-2) + C(40)*TERMS_OF_TRADE(-1) + C(41) *TERMS_OF_TRADE(-2) + C(42)*ANNUAL___CHANGE_OF_DOW_JONES(-1) + C(43)*ANNUAL___CHANGE_OF_DOW_JONES(-2) + C(44)

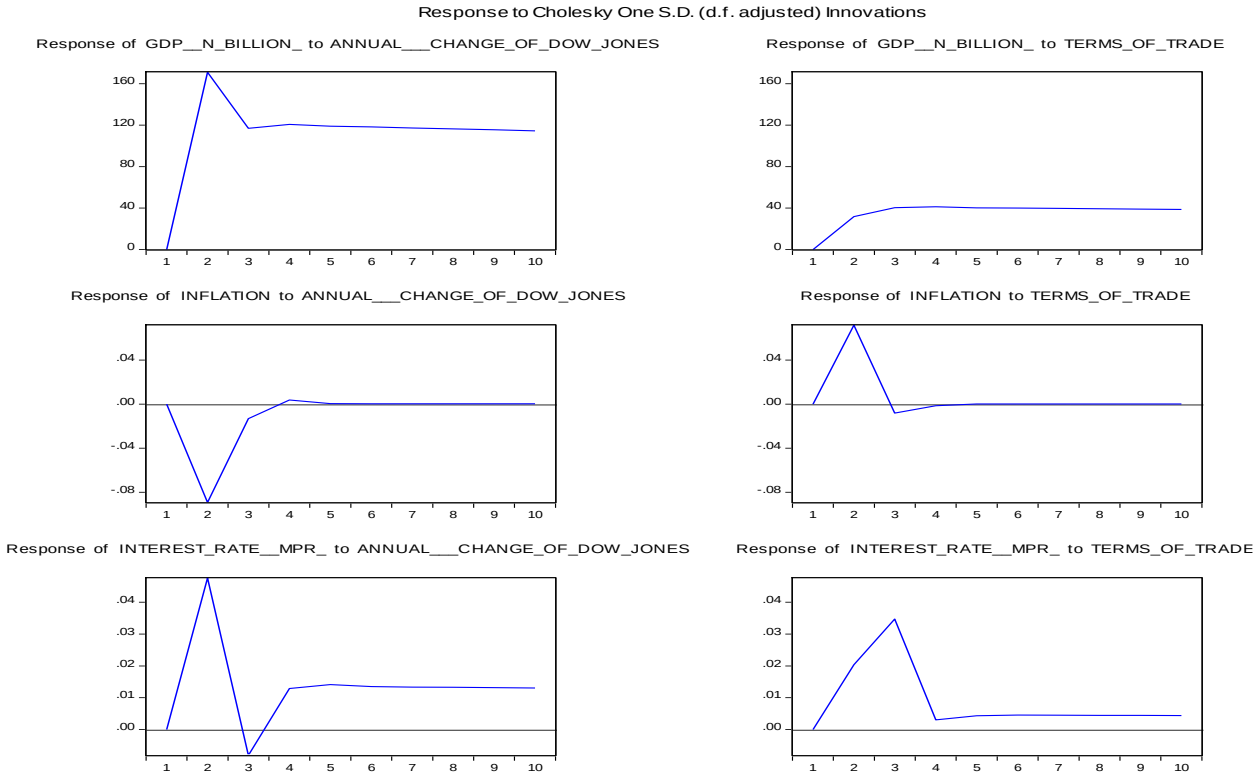
Observations: 11			
R-squared	1.000000	Mean dependent var	277.9091
S.D. dependent var	499.8825	Sum squared resid	5.74E-19
Durbin-Watson stat	1.996868		

Equation: ANNUAL___CHANGE_OF_DOW_JONES = C(45) *GDP__N_BILLION_(-1) + C(46)*GDP__N_BILLION_(-2) + C(47) *INFLATION(-1) + C(48)*INFLATION(-2) + C(49)*INTEREST_RATE__MPR_(-1) + C(50)*INTEREST_RATE__MPR_(-2) + C(51) *TERMS_OF_TRADE(-1) + C(52)*TERMS_OF_TRADE(-2) + C(53) *ANNUAL___CHANGE_OF_DOW_JONES(-1) + C(54) *ANNUAL___CHANGE_OF_DOW_JONES(-2) + C(55)

Observations: 12			
R-squared	0.996984	Mean dependent var	7.982500
Adjusted R-squared	0.966819	S.D. dependent var	16.63259
S.E. of regression	3.029728	Sum squared resid	9.179254
Durbin-Watson stat	2.267322		

Source: Author's Calculation

Table 7. The Impulse Response Function of the External Sector Shocks and Macroeconomics



Source: Author's Calculation

Table 8. The Variance Decomposition Estimates

Table 1. The Gross Domestic Product

Period	S.E.	GDP	INFLATION	INTEREST RATE	SHOCKS DOW JONES	TERMS OF INTRADE SHOCKS
1	3159.450	100.0000	0.000000	0.000000	0.000000	0.000000
2	4065.589	99.24127	0.232424	0.342954	0.177272	0.006077
3	4840.271	99.00375	0.427190	0.374341	0.183474	0.011241
4	5488.311	98.87995	0.513945	0.400553	0.191169	0.014387
5	6060.304	98.80300	0.569379	0.416023	0.195395	0.016202
6	6574.484	98.74995	0.607242	0.426881	0.198460	0.017464
7	7043.940	98.71134	0.634870	0.434742	0.200664	0.018381
8	7477.161	98.68197	0.655880	0.440728	0.202344	0.019080
9	7880.239	98.65887	0.672399	0.445434	0.203665	0.019629
10	8257.685	98.64024	0.685726	0.449230	0.204730	0.020072

Table 2. inflation

Period	S.E.	GDP	INFLATION	INTEREST RATE	SHOCKS DOW JONES	TERMS OF INTRADE SHOCKS

1	3.550834	1.667176	98.33282	0.000000	0.000000	0.000000
2	3.555029	1.700753	98.15166	0.043884	0.063032	0.040676
3	3.555348	1.704696	98.14582	0.043901	0.064385	0.041200
4	3.555361	1.705098	98.14515	0.044036	0.064501	0.041215
5	3.555369	1.705502	98.14474	0.044037	0.064502	0.041215
6	3.555376	1.705885	98.14436	0.044038	0.064503	0.041215
7	3.555383	1.706272	98.14397	0.044040	0.064503	0.041215
8	3.555390	1.706650	98.14359	0.044042	0.064504	0.041215
9	3.555397	1.707023	98.14321	0.044044	0.064504	0.041215
10	3.555404	1.707390	98.14284	0.044045	0.064505	0.041215

Table 3. Interest Rate

Period	S.E.	GDP	INFLATION	INTEREST RATE	SHOCKS DOW JONES	TERMS OF INTRADE SHOCKS
1	3.168139	5.277123	2.119559	92.60332	0.000000	0.000000
2	3.181504	5.841664	2.302806	91.82910	0.022326	0.004102
3	3.194981	6.615599	2.289445	91.05633	0.022772	0.015858
4	3.208612	7.395611	2.275721	90.28866	0.024195	0.015812
5	3.221969	8.148761	2.263569	89.54589	0.025920	0.015865
6	3.235034	8.876644	2.251983	88.82799	0.027452	0.015937
7	3.247841	9.581679	2.240726	88.13266	0.028930	0.016006
8	3.260394	10.26469	2.229818	87.45906	0.030364	0.016072
9	3.272699	10.92660	2.219248	86.80626	0.031755	0.016136
10	3.284763	11.56829	2.209001	86.17341	0.033102	0.016198

Source: Author's Calculation