Macroeconomic Volatility and Government Consumption Expenditure Implication for Public Welfare
A Dynamic Macroeconometric Stochastic Model

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Abstract

This paper addresses the effects of macroeconomic volatility on government consumption expenditure (GCE) in Nigeria well as the burdens and challenges it has been imposing on public welfare. Methodologically, a dynamic macroeconometric stochastic model was used to analysis the nature of the impacts, where GCE is presumed to depend upon changes in various indicators of macroeconomic performances. We empirically mode the relationship between GCE and the macroeconomy with a hybrid model that employs a reduced form coefficients of simultaneous equation models, to capture the dynamic interactions among the data and a structural economic model to describe the contemporaneous relationship between the variables. The Structural Auto-Regression (SVAR) process including the GCE, real exchange rate, general price level (inflation rate), unemployment rate and debt service obligation, is estimated over the period 1980-2008. The model ascertained the extent in which volatility of the macroeconomics does lead to a decline in GCE. We find that, the GCE response to structural one innovation appears to be greater in inflation than other endogenous and exogenous variables that is, an economic shock to inflation effect is stronger on the GCE at longer horizon. Also, inflation innovations play a larger role in explaining GCE forecast error variance in the short run than they do in the long run and this generates negative net effects on public welfare in the short run than long run.

Keywords: Macroeconomic volatility, GCE, Macroeconometric Stochastic Model, Nigeria

1. Introduction

Recent empirical evidence suggests that macroeconomic volatility reduces government consumption expenditure and this poses negative challenges on public welfare (Giovanni and Dublin, 2003). Over the past twenty years, dozens of scholars have explored the relationships between macroeconomic volatility and government consumption expenditure of national economies. Different methods of analysis have yielded different results, sometimes sharply different, sometimes modestly. This paper offers a review of both theoretical and empirical research and a discussion of its different findings. In fact, key macroeconomic variables such as government final consumption expenditure, real exchange rate, general price level (inflation), and unemployment rate and debt service obligations have witnessed profound fluctuations since 1980. Persistent volatility in these key macroeconomic variables could have severe welfare implications, thus inducing challenges for policy making, while, public welfare are affected indirectly through their relation with macroeconomic polices. Casual evidence of falling government consumption in the country can be glimpsed from rising incidence of mass unemployment, rising price of goods and services (inflation), high debt burden on the part of the government, unstable exchange rate, and among others.

It is being hypothesized that macroeconomic volatility lower government consumption expenditure level in an economy. But few studies exist yet on the dynamic effect of key macroeconomic volatility on government

consumption expenditure for an oil exporting country as Nigeria. However, most of these empirical studies carried out have focused on the static nature of macroeconomic volatility in economic growth, particularly the developed economies. Furthermore, existing studies have shown that no efforts have been made to distinguish between the shortest and long-run macroeconomic volatility as they affect welfare (Ferreira et al., 1999). So there is need to distinguish between the short – term and long-term effects to enable policy makers effectively address short-term immediate need of households as against their long-term aspirations, particularly in a country like Nigeria where resources are limited. This paper is an attempt to fill the gap by applying a dynamic macroeconometric stochastic regression model to capture the contemporaneous relationship between macroeconomic volatility and government consumption expenditure in Nigeria from 1980 – 2008. This paper is a time series static analysis of 29 years period, it is considered long enough to establish cyclical and secular relationships between the variables.

The present paper is motivated by the findings that it was not the macroeconomic volatility themselves but policy makers' response to them that caused decrease in consumption level in aggregate economic activity and affect public welfare. The main objective of this paper is to analyze the impacts of some key macroeconomic volatility on government consumption expenditure in Nigeria in relation to public welfare level and measure the magnitude of such impacts. In the empirical part of this paper, it focused attention on the effects of change in some critical macroeconomic variables on the level of consumption in Nigeria. Thus, structure of the paper is as follows. After, the introductory part, section 2 presents conceptual issues and macroeconomic trend in Nigeria. Section 3 provides the theoretical framework while, section 4 describes the possible consequences of macroeconomic volatility on government consumption and public welfare, while model specification and estimation strategy are describe in section 5. Section 6 discusses the empirical results in the study and section 7 looks at the policy implication while, section 8 concludes with a brief.

2. Conceptual Issues and Macroeconomic Trend in Nigeria

Macroeconomic volatility refers to a situation of rapid fluctuations and changes in the overall condition and in the critical macroeconomic variables in the economy. Such volatility can be measured in many dimensions; some of the key variables are price inflation, unemployment, exchange rate, real growth rate, monetary growth, and debt service obligations (Balke and Slottje, 1993). Macroeconomic volatility is a major constraint on development, making planning more problematic and investment more risky. A more stable macroeconomic environment would reduce management problems and improve the prospects of realistic planning for sustainable growth and development.

Inflation as a macroeconomic variable has received great attention in recent times. The concept of inflation has undergone considerable modification since it was first treated by the neo-classical economists. According to Haslag (1997), inflation is always and everywhere a monetary phenomenon; and can be produced only by a more rapid increase in quaintly of money than output". They regarded inflation "as a destroying disease born out of lack of monetary control whose result undermined the rules of business, creating havoc in the markets and financial ruin of even the products. Inflation's effect on economic activity, and ultimately on people's well-being, is a primary concern of monetary policymakers and has been the focus of much study. For instance, analysts have questioned whether a permanent change in the inflation rate raises or lowers the rate of economic growth.

Nigeria started experiencing inflation rates in the early 1960s with a rate 6.13 percent in 1961 and rose to 29.74 percent in 1963. In 1970, inflation rate was as low as 1.75 percent and rose to 13.53 and 33.93 percent in 1974 and 1975, respectively (CBN, 2008). The inflation in Nigeria ground early 1980s was a direct result of policies of Nigeria governments to stimulate a fast rate of economic growth and development. Throughout the early 1980s, the Nigerian economy continued to experience the problems of low domestic output high rate of inflation, unemployment, huge public debt and balance of payments disequilibrium (Siyanbola et al, 2005). In 1983 and 1984 inflation rates in Nigeria were 23.22 and 40.71 percent respectively, while, in 1985 and 1986, the rate reduced considerably which might not be unconnected to the structural adjustment programme of 1986, but it started increasing in 1987 and went as high as 56.04 percent in 1988. The inflation rate fluctuated between 1992 and 1995 giving the country the highest episode of inflation since independence. This upward trend in the domestic price level continued unabated till 1995 due largely to the huge and persistent government fiscal budget deficit financed largely by the Central Bank of Nigeria which resulted in excess liquidity in the system and increased domestic aggregate demand. The highest inflation rate recorded throughout the period was 44.81, 57.12, 57.03 and 72.81 percent in1992, 1993, 1994 and 1995, respectively, which was due to a number of factors, such as the initial substantial depreciation of the naira exchange rate and the lagged effect of upward adjustments in the prices of petroleum products in 1994. Inflation reduced to as low as 6.62 percent in 1999 and 6.94 percent in 2000, while in 2005, it rose 17.89 percent and fell to 11.60 percent in 2008 (CBN, 2008)

On the concept of unemployment, according to Aghion and Howitt (1994) and Blanchard (1999) "To be idle and to be poor have always been reproaches, and therefore every man endeavours with his utmost care hide his welfare from others, and his idleness from himself". In the view of Richiardi (2003), a man willing to work, and unable to find work, is perhaps the saddest sight that fortunes inequality exhibits under this sun". Unemployment is a major problem confronting most development capitalist economies, but also varies from one economy to another in accordance with the level of industrialization (Blanchard and Diamond, 1990). Unemployment rate by Nigeria concept is defined as the proportion of Labour Force who were available for work but did not work in the week preceding the survey period for at least 39 hours (The International Labour Organisation ILO definition which is based on One hour of work in a week) (NBS, 2006)

The unemployment rate in Nigeria has been erratic since 1981 and it has been relatively high. Between 1981 and 1985 the average rate of unemployment was 5.8 percent, while between 1986 and 1990 the average rate was 4.7 percent which shows a decrease rate of unemployment. In the 1990s the average fell to 3.2 percent, that is, between 1991 and 1999 and it rose to an average of 3.8 percent between 2000 and 2006 (NBS, 2006). On decomposition, unemployment rate slightly increased in 2005 at 11.9% compared to 2004 at 11.8% on the national level but while urban rate declined by 0.9% to 10.1% in 2005 from 11% in 2004, the rural rate rose from 12.1% in 2004 to 12.6% by 2005 and fell to 5.8 percent in 2007 (see NBS, 2007). According to CBN (1999), the indication that most unemployment intensified in 1995 could be traced to a number of factors.

On exchange rate concept, it can therefore be defined as the price of one country's currency in terms of another. It refers to the cost of exchanging one country's currency for others. It therefore, denotes the numerical value of the domestic currency of one country at any given time in relation to that of either countries with which it has trade links. The Nigeria economy is highly susceptible to exchange rate change because of the important department nature of its largely uncompetitive manufacturing industries. The average AFEM intervention rate which closed at 82.23 to a dollar in 1995 appreciated to 81.48 per dollar in 1996. The rate depreciated continuously to 81.98; 84.94 and 91.83 to a dollar in 1997, 1998, and 1999 respectively. The rate has been stabilized at 132.37 to a dollar in 2004. The rates in the Bureaux de change showed similar trend. At the Bureaux de change the rate closed at 83.15 per dollar in 1996 before depreciating continuously to 99.26 per dollar in 1999. The parallel market premium moved from 1.6 percent in 1996 to 3.2 percent in 1999. Meanwhile, the market determined exchange rate at the IFEM has remained within the pre-determined fluctuations bands. Between 2005 and 2007, exchange rate witnessed appreciation at 130.37 to a dollar in 2005 to 120.97 to a dollar in 2007. The rate depreciated a little, it moves from 120.97 to a dollar in 2007 to 121.90 to a dollar in 2008 (see CBN, 2008)

Considering the debt service ratios (ratios of debt service payments to exports of goods and services), they were generally insignificant and below 10%. In 1980 and 1981, the ratio of debt service to export earning was as low as 1.8, and 9.32%, respectively. Nigeria really did not experience any debt servicing difficulties until 1982. The debt servicing difficulties high began in 1982 continued unabated till 1993. The actual debt service ratio has been below 3% for about a decade. This has been because of the deliberate official policy, since 1986, of holding down disbursement on debts service 30% or less of earnings from export of goods and services. From 1982 the ratio shot up from 14.22 percent to 18.29% in 1986 and 29.62 percent in 1988 in an erratic manner. The ratio declined to 9.44% in 1992 and peaked at 37.06% in 1993. The period, 1983–1986 has been one of severe debt servicing difficulties to the extent that the country had to seek debt relief through restructuring. Debt servicing difficulties are also portrayed by other indicators. Accordingly, the actual debt services ratios averaged 15.59%, between 1980 and 1990; 10.19% between 1991 and 2008 and 6.78%, between 1999-2008 (CBN, 2008).

3. Theoretical Framework

From the modeling point of view, Giovanni and Juha (2007) paper, which titled "Public Infrastructures, Public Consumption and Welfare in a New-Open-Economy-Macro Model" augments a standard New Open Economy Macroeconomics (NOEM) model by introducing productive public infrastructures. The results show that a temporary increase in the domestic stock of public capital financed by a reduction in public consumption reduces domestic welfare in the short run because the temporary gains from higher productivity do not compensate domestic residents for the utility loss due to lower public consumption.

Giovanni and Juha (2007), analysis shows that a permanent increase in domestic public infrastructure financed by a reduction in public consumption is likely to be welfare enhancing for domestic residents, provided that the productivity of public capital is not too low and the weight of public consumption (compared to private consumption) in private utility not too high. However, since a negative net welfare impact cannot be ruled out, one policy implication is that governments should take into account household preferences with respect to public provision of goods and

services in deciding the composition of public spending. Governments should also carefully evaluate the impact of planned infrastructure projects on the productivity of the private sector before changing the public spending mix.

In the Giovanni and Juha (2007), a standard New Open Economy Macroeconomics (NOEM) model, Domestic households gain utility from private and public consumption and real balances. They also experience disutility from supplying labor. The domestic utility function is therefore given by

$$U_t = \sum_{s=t}^{\infty} \beta^{s-t} \left[\log C_s + \frac{\chi}{1-\varepsilon} \left(\frac{\mathrm{M}_s}{\mathrm{P}_s} \right)^{1-\varepsilon} - \frac{l_s(z)^2}{2} + \phi \log G_t^c \right] \tag{1}$$

where 0 <β<1 is the discount factor, C is a composite good representing private consumption and P_s is the price index associated with it. G_s^c represents public consumption. M_s denotes nominal money balances and l_s (z) s the household's supply of labor; ε>0 is the inverse of the consumption elasticity of money demand, and χ and φ are positive parameters.

The composite private consumption good is defined in the following equation as an aggregate across the individual goods produced by firms

$$C_t = \left[\int_0^1 c_t(z)^{\frac{\theta-1}{\theta}} dz \right]^{\frac{\theta}{\theta-1}} \tag{2}$$

where θ is the elasticity of substitution between any pair of individual goods. The associated price index is

$$P_t = \left[\int_0^n p_t(z)^{1-\theta} dz + \int_0^1 \left(E_t p_t^*(z) \right)^{1-\theta} dz \right]^{\frac{1}{1-\theta}} \tag{3}$$

Where $p_t(z)$ is the price of good z expressed in domestic currency, $p_t^*(z)$ is the foreign currency price of foreign good z and E is the exchange rate, defined as the price of the foreign currency in terms of the domestic currency.

The budget constraint of the domestic representative household is given by

$$M_t + \delta_t D_t = D_{t-1} + M_{t-1} + w_t l_t(z) - P_t C_t + \pi_t - P_t \tau_t \tag{4}$$

where D denotes household's holding of domestic currency denominated nominal bonds, which account for international shifts in wealth, δis the price of a bond (the inverse of one plus the nominal interest rate), w_t is the nominal wage paid to the household in a competitive labor market, π is the household's share of profits received by firms and τdenotes real lumpsum taxes paid to the government.

Given that bonds are denominated in domestic currency, the budget constraint of the foreign representative household is

$$M_t^* + \delta_t^* \frac{D_t^*}{E_t} = \frac{D_{t-1}^*}{E_t} + M_{t-1}^* + w_t^* l_t^*(z) - P_t^* C_t^* + \pi_t^* - P_{t\,t}^* \tau_t^* \tag{5}$$

where foreign variables are denoted by asterisks.

The first order conditions are given by

$$\delta_t P_{t+1} C_{t+1} + = \beta P_t C_t \tag{6}$$

$$\delta_t^* P_{t\,t+1}^* C_{t+1}^* E_{t+1} = \beta P_t^* C_t^* E_t \tag{7}$$

$$l_t = \frac{w_t}{C_t P_t} \tag{8}$$

$$l_t^* = \frac{w_t^*}{C_t^* P_t^*} \tag{9}$$

$$\frac{M_t}{P_t} = \left(\frac{\chi C_t}{1-\delta_t} \right)^{\frac{1}{\varepsilon}} \tag{10}$$

$$\frac{M_t^*}{P_t^*} = \left(\frac{\chi C_t^*}{1-\frac{\delta_t^* E_{t+1}}{E_t}} \right)^{\frac{1}{\varepsilon}} \tag{11}$$

Equations (6) and (7) are the Euler equations for optimal domestic and foreign consumption, respectively. Equations (8) and (9) are the domestic and foreign optimal labor supply equations, which equate the disutility of supplying an extra unit of labor with the marginal utility of the extra private consumption that can be bought due to the marginal increase in labor supply. Finally, equations (10) and (11) show that households' optimal money demand is an increasing function of private consumption and a decreasing function of the interest rate.

The government budget constraint, expressed in per-capita terms, is given by

$$G_t = \tau_t \frac{M_t - M_{t-1}}{P_t} \tag{12}$$

where total government spending G_t is distributed between public consumption G_t^c and public capital G_t^I, according to the formula $G_t = G_t^c + G_t^I$

Government consumption takes the same form as the private sector's consumption index and it is thus given by

$$G_t^c = \left[\int_0^1 g_t^c \left(z \right)^{\frac{\theta-1}{\theta}} dz \right]^{\frac{\theta}{\theta-1}} \tag{13}$$

An analogous index governs public capital spending. Government spending on public capital and consumption are assumed to follow a first-order autoregressive process described by the following equations

$$\hat{G}_t^I = \rho \hat{G}_{t-1}^I + \sigma_t^I \tag{14}$$

$$\hat{G}_t^c = \rho \hat{G}_{t-1}^c + \sigma_t^c \tag{15}$$

where ρ governs the persistence of a fiscal shock, σ σ^I I and σ^c C are unpredictable shifts in the components of government spending and the hat notation represents percentage deviations from the initial steady state.

4. Consequences of Macroeconomic Volatility on Public Welfare

Macroeconomic volatility as measured by inflation, exchange rate, debt service ratio and unemployment may affect level of welfare. For example, it is well known that the level of unemployment impacts the rate of welfare. An increase in unemployment will first impact those marginal low skill, low wage workers that are the prime candidates to fall into poverty (Deutsch and Silber, 2005). Fabiosa and Jensen (2002) explained that macroeconomic shock will have impact on the level of household welfare via low government consumption expenditure and Inflation may also affect measure of welfare if the income of low income families responds slowly to increases in the price level.

For example, Akerlof et al. (1996), Easterly and Fischer (1999), Amano and Mora (2008) suggests that one of the reasons for the vulnerability of those individuals with low incomes to inflation is because their incomes are typically defined in nominal terms and is usually net indexed to inflation. Therefore in times of high inflation, the incomes of the poor, ceteris paribus, tend to decrease in real terms. Moreover, at a different level, empirical evidence suggest that macroeconomic volatility affect the welfare of people through the returns on physical assets and capital gain or losses, changes in interest and bond prices, stock market crashes, falling real estate prices and inflation; all affect the income people who own these various types of assets. (Dalt and Ravallion, 1998). On return on physical assets and capital gain or losses, changes in interest rate and bond prices, stock market crashes, falling real estate prices, and inflation all affect the incomes of people who own these various types of assets. The non-poor are generally better able to protect

their living standards from inflationary shocks than the poor. Since independence, inflationary periods in Nigeria have resulted in temporarily higher welfare incidence, depth and severity (Daft and Ravillion, 1998; Tomori *et al*, 2005).

Relative price changes such as exchange rate depreciation or commodity price charges and policies (such as trade reforms, public sector price increases, and tax/subsidy charges) affect relative prices. This price charges alter the profitability of each sector, and affect relative wages and employment levels. The relative prices of consumer goods also charge with a further effect on real incomes. Strong predictions are possible in some special cases. For example, a real devaluation (such as one induced by a fiscal contraction) implies that the prices of the goods that are traded must rise relative to those of non-traded goods. If the poor are not suppliers of traded (non-traded) goods or tends to work in industries producing them, then they will gain (lose) from the fiscal contraction via the charge in relative prices (Sahn *et.al*, 1997).

The impact of debt service obligations on welfare is highlighted. The position of the paper is that debt service obligations and welfare are negatively related. Heavy debt service payments have continued to be a burden on the economy, exacerbating the problem of development finance and so government at times find it difficult to utilize available resources for projects that benefit the poor. Many studies have demonstrated that increases in government expenditure on debt service obligations tends to adversely affect development from distributional perspective, as the poor are likely to receive the short term of the stock in expenditure reduction measures **(**Obadan, 1998a**).**

In Nigeria, per capita social spending fell by 20 percent between 1981 and 1986. The poorest 40 percent of families were particularly hard hit: their share of personal income was only 12 percent but they received 50 percent of public spending in health and education and 20 percent of social security payments (Bourguigon and Morrison, 1992). As incomes falls and public welfare decline and unemployment rise, crime and other types of violence including domestic violence – tend to become more pervasive. Similarly, garbage collection and other services can lead to deterioration in hygiene and public health conditions in poor neighborhoods. A number of cholera outbreaks in Nigeria in the 1980's were widely linked to worsening public health conditions in the wake of stringent budgetary austerity.

5. Model Specification and Estimation Strategy

To obtain some rough estimates of the magnitude of the effects of macroeconomic volatility on government consumption expenditure in Nigeria, we regress, measure of government consumption expenditure on the level of the exchange rate, debt services ratio, rate, inflation rate, unemployment. We followed Blanchard, Olivier and Danny Quah (1989), sequential method of scoring (analytic derivatives) of structural and unrestricted VAR estimates. The dynamic relationships between variable are modeled empirically as a vector autoregression (VAR) while a simple structural model based on economic theory is used to model the contemporaneous relationships. The advantage of using economic theory to model the contemporaneous relationships is that the impulse response functions and variance decompositions will now have clear economic interpretations --- they represent the dynamic response of shocks to aggregate supply, demand, etc.

To estimate the hybrid model, we estimate by an unrestricted VAR of the form.

$$Y_t = C_0 + \sum_{i=1}^{k} C_t Y_{t-1} + y_t \ . \tag{16}$$

The (*n x 1*) vector Y_t contains *n* variable in the system, which is list of vector of endogenous variables that includes. The vector Y_t contains debt services ratio to total export (DSR_t), exchange rate (EXR_t), unemployment rate (UNE_t), aggregate price level (INF_t), and government consumption expenditure (GCE_t) a measures of welfare. C_0 is a vector that contains the constant terms. The (*n x 1*) vector y_t contains the residuals from the VAR and is a vector of serially uncorrelated shocks. The contemporaneous relationship between the residuals from the VAR can be modeled as a system of simultaneous equations of the form:

$$y_t = \beta_0 y_t + e, \tag{17}$$

Where the (n x n) matrix β_0 is the same as in equation (1)

In order to identify the contemporaneous parameter matrix, β_0, we us the following simple structural VAR (SVAR) estimate model. The main purpose of structural VAR (SVAR) estimation is to obtain non-recursive orthogonalization of the error terms for impulse response analysis. This alternative to the recursive Cholesky orthogonalization requires the user to impose enough restrictions to identify the orthogonal (structural) components of the error terms. The structural VAR (SVAR) estimate model could be specified in these formats below:

Model: $Ae_t = Bu_t$ where $E[uu']=I$

Identification restriction type: short-run text form

$$e_{1t} = \beta_1 u_{1t} \quad (18a)$$

$$e_{2t} = \beta_2 e_{1t} + \beta_3 u_{2t} \quad (18b)$$

$$e_{3t} = \beta_4 e_{1t} + \beta_5 e_{2t} + \beta_6 u_{3t} \quad (18c)$$

$$e_{4t} = \beta_7 e_{1t} + \beta_8 e_{2t} + \beta_9 e_{3t} + \beta_{10} u_{4t} \quad (18d)$$

$$e_{5t} = \beta_{11} e_{1t} + \beta_{12} e_{2t} + \beta_{13} e_{3t} + \beta_{14} e_{4t} + \beta_{15} u_{5t} \quad (18e)$$

Where (endogenous variable list), e_{1t} represents EXR_t residuals (exr_t), e_{2t} represents DRS_t residuals (drs_t), e_{3t} represents INF_t residuals (inf_t), e_{4t} represents UNE_t residuals (une_t) and e_{5t} represents GCE_t andresiduals (gce_t)

The special key symbols *"e_1", "e_2", "e_3," r"e_4," "e_5,"* in equations (18a-18e), represent the first, second, third, fourth and fifth elements of the e_t vector, (the e_i*'s* represent exogenous structural shocks to the to the various equations), while *"u_1," "u_2", "u_3" "u_4", "u_5"* represent the first, second, third, fourth and fifth elements of the u_t vector (u_i captures a set of other explanatory factors). In this model, all unknown elements of the *A* and *B* matrices are represented by elements of the β coefficient vector (where β_i are parameters to be estimated) and the subscript *t* will be used for time series data. Equations (18a-18e) could further be express in the forms:

$$exr_t = \beta_1 u_{1t} \quad (19a)$$

$$drs_t = \beta_2 exr_t + \beta_3 u_{2t} \quad (19b)$$

$$inf_t = \beta_4 exr_t + \beta_5 drs_t + \beta_6 u_{3t} \quad (19c)$$

$$une_t = \beta_7 exr_t + \beta_8 drs_t + \beta_9 inf_t + \beta_{10} u_{4t} \quad (19d)$$

$$gce_t = \beta_{11} exr_t + \beta_{12} drs_t + \beta_{13} inf_t + \beta_{14} une_t + \beta_{15} u_{5t} \quad (19e)$$

The lower case letter represent residual series from the unrestricted VAR and are the elements from the vector y_t. The series exr_t is the residual from exchange rate equation of the VAR; dsr_t is the residual from the debt services ratios equation; inf_t is the residual from the inflation equation; une_t is the residual from the unemployment equation of the VAR; and gce_t is residual from the government consumption expenditure (welfare) equation.

The simultaneous equations model given by equations (18a) through (18e) is a static macroeconomic model that consists of aggregate demand and supply curves; contemporaneous reaction functions for exchange rate, unemployment rate, debt services ratio and aggregate price level and contemporaneous response welfare to macroeconomic volatility as captured by government consumption expenditure and to macroeconomic policy as captured by exchange rate, unemployment rate, debt services ratio and aggregate price level. We assumed that contemporaneous exchange rate (equation, 19a) is exogenous and is uncorrelated with structural disturbances (e_i*'s*) in the other equations. Equation (19b) implies that debt service obligations react to changes in exchange rate and reflects the countercyclical behavior of exchange rate to GDP. Equation (19c) describes the growth in aggregate demand where exchange rate is again cast as the explanatory variable. Equation (19d) represents an aggregate supply curve where unemployment instead of GDP is cast as the output measure. The aggregate supply curve implies that unemployment should fall as prices increase. Another interpretation of this equation would be a Philips curve relationship. Equation (19e) implies the reaction of government consumption expenditure to macroeconomic volatility, this equation (19e) describes the contemporaneous effect of macroeconomic volatility on government consumption expenditure (welfare).

Since equations (19a) - (19e) constitute a simultaneous equation, we use, following Blanchard, Olivier and Danny Quah (1989), sequential method of scoring (analytic derivatives) of structural and unrestricted VAR estimates. With optimization control to estimate the parameter matrix of $Ae = Bu$ where $E[uu']=I$. The government consumption expenditure equation (19e) is estimated by method of scoring (analytic derivatives) of the structural VAR estimates (SVAR). Since all the right-hand variables are assumed to be uncorrelated with the error term u_{5t}. We identify the response of GCE to macroeconomic shock using the structural decomposition method. The overall relationship between the government consumption expenditure and its explanatory variables are expected to be negative. We use annually data from the NBS and CBN bulletins. Owing to data limitations, we restrict our estimation to the sample period 1980 to 2008. Government consumption expenditure (GCE) is measured by the sum of local, state, and federal real expenditure

6. Estimation Results

In order to ensure stationarity of the data, all the variables are in terms of first differences of logarithms (growth rates) and none at level. Our estimation technique consists of two steps procedure. First, a vector autoregression estimate, using the seemingly unrelated simultaneous regression method (including a constant term) is run over the sample period 1980-2008. The lag length of two was chosen based on the Akaike Information. Once the VAR (using the seemingly unrelated simultaneous regression method)) was estimated, we proceed to the structural factorization. And

the residuals from the structural VAR (SVAR) are then used to estimate the structural models given in (19a) - (19e) and with 15 structural coefficients, the SVAR is just-identified.

In Table 1 in the Appendix we report the vector autoregression estimate (using the seemingly unrelated simultaneous regression method) for the five variables excluding the standard errors, using a lagged period of two. Examination of these results indicates that exchange rate (-1.0 and 0.5%), debt services (-1.7 and 0.9%), inflation rates (0.4 and -4.0%), and unemployment rate (-1.2 and 1.9%) all have significant effects (negative and positive) on current government consumption expenditure, including the first and second lag respectively, while past government consumption expenditure (first and second lag) have positive significant effect on the current government consumption expenditure, given a coefficient of determination (R^2) of (96%). The result shows that inflation and unemployment seem to have the highest impact. The result also shows that past debt service obligations and inflation rate, has a negative significant effect in the unemployment equation using the first and second lag value while, unemployment rate is highly negative significant in the inflation equation, this is a Philips curve relationship. Government consumption expenditure does appear to have much significant feedback effect on exchange rate, inflation rate than debt services. The Durbin-Watson (DW) test statistic (d*) shows the presence of serial correlation between the error terms in the UNE equation (19d), while EXR, DSR, INF and GCE equations that is (19a), (19b) and (19c), (19e), respectively, show negative autocorrelation.

Estimation of the structural model based on the residuals from the SVAR is reported in Table 2 in the Appendix. The entire variables have the expected sign. Exchange rate is has a positive significant in the inflation equation and negative significant other equations, while inflation has a negative significant in the aggregate supply equation (unemployment) and positive significant in the government consumption(GCE) equation.

On the government consumption expenditure equation (see Table 2 in the Appendix), all the variables have significant direct contemporaneous effect on government consumption expenditure. Not surprisingly, the unemployment rate and debt service obligations have the highest significant contemporaneous effect on government consumption expenditure. The result shows that an increase in unemployment and debt services by 1% rate will decreases the growth rate of government consumption expenditure by 9.2% and 4.4%, respectively while, exchange rate has a significant effect but to a lesser extent (1.2%). Debt Service obligations and welfare are negatively related. A country that has to spend part of her GDP to service her debt would find it difficult to utilize resources for projects that benefit the poor. The relationship between exchange rate depreciation and government consumption expenditure is postulated to be negative. A depreciated exchange rate is supposed to boost exports and the expansion of import competing industries and the overall expected effect is to increase employment, greater out and consequently improved welfare, but it is so with the developing countries like Nigeria.

Also, the result shows that, inflation has positive significant effect on government consumption expenditure but the value is very insignificant (1.6%). This implies that, an increase in inflation rate by 1% will increases government consumption expenditure by just 1.6%. This also implies that, the rise in inflation is less than the rise in government consumption expenditure with a difference of 0.6%. This implies that household government final consumption expenditure as a percentage of GDP would reduce by at least the same proportion. Therefore, reduction in poverty level through government consumption expenditure will decline when inflation increases.

6.1 Impulse Response and Variance Decomposition

The estimated coefficients of the VAR and contemporaneous model indicate the direct effects on the measure of government consumption expenditure. Yet, we are also interested in the total effects (direct and indirect effects) that these variables will have on government consumption expenditure. Thus, in Tables 3 and 4 in the Appendix, we present the results from the impulse response and variance decompositions for the level of government consumption expenditure. The actual impulse response function and variance decompositions are based on the initially estimated model of the structural vector autoregression (SVAR) estimate using the actual data. The decomposition method used is structural decompositions.

6.2 Impulse Response Function (IRF)

An IRF traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. A shock to the one variable not only directly affects another variable but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VAR. Our innovations are assumed to contemporaneously uncorrelated after a transformation and the numbers in parentheses are the response standard errors.

The IRF results in Table 3 in the Appendix traces out the response or describe how government consumption expenditure react over time to exogenous impulses' (shocks) in the macroeconomic variables. The results show that

government consumption expenditure is affected contemporaneously by the shock to itself (fifth column) and also affected contemporaneously by the shocks from other variables (columns one to four). The fifth column is the response of the government consumption expenditure to itself; the first column is the response of government consumption expenditure to the exchange rate shock; the second column is the response of government consumption expenditure to debt service obligations and so on.

The government consumption expenditure response to structural one innovation appears to be greater in inflation than other endogenous variables. An economic shock to inflation effect is stronger on the government consumption expenditure at longer horizon (for all the years) that is, it is greater than government consumption expenditure shock to itself for all the periods. For example, one innovation in inflation show large percentages of government consumption expenditure response (36.5%, 34.1%, 30.9% and 32.1% at the 3rd, 4th 6th and 7th years' horizon, respectively). Inflation innovations seem to play a larger role in explaining government consumption expenditure response in short run than they do in the long run, that is 29.3%, 27.1% and 24.0% at 8th, 9th and 10th years' horizon, respectively. Indeed, for the ten period horizons aggregate inflation shocks explain a greater proportion of the response of government consumption expenditure (GCE) to macroeconomic volatility than other explanatory variables (see Table 3 in the Appendix).

Thus, government consumption expenditure appears to be less or not sensitive to the economic shocks to debt service obligations and unemployment rate. In other words, it appears that both are not very important in explaining government consumption expenditure in either the short or long run. Overall, it appears that innovations in inflation is an important contributors to variability of government consumption expenditure either the short run, the medium run or long run while, economic shocks to exchange rate contributors little to the variability of government consumption expenditure in the long run (from the fourth period).

6.3 Variance Decomposition

The resulting variance decompositions of the effect of macroeconomic volatility are presented in Tables 4 in the Appendix. Some of the expected forecast error for government consumption expenditure in the first period is due to innovations in the government consumption expenditure itself (35.2% and 29.9% at the 1st and 2nd year horizon, respectively), but this percentage is not much larger than those attributable to inflation from the 1st-10th periods because, most of the variability in government consumption expenditure appears to be due to innovations in inflation. Inflation effect is stronger on the government consumption expenditure at longer horizon (10 years) and is larger than government consumption expenditure. Innovations in inflation consistently explain relatively large percentages of government consumption expenditure forecast errors (45.8% average between 1st-10th year horizons). Inflation innovations play a larger role in explaining government consumption expenditure forecast error variance in the short run than they do in the long run. Indeed, for the ten period horizons aggregate inflation shocks explain a greater proportion of expected forecast variance than do innovations in government consumption expenditure.

Innovations in exchange rate and unemployment explain relatively proportions of the forecast variance of government consumption expenditure and their effects were greater after the 3rd year's horizon, the long run. Thus, variability in debt service obligations appears to be less sensitive to shocks than other variables and it appear not to be very important in explaining government consumption expenditure in either the short or long run. Overall, it appears that an economic shock to inflation is important contributors to variability of government consumption expenditure. The variance of decompositions of the other variables in the system does not indicate significant feedbacks effects by government consumption expenditure on the rest of the macroeconomy.

7. Policy Implication

Our analysis shows that macroeconomic volatility has negative impact on government consumption expenditure and welfare implications. The results imply that the shock on the macroeconomic may temporary shift government consumption expenditure composition away from public welfare, and this is likely to be harmful for public welfare. The results show that public welfare decreases in the short, medium and the long run (rather than just not returning to the pre-shock level) because the lower wealth accumulated by domestic residents through running a current account deficits allows them to increase their supply of labour, while at the same time decreasing consumption. This impact on public welfare is driven by the shock on the macroeconomic via government consumption expenditure and output movements as a result of the cut in publicly provided consumption.

One obvious policy implication is that governments which value the welfare of their citizens should ensure prosper policy response volatility in macroeconomic. If the policy response is effective, public welfare is likely to increase, provided that the productivity of government expenditure is not too low. Also, it is worth pointing out that volatility is detrimental for what has been referred to as the risk-adjusted standard of living of the poor, which is simply a

measure of welfare that adjusts nominal consumption for their variability, on the basis of assumptions regarding the degree of risk aversion of households.

8. Conclusion

This paper we focused, on the trade-offs faced by macroeconomic volatility and government consumption expenditure in enhancing public welfare in an open economy. The paper introduced a dynamic macroeconometric stochastic model of the effect of macroeconomic volatility on government consumption expenditure in the Nigeria. Our purpose was to see if macroeconomic activity has both contemporaneous and lagged impacts on government consumption expenditure in Nigeria. We find results consistent with other researcher on contemporaneous impacts and all the past macroeconomic variables appear to impact on government consumption expenditure. We also used structural decompositions to analysis the impulse response and variance decomposition of the effect of macroeconomic volatility on consumption expenditure. The results appear to be consistent with the overall government consumption expenditure model.

The principal findings of this paper is that, government consumption expenditure appear to be less sensitive to one innovation or shock of unemployment and debt service obligations than inflation. This is because, the magnitude of their coefficients (unemployment and debt service obligations) are relatively smaller than the inflation coefficient. Inflation appears to have stronger impact on government consumption expenditure over time. Though, inflation seem to have a lesser lagged impacts on government consumption expenditure in Nigeria, but government consumption expenditure seem to response to contemporaneous behavior in inflation in both the short and long run than other variables. The estimates also reveal that, variability in exchange rate appears to be less sensitive to shocks than other variables and it appear not to be very important in explaining government consumption expenditure in either the short or long run, because the magnitude of the coefficient is considered to be relatively too small.

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Table 1. Coefficients Estimates of Lagged Variables of The Seemingly Unrelated Simultaneous Regression Method of the Vector Autoregression (VAR)

	Independent Variable				
Dependent Variable	exr_t	dsr_t	inf_t	une_t	gce_t
EXR(-1)	0.732	-0.021	0.094	-0.002	0.010
EXR(-2)	-0.044	0.032	-0.143	0.002	-0.005
DSR(-1)	0.866	0.192	-1.518	-0.019	-0.017
DSR(-2)	-0.366	-0.222	0.356	0.016	0.009
INF(-1)	-0.099	0.015	0.368	0.009	0.004
INF(-2)	-0.355	0.059	-0.349	-0.021	0.004
UNE(-1)	-0.236	0.092	-4.597	0.430	0.012
UNE(-2)	1.169	-0.359	-1.254	-0.153	-0.189
GCE(-1)	2.879	-4.079	28.870	-0.995	0.916
GCE(-2)	8.421	0.326	-38.662	0.821	-0.154
C	-107.177	58.114	169.975	5.341	3.270
R-squared	0.964	0.772	0.782	0.554	0.983
Adj. R-squared	0.936	0.597	0.614	0.212	0.970
F-statistic	35.046	4.404	4.651	1.618	75.410
Durbin-Watson stat	2.559	2.597	2.769	1.586	2.739

Table 2. Coefficient Estimates of Structural Model

$$exr_t = \hat{\beta}_1, \hat{u}_{1t} = 13.386 \quad (1)$$

$$drs_t = -0.063exr_t + \hat{\beta}_3, \hat{u}_{2t} = 4.712 \quad (2)$$
(0.072)

$$inf_t = 0.095exr_t + 0.113drs_t + \hat{\beta}_6, \hat{u}_{3t} = 12.889 \quad (3)$$
(0.200) (0.559)

$$une_t = -0.021exr_t - 0.089drs_t - 0.022inf_t + \hat{\beta}_{10}, \hat{u}_{4t} = 0.792 \quad (4)$$
(0.012) (0.034) (0.013)

$$gce_t = -0.012exr_t - 0.044drs_t + 0.016inf_t - 0.092une_t + \hat{\beta}_{15}, \hat{u}_{5t} = 0.189 \quad (5)$$
(0.003) (0.009) (0.003) (0.049)

Note: Numbers in parentheses represent standard errors

Table 3. Impulse Response of Government Consumption Expenditure to Structural one S.D. Innovations

Period horizon	EXR Shock	DSR Shock	INF Shock	UNE Shock	GCE Shock
1	-0.081	-0.039	0.229	-0.072	0.189
2	0.070	-0.108	0.262	-0.057	0.174
3	0.181	-0.147	0.365	-0.221	0.169
4	0.196	-0.176	0.341	-0.300	0.207
5	0.218	-0.127	0.276	-0.256	0.159
6	0.208	-0.112	0.309	-0.255	0.143
7	0.194	-0.149	0.321	-0.246	0.163
8	0.204	-0.152	0.293	-0.225	0.151
9	0.199	-0.131	0.271	-0.227	0.137
10	0.181	-0.114	0.2404	-0.216	0.130
Factorization: Structural					

Table 4. Structural Decomposition for the Level of Consumption Expenditure

Percentage of Forecast Variance Decomposition Explained by Innovations						
Period	S.E.	EXR Shock	DSR Shock	INF Shock	UNE Shock	GCE Shock
1	0.319	6.354	1.458	51.851	5.161	35.176
2	0.470	5.175	5.953	55.087	3.866	29.919
3	0.697	9.067	7.172	52.479	11.787	19.496
4	0.897	10.273	8.184	46.160	18.277	17.105
5	1.017	12.559	7.935	43.191	20.556	15.760
6	1.128	13.623	7.443	42.658	21.836	14.440
7	1.234	13.864	7.694	42.403	22.231	13.808
8	1.322	14.476	8.037	41.876	22.276	13.334
9	1.396	15.019	8.088	41.334	22.626	12.933
10	1.454	15.380	8.061	40.805	23.041	12.714
Factorization: Structural						