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EXPLORING THE EFFECTS OF INCREASED GOVERNMENT AGRICULTURAL EXPENDITURE ON NIGERIAN ECONOMY USING COMPUTABLE GENERAL EQUILIBRIUM MODELLING APPROACH

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ABSTRACT
The study was conducted to examine the effects of increased government agricultural expenditure on Nigerian economy using computable general equilibrium (CGE) modelling approach. The research used simple, practically-oriented exposition of computable general equilibrium (CGE) modelling. The study relied strictly on secondary data, to estimate parameters of the model before simulation using the Nigerian Social Accounting Matrix (SAM) of 2012 as the base year data in General Algebraic Modelling System developed (GAMS) by IFPRI for this analysis. The 2012 SAM is the most recent SAM data for Nigeria. But after the parameters were estimated, the 2018 SAM data used for the simulation. This 2018 SAM data capture 83 activities, 84 commodities, 18 factors, 15 categories of households, 5 taxes, and 6 other accounts. The result shows that the introduction of 10% on government expenditure affects virtually many sector of Nigerian economy in a different ways. The findings of the study revealed that most macroeconomic variables have shown positive changes except for consumption in government investment which was reduce by 2.00%. The gross domestic product (GDP) at market prices increased by 0.28%, 1.05% on transport and communication and 0.73% for trade margin. On exports increase by 0.98 per cent, 0.36% and 0.59%. Other manufactured products increased by 2.1%, 0.7%, and 0.6%, other capital equally increases by 1.21%, 0.82% and 0.44%. Household income increases for rural for those with primary education at 0.22%, 1.7% and 1.72%. Changes in investment, affect rural labour for the non-school sector, which was reduced by 0.84%, although, the value of the land on government investments equally reduces by 0.69%, capital reduces by 0.76%, and livestock equally reduces by 0.71%. The impact of 10.00% shock result in changes in urban household with primary education increases by 3.37% followed by labour household with secondary education with 3.17%. The study concluded that application of 10.00% shocks impacted both positively and negatively on several sectors of the economy like GDP at market prices, sectoral GDP, prices, nominal household income and export. The study recommended the need for government at all tiers to examine the effect of such policy on other sectors of the economy. It is therefore recommended that Government should enhance expenditure by 10.00% to stimulate productivity, output and consumption; Govt. should support short term agricultural consumption subsidy policy measure, increase government investment on research and development (R&D).

Keywords: Agriculture, Calibration, Computable General Equilibrium, General Algebraic Modelling System, Gross Domestic Product, Social Accounting Matrix.

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INTRODUCTION

To a great extent, the development of all countries relies directly or indirectly on its government expenditure. Agricultural expenditure is a function of budget, that is all expenses expended by government or any organizational structure must first be effected in the budget, ones deem fit it is approved by the relevant authorities. Agricultural expenditure is basically categorized into capital and recurrent expenditures (Agbonkhese, 2014). Capital expenditure include all those costs incurred to research, buildings and infrastructures. The agricultural recurrent expenditure is the day to day cost incurred due to purchase of good and services such as labour, wages and salaries. Ones the capital expenditure is incurred it takes the provision of recurrent expenses for the smooth running of the capital at the ground. Expenditure is, therefore, a key determinant of a country's agricultural development such amount expended has a macro effect on the whole economy hence it calls for a serious attention before implementation. However, the macro effect posed by government spending, therefore, calls for the adoption of equilibrium models to simulate the possible effect, and how the macroeconomy can respond to possible changes in the entire economy. It can be seen using the circular flow model. The model demonstrates how Walrasian equilibrium theory that underlies provide a background for the development of a Computable General Equilibrium model (CGE) model. The social accounting matrix uses the algebra of its accounting rules reflects the conditions of general equilibrium.

In the circular flow, the main actors are households, who own the factors of production and are the final consumers of produced commodities, and firms, who rent the factors of production from the households for the purpose of producing goods and services that the households then consume (Abebe, 2017). Many CGE models also explicitly represent the government, but its role in the circular flow is often passive, usually to collect taxes and disburse these revenues to firms and households as subsidies and lump-sum transfers, subject to rules of budgetary balance that are specified by the analyst. In tracing the circular flow one can start with the supply of factor inputs (e.g., labour and capital services) to the firms and continue to the supply of goods and services from the firms to the households, who in turn control the supply of factor services. One may also begin with payments, which households receive for the services of labour and capital provided to firms by their primary factor endowment, and which are then used as income to pay produce sectors for the goods and services that the households consume. The implications of the circular flow for both the structure of CGE models and the economic data on which they are calibrated are clearly illustrated in an algebraic framework. General equilibrium analysis addresses precisely how vast numbers of individual and seemingly separate decisions" referred to by Arrow aggregate in a way that coordinates productive effort, balances supply and demand, and leads to an efficient allocation of goods and services in the economy (Sifiso *et al*., 2017).

Computable General Equilibrium (CGE) models are the large-scale numerical model that simulates the economic interactions in an economy (HMRC, 2013; and Abebe, 2017). It uses the data gathered over the years to estimate the effect of government policies on the economic system. The data is usually linked together through sets of equations which are gotten from the economic theory of general equilibrium and it ensures supply and demands of goods, services, factors of production in the economy are balanced. It consequently determines how firms, households and the entire economy responds to changes in policies or shocks in the economy. Consequently, CGE turns the abstract models of general equilibrium theory into a practical tool for policy analysis. A CGE model is one of the most rigorous, cutting-edge quantitative methods to evaluate the impact of economic and policy shocks particularly policy

reforms in the economy as a whole. Because of its nature, this tool is significantly useful for policy design as well as exploring the consequencies of policy action before implementation. However, because of its complexity and data requirement many policy analysts do not have a clear understanding of it. This makes many policy analyst to use a partial equilibrium approach (Corong and Erwin, 2009). Usually under assumption of centeris peribus. Regrettably, in real life situation, partial equilibrium cannot work effectively, because changes in sector is usually accompanied by changes in moany sectors of the economy (Abebe, 2017; and Al-Amin *et al.,* 2009). So, consequencies of such changes transmit to several and causing undesirable effect in other sectors.

The CGE models unlike partial equallibrium is a standard tool of empirical analysis and are widely used to analyze the overall economy as a system and examing the welfare and distributional impacts of policies that might affect the entire economy. Government spending, investments and taxes have wide effects and such effect can be transmitted through multiple markets (Nkang *et al.,* 2012). However, in spite of its goodness in policy analysis, the use of it remains unpopular, among policy analysts. Aside that, only a few analysts have flair to use it, thus making modelling economic policy is a problem in many developing countries like Nigeria. The conventional method of modeling economic policy relies on one sector solution since the use of once sector solution cannot address and explore the impact of any policy on the entire economy (Vaqar and Cathal, 2007).

Therefore, the need to use a robust modelling procedure which not only account for the changes happening in all sector but equally estimate the magnitude of the possible changes. This gap in the literature motivates the present paper, whose aim is to de-mystify CGE models by opening up the black box to scrutiny, and to increase their accessibility to a wider group of economists and policy analysts' students, practitioners and academics alike who would otherwise remain unfamiliar with its benefits (Abebe, 2017).

The general algebraic framework of a CGE model is developed from microeconomic fundamentals. CGE models are a standard tool of empirical analysis, and are widely used to analyze the aggregate welfare and distributional impacts of policies whose effects may be transmitted through multiple markets, or contain menus of different tax, subsidy, quota or transfer instruments (Nwafor *et al.,* 2010; and Al-Amin *et al*., 2009). The components of the CGE model comprises of theory, data and shocks. The theory takes care of all the explicit underlying theoretical specifications of the model, data describes the structure of the economic system under study and how the system responds to changes, finally, the shocks represent a policy change on the economic system (Al-Amin *et al.* 2009; and Gilbert, 2014). To make CGE easy for operation and more practical, the model which consists of a set of relationships drawn from economic theories were later modelled into General Algebraic Modelling System (GAMS). All it takes in the computer-operated GAMS is to insert the shock in the system and the application will execute the activity and brings out the effect of the shock to the entire economy. International organizations such as the world bank and IFPRI has developed their standard GAMS and have used it numerously over the years in offering best policy options to policymakers globally on food security and poverty. This study aims at exploring the effects of increased government agricultural expenditure on Nigerian economy using computable general equilibrium modelling approach and to examine how an increase in the expenditure will affect other factors such as total factor productivity and trade margins.

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MATERIALS AND METHODS

The Study Area

Nigeria is a middle-income, mixed economy and emerging market. The current expanding market is manufacturing, financial, service, communications, and technology and entertainment sectors. It is one of the important economies in sub-Saharan Africa ranked as the 27th-largest economy in the world in terms of nominal GDP (*Manufacturing Sector Report, 2015)*. It further ranked the country as the 22nd largest in the world based on purchasing power parity. It is the largest economy in Africa; its re-emergent manufacturing sector became the largest on the continent in 2013. The country produces a large proportion of goods and services for the West African sub-continent (Chijioke, 2014). In addition, the debt-to-GDP ratio is 11.00%, which is 8.00% below the 2012 ratio (Chijioke, 2014). Although the country has resources there is general agreement that the development of the country is stalled for many years.

Similarly, Nigerian GDP at purchasing power parity (PPP) indicated that it was $522 in 2013, rises to $576 in 2014, then continue to decline to projected $376 billion in 2019. Correspondingly, the GDP per capita follows a similar trend with GDP at PPP as well from $3,082 per person in 2013, rises to $3,312 in 2014 then decline to an estimated $1,995 per person in 2019. Unfortunately, Nigeria still remains the only country with a large un-documented informal economy. This affects the correct estimation of GDP. The estimates of the size of the informal sector (which are not captured in official figures) were estimated to around $630 billion in 2014 (Chijioke, 2014). But might double (if the informal sector were included it might likely fly around twice the documented formal per capita.

According to Nigeria Agricultural Economics Research and Liaison Services [NAERLS] (2018), the Nigerian agricultural sector is comprised of livestock, field crops and fruit. Agriculture in Nigeria accounts for a relatively high share in the economy more than 23% of gross domestic product. It employs more than 65% of the country's population. The sector is a major export earner in the late pre and early post-independence period before the discovery of oil. However, the discovery of oil reduced Nigeria dependence on agriculture. But the present renew government effort in diversifying the economy. There is the need to look at the consequences of policy on increase agricultural expenditure. The country's population increased from 169 million in 2012 to projected 191 million in 2019 (Chijioke, 2014) as it is shown in Table 1. To use the CGE effectively the Nigeria GDP was examined from 2013 to 2019. Gross Domestic Product represents the economic production and growth of a nation and is one of the primary indicators used to determine the overall well-being of a country's economy and standard of living. It consists of consumption, government spending, investments, and net exports.

Sampling and Analytical Techniques

The methodology for this study uses a computable general equilibrium model. The model is a trajectory to general equilibrium theory. The general equilibrium theory studies the properties and operation of free-market economies usually as a system. Thus a simultaneous change in the properties of one or more inputs variables will result in changes in the entire system, this move off from using a partial equilibrium approach, which uses single equation model at a time. Indeed, general equilibrium reflects the true situation in the economy, where changes in one or two indicators by government or market will stimulate several changes in other economic indicators. The model was developed to respond to a series of questions originally outlined by Leon Walras about the operation of markets in an economy. The study relies strictly on secondary data. To estimate parameters of the model, the Nigerian Social

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Accounting Matrix (SAM) of 2012 was used as the base year in GAMS (General Algebraic Modelling System) developed by IFPRI for this analysis. This is because the 2012 SAM is the most recent SAM data for Nigeria. The 2018 datasets used for the six simulations, the datasets capture 83 activities, 84 commodities, 18 factors, 15 different categories of households.

Table 1: Describe the Nigeria Economic Indices from 2013 to 2019

Economics Indices	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Population (million)	169	174	179	184	189	190	191
GDP per capita (USD)	3,082	3,312	2,766	2,206	1,995	1,995	1,995
GDP (USD bn)	522	576	494	405	376	376	376
Economic Growth (GDP, annual variation in %)	5.5	6.2	2.8	-1.6	0.8	-1	-3
Consumption (annual variation in %)	21.2	0.5	-0.4	-3.7	4.4	2	2
Investment (annual variation in %)	7.9	13.4	0.6	-6.8	3.775	2	2
Industrial Production (annual variation in %)	-0.1	6	-3.4	-9.4	-3.6	-4	-4
Unemployment Rate	3.7	4.6	4.3	7.1	7	7	7
Inflation Rate (CPI, annual variation in %)	8.5	8.1	9	15.7	16.5	17	17
Policy Interest Rate (%)	12	13	11	14	14	14	14
Exchange Rate (vs USD)	155. 2	167.5	196.5	304.5	305.5	306	306
Current Account (% of GDP)	3.7	0.2	-3.1	0.7	2.8	6	7
Current Account Balance (USD bn)	19.2	0.9	-15.4	2.7	10.4	13	14
Trade Balance (USD billion)	43.8	21	-6.4	-0.5	13.1	-14	-16
Exports (USD billion)	95.1	82.6	45.9	34.7	45.8	46	46
Imports (USD billion)	51.4	61.6	52.3	35.2	32.7	33	33
Exports (annual variation in %)	0.8	-13.2	-44.4	-24.4	32	30	30
Imports (annual variation in %)	-3.8	19.9	-15	-32.7	-7.3	-8	-8
International Reserves (USD)	43.6	34.5	29.1	25.8	38.8	39	39
External Debt (% of GDP)	1.7	1.7	2.2	2.8	5	6	6

Note: 2018 and 2019 are extrapolated based on previous data
Source: https://www.focus-economics.com/countries/nigeria

The household categories are rural farming in quintile 1 to quintile 5, rural non-farming in quintile 1 to quintile 5, and urban households in quintile 1 to quintile 5. It equally captures 5 taxes, and 6 other accounts (Abebe, 2017; and Sifiso *et al.*, 2017). Figure 1 and 2 shows how the files were put together for the analysis and iteration in the simulation of the results.

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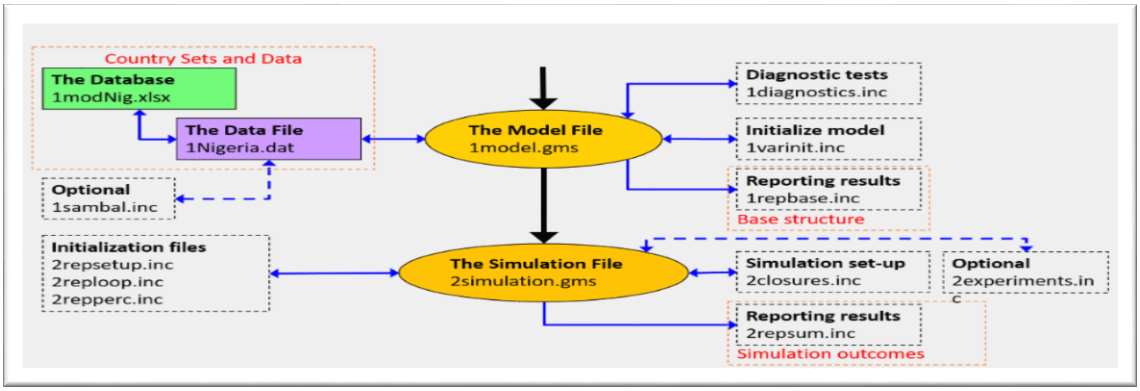

Figure 1: *Show how the files put together for the analysis*

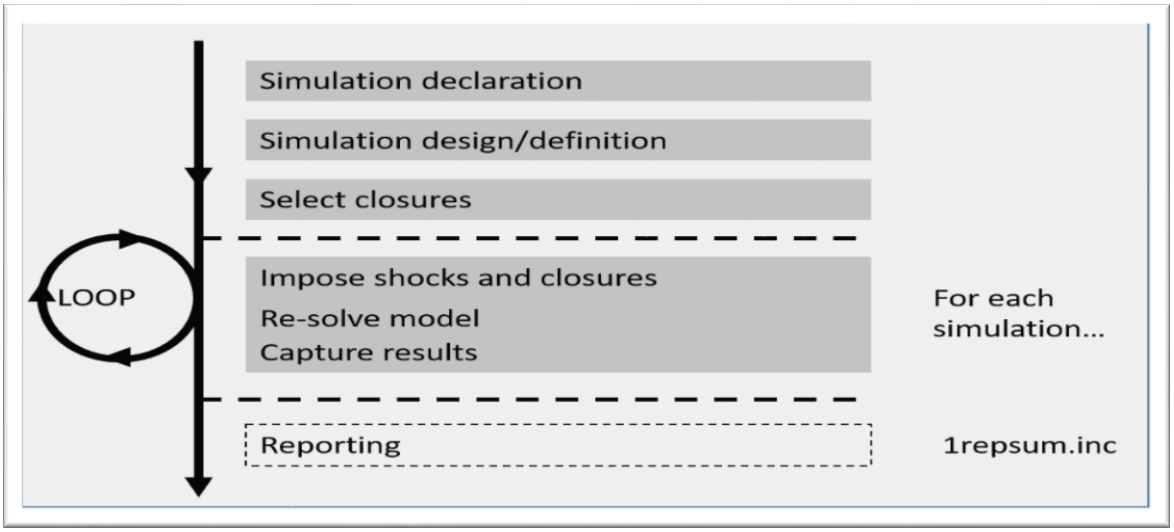

Figure 2: *Show how the files put together for the analysis*

Computable General Equilibrium (CGE) Model

The Computable General Equilibrium (CGE) modelling is an extension of the general equilibrium model discussed earlier. It used the computer microprocessor to work out the model in environmental and resource economics. CGE models are a widely-used tool for the quasi-empirical analysis of environmental externalities and policies for explanatory purpose. It is used to find out how changes in externalities will impacted product prices, output and services across multiple markets in the entire economy. The framework was developed from microeconomic fundamentals. The framework examines how resulting algebraic structure may be numerically calibrated using the economic and environmental data and then solved for the equilibrium values of economic variables, and illustrates how CGE simulations may be used to analyse the economy-wide impacts of environmental externalities and associated policies like agricultural expenditure, interest rate, subsidy, and employment creation, poverty and food security in the economy (Erol *et al.,* 2009; Abebe, 2017; and Sifiso *et al.*, 2017).

Walrasian general equilibrium prevails when two or more economic indices are equalized across all of the interconnected markets in the economy. A CGE model is an algebraic representation of the abstract Arrow-Debreu general equilibrium structure which is calibrated on economic data (Abebe, 2017; and Sifiso *et al.,* 2017). The resulting numerical

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problem is to solved for any economic indices which support equilibrium across a specified set of markets economy. It can be estimated using a single, sub-national region to multiple groups of countries interacting within the global economy. Every economy represented in these models typically has the same basic structure: a set of producers, consumers and governments whose activities are linked by markets for commodities and factors as well as taxes, subsidies and perhaps other distortions as represented with Figure 3. Gross Domestic Product is the monetary value, in a local currency, of all final economic goods and services produced within a country during a specific period of time. One way to determine how well a country's economy is thriving is by its GDP growth rate. This rate reveals the increase or decrease in the percentage of economic output in monthly, quarterly, or yearly periods.

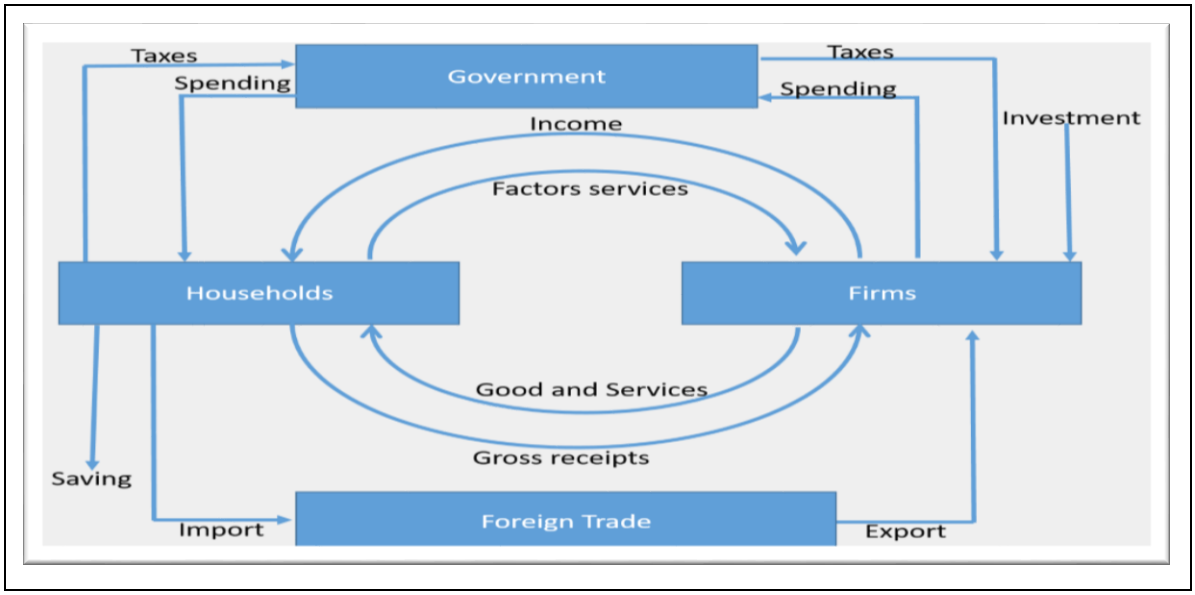

Figure 3: *Circular flow in GDP interaction with other sectors of the economy*

The indicator enables economic policymakers to assess whether the economy is dwindling or developing if it needs improvements or restrictions and if threats of recession or inflation are imminent. From these assessments, government implementing agencies can determine if expansionary, monetary policies are needed to address economic issues. Investors place importance on GDP growth rates to decide how the economy is changing so that they can make adjustments to their asset allocation. However, when there is an economic fall, businesses experience low profits, which means lower stock prices and consumers tend to cut spending. Investors are also on the lookout for potential investments, locally and abroad, basing their judgment on countries' growth rate comparisons (Tokumbo and Oluwatoyin, 2005). The relationship between these indicators has been depicted using figure 3 on circular flow in the economy showing how each sector interaction and cause changes in might result in changes in another.

The 2012 Nigeria's social accounting matrices (SAM) model in GAMS developed by IFPRI was used a base data. The model was data linked through sets of the economic theory of general equilibrium. A shock of 10% increase on agricultural expenditure was deliberately added to the system and the prevailing results were taken. This is because one of the beauties of CGE modelling an intentional value can be added to examine the effect of such addition, or a value can be reduced from the system and examines the effect on the system. This addition

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and reductions are termed as shock. Figure 4 below demonstrations how the Computable equilibrium model is used on Nigeria SAM 2012 to determine the parameters of simulation, and used 2018 datasets for simulation in order to explore the impacts.

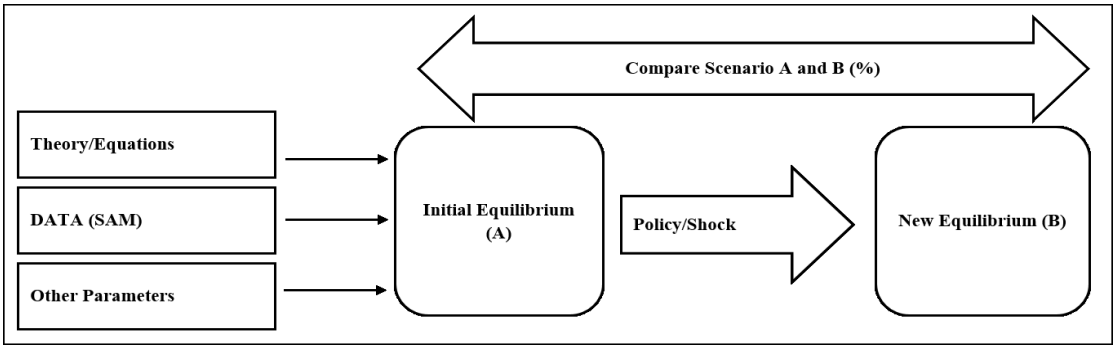

Figure 4: *How the CGE model works*

RESULTS AND DISCUSSION

Gross Domestic Product (GDP) at Market Prices

The gross domestic product can be estimated at market prices, or at factor cost. GDP at market prices is the sum of the gross values added of all resident producers at market prices, plus taxes fewer subsidies on imports. When GDP is estimated with the market price it is equally called the Gross National Product at Market Price. Meaning GNP at market price is defined as "the market value of all the final goods and services produced in the local territory of a nation by common populaces during an accounting year including net factor income from abroad, this income of Nigerians leaving and working abroad. Table 2 for this study shows that the initial GDP at market prices for the base year was 59.91 billion Naira for absorption, (absorption is not a common term, it refers to the total level of spending in an economy), consumption was 43.17 billion Naira, investment was 10.60 billion Naira, GDP at market price was 71.41billion Naira and GDP at factor cost was 70.03 billion Naira, it deficit a positive trend similar with the findings of Abebe (2017), although there was a reduction of imports value by 9.19 billion Naira in the overall economy. However, after 10% increase in agricultural expenditure and simulating of 2018 datasets, to examine how the economy respond to the changes. The GDP at factor cost has grown by 0.35% and real investment increased by 1.68%. Absorption which includes import spending but excludes exports spending. Absorption includes spending on all goods and services in the economy. Countries with a high marginal propensity to consume tend to have a high absorption rate. After simulation, government investment was found to increase by 0.33%, transport and communication by 1.25% and trade merging by 0.87%t for absorption

Nonetheless, consumption was 43.17 billion Naira, investment 10.60 billion Naira. Export is 20.69 billion Naira whereas GDP at a market price of a commodity is 71.41 billion Naira; indirect tax is 1.37 billion Naira. By introducing a shock (per cent) changes the equilibrium of the system entirely. Consumption decreases by 2.0%. While investment increases by 10.00%. Similarly, absorption decreases by 0.33% while at the same time transport and communication equally increases by 1.25% but trade margin reduces to 0.87%. When the investment is at 10.6 billion Naira in the base year, government investment increases by 10.00% while transport or communication and trade margin remains unchanged. The introduction of shock when export were based at 20.69 billion Naira, government investment increases by 0.98%, transport and communication changes by 0.36%, while trade margin

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changes by 0.26%. Similarly, the introduction of stock only reduces government investment by 2.00% when consumption was at 43.17 billion Naira at base year, but at the same time, transport and communication increases to 1.73%. Similar changes is seen on trade margin while changes in 1.20%. The general implication of this policy on the economy wide is often expressed in terms of the size of the "fiscal multiplier," i.e., the quantitative effect on aggregate GDP at market prices, increase in government expenditure or, more formally, the value of the derivative. As a matter of accounting, the size of the multiplier will depend on the response of Absorption, consumption, investment and other components of aggregate demand to the increase in government expenditure. That response, and its pattern over time, will generally depend on several features of the economy, as well on the details of the fiscal intervention analyzed. In particular, it is likely to depend on the kind of frictions present in the economy, the persistence of the shock, its impact on other factors like taxes or debt, and any possible direct effect on productivity or utility as this finding corresponds to the findings of Corong *et al*., 2009; and Scott, 2014.

Table 2: GDP at Market Prices

GDP at Market Prices	Base (Billion Naira)	Government Investment (%)	TFP in Transport and Communication (%)	Reduced Trade Margin (%)
Absorption	59.91	0.33	1.25	0.87
Consumption	43.17	-2.00	1.73	1.20
Investment	10.60	10.00	0.00	0.00
Stocks	0.20	0.00	0.00	0.00
Government	5.94	0.00	0.00	0.00
Exports	20.69	0.98	0.36	0.26
Imports	-9.19	2.21	0.81	0.59
GDP at market prices	71.41	0.28	1.05	0.73
Indirect taxes	1.37	0.15	1.48	0.60
GDP at factor cost	70.03	0.28	1.04	0.33

Source: IFPRI, 2012 SAM and Datasets 2018

Market cost is derived after adding the indirect taxes to the factor cost of the product. The formula to calculate is Market Cost = Factor Cost - Subsidies + Indirect Taxes. The distinctive feature between the two costs is that GDP is the aggregate value of-all find goods and services produced within a country during a year. The GDP at factor cost on the other hand such as indirect taxes, subsidies, etc., may affect the computation. If the Government tries to raise the subsidies, the difference between the GDP (FC) and GDP (FC) will increase. The same is opposite for indirect taxes.

GDP at Factor Cost

The GDP at factor cost shows what the productivity is if you remove all the excesses over and above what the producer receives. That is if indirect taxes and subsidies are removed, then it becomes GDP at factor cost. Although, GDP at current price can present a distorted picture of the actual growth in GDP owing to price changes. However, if the price of the base year is considered to be constant and compute the GDP growth rate of the current year using

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that constant price, then the value so arrived at will give a true picture of the actual growth rate in GDP. This measure is called the Real GDP or the GDP at a constant price. Factor cost is the price of the commodity from the producer's side (Al-Amin *et al.* 2009).

Table 3 further shows the value of agriculture at the base year, the value of GDP at factor cost is 20.3 billion Naira. But where stock is introduced, government investment reduces by 0.70% while transport and communication increase by 0.5 per cent whereas the trade margin increases 1.1%. Mining at the base year is 18.2 billion Naira, but the introduction of a 10 per cent stock in agricultural expenditure stimulates government investment in research and development by 0.4%, transport and communication by 1.00% and the trade margin is 0.2%. Unfortunately for other industries at the base year, it is 19.7 billion Naira, but the 10.00% expenditure in agriculture changes the equilibrium by 2.1% for government investment, 0.4% for transport and communication and reduces trade margin by 0.72%. Private Service which was 29.8 billion at the base year quickly decline by 2.0% but stimulate increases in transport and communication by 2.0%, while at the same time increasing trade margin by 0.4%. Public services which are 4.0 billion Naira at base year changes the equilibrium by 0.8% stimulates government investment, increasing transport by 1.3% while for trade margin by 0.52%. Though, the trade margin exports were greater than imports, that is, $X - M > 0$, led to a foreign trade surplus. This means that the domestic economy is earning more from the transaction of goods and services with the foreign markets. Therefore, the value of domestic goods is greater than foreign goods. But where the trade margin for imports was greater than exports, that is, $X - M < 0$, implies the foreign trade deficit. This suggests that the domestic market is importing more goods and service than it is exporting to the foreign markets. Thus, the value of foreign goods was greater than domestic goods and services. On the other hand, if the net export was equal to zero, that is, $X - M = 0$, meaning foreign trade balance. This means that imports and exports were in balance position with no surplus or deficit. In this case, the value of equilibrium output or income in a four (4) sector economy will be equal to the value of equilibrium output or income in a three (3) sector economy.

Table 3: Sectorial GDP at Factor Cost

GDP at factor cost	Base (Billion Naira)	Government Investment (%)	TFP in Transport and Communication (%)	Reduced Trade Margin (%)
Agriculture	20.3	-0.7	0.5	1.1
Mining	18.2	0.4	1	0.2
Manufacturing	8	0.4	0.5	0.7
Food, beve. & tobacco	4.5	-0.7	0.5	0.8
Textiles and leather products	1.2	1.3	0.5	0.7
Other manufactured products	2.3	2.1	0.7	0.6
Other Industries	19.7	2.1	0.4	-0.7
Private Services	29.8	-0.2	2	0.4
Public services	4.0	-0.8	1.3	0.5

Source: IFPRI, 2012 SAM and Datasets 2018

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Analysis of Output Prices

The term "output" in economics is the "quantity of goods or services produced in a given time period, by a firm, industry, or country", whether consumed or used for further production. The concept of national output is essential in the field of macroeconomics. It is national output that makes some country rich, not large amounts of money. A measure of the change in the prices of goods and services sold as output by domestic producers. It covers both outputs sold on the domestic market and output sold as exports. Output producer prices are the basic prices received by the producer exclusive of taxes on products, separately invoiced transport charges, and retail and wholesale margins. The output price index measures the average price change of all covered goods and services resulting from activity and sold on the domestic market and also on export markets. In constructing a family of output PPIs, export prices are usually collected from a separate source to produce a separate export price index.

Similarly, as depicted in Table 4 on sectoral output prices, the introduction of 10.00% shock in agricultural expenditure equally stimulate changes in equilibrium for output prices. The output prices of Agriculture reduces by 0.34% although transport communication increases by 0.43% but the increase will now move the GDP value for the economy, trade margin equally increase by 0.62%. Because of decrease in the output prices for agricultural product the Nigeria citizen will experience a reduce food price and hence improve access to food among especially urban household. This has been confirmed when Sifiso *et al.* (2017) introduce shock in Ghanian economy and thus result in 6% of employment and about 10.00% of exports increase. Equally affected were the government investment on food, beverages, tobacco which reduces by 0.31% but escalate transport comment by 1.03%. It equally brings a positive change to trade margin which increases by 0.46%. In general, the introduction of 10.00% shock in agricultural expenditure brings 0.31% for increase in food, beverages and tobacco. Private Service reduces by 0.82% while textile and leather industries reduce by 0.68%, other industries reduce on trade margin by 0.70%. The implication of this finding as reported by Gover *et al*., 2014 that whenever there is an injection of into the circular flow there is likely to be a multiplier effect. This is because an injection leads to more service and production sectors of the economy, which creates more income, and so on. This is the multiplier effect increase in final income arising from any new injection.

Table 4: Sectorial Output Prices

Output prices (PX)	Base	Government Investment (%)	TFP in Transport & Communication (%)	Reduced Trade Margin (%)
Agriculture	1	-0.34	0.43	0.62
Mining	1	0.41	0.24	0.21
Manufacturing	1	0.69	0.67	0.14
Food, beverages and tobacco	1	-0.31	1.03	0.46
Textiles and leather products	1	0.87	0.57	-0.68
Other manufactured products	1	1.54	0.37	0.24
Other Industries	1	1.82	0.74	-0.70
Private Services	1	0.21	-0.82	0.61
Public services	1	0.18	0.82	0.38

Source: IFPRI, 2012 SAM and Datasets 2018

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Analysis of Total factor Income

The factor income is income received from the factors of production such as land, labour, and capital. Factor income on the use of land is called rent, income generated from labour is called wages and income generated from capital is called profit. The factor income of all normal residents of a country is referred to as factor Income. It is income derived from selling the services of factors of production. In the case of labour, this means wages, plus the part of the incomes of the self-employed which is a reward for their own labour. Income from land is rented, including part of the incomes of the self-employed, and part of the imputed incomes of owner-occupiers of houses. Incomes from capital and entrepreneurship are received as dividends, interest, the retained profits of companies and the part of the incomes of the self-employed which is a return on their own capital and entrepreneurship.

Based on the results from Table 5, the study shows that the introduction of shock changes many indices on total factor income. For government investment, rural labour for non-school sector reduces by 0.84%, the value of the land on government investments equally reduces by 0.69%, capital reduces by 0.76%, livestock equally reduces by 0.71%. The impact of the shock on government investment changes those with positive values are connected with care labour increases, urban basically is households with primary education which increases by 3.37% followed by labour household with secondary education with 3.17%. The third was the urban households with tertiary education increased by 2.00%. For transport and communication, the shock increases for every sector of labour, urban secondary household increases by 2.91%, urban primary increases by 2.89% rural primary-come third with 1.73%. Nonetheless, the introduction of stock equally changes trade margin positively for all labour. Rural households with no school attendance top with 2.69% increase. It was followed by rural primary with 1.72% the least was for the capital and mining with only 0.28% increase. Income is one of the most important variables in the household economy; it provides the resources to finance current consumption and savings. Total household income is the sum of resources received by factor and non-factor sources, representing the total purchasing power of a household in a given time period. Households' labor and non-labor income by sector, where aggregate labor income for rural no schooling, primary, secondary and tertiary education depict the variance in the different categories of income. Rural no schooling and primary are the most important major component of labor income in most urban and rural areas, This decipher to affect the household spending and expenditure making the household at either among poorest or the rich class. Thereby increasing the household available resources; hence, reducing poverty and food security (Gover *et al.,* 2014).

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Table 5: Total Factor Income

Total factor income (YF)	Base (Billion Naira)	Government Investment (%)	TFP in Transport and Communication (%)	Reduced Trade Margin (%)
Labour - Rural - No schooling	2.92	-0.84	1.63	2.60
Labour - Rural – Primary	3.79	0.22	1.73	1.72
Labour - Rural – Secondary	2.43	0.64	1.27	1.58
Labour - Rural – Tertiary	2.79	0.26	0.60	0.32
Labour - Urban - No schooling	0.66	1.55	0.86	1.55
Labour - Urban – Primary	3.21	3.37	2.89	0.74
Labour - Urban – Secondary	2.94	3.17	2.91	0.75
Labour - Urban – Tertiary	2.80	2.00	1.19	0.39
Land	6.15	-0.69	0.49	1.32
Capital – Crop	3.10	-0.76	0.65	1.33
Capital – Livestock	0.78	-0.11	0.83	1.27
Capital – Mining	7.56	0.57	0.98	0.28
Capital – Other	30.90	1.21	0.82	0.44

Source: IFPRI, 2012 SAM and Datasets 2018

Analysis of Households Institutional Income

The household in social statistics includes one person living alone or a group of people, not necessarily related, living at the same address with common housekeeping. A household, in the context of surveys on social conditions or income defined as a housekeeping unit or, operationally, as a social unit, having common arrangements; sharing household expenses or daily needs; in a shared common residence. Collective households or institutional households (as opposed to private households) are, for instance: hospitals, old people's homes, residential homes, prisons, military barracks, religious institutions, boarding houses and workers' hostels.

Household income is a measure of the combined incomes of all people sharing a particular household or place of residence. It includes every form of income, e.g., salaries and wages, retirement income, near cash government transfers like food stamps, and investment gains. A median household income refers to the income level earned by a given household where half of the homes in the area earn more and half earn less. It's used instead of the average or mean household income because it can give a more accurate picture of an area's actual economic status.

In the study, as presented in Table 6, the household primary income decreases several sectors because of the introduction of shock, almost both rural farming and non-farming household in the first to the fifth quantile reduces on government investment relative to its respective base year value Table 6 shows the outcome in the introduction of a shock to household income. Those who benefited from the introduction of the shock are the urban households because their income increased as a result of government investment. The urban household at Second quintile rank highest with 0.98% increases. However, on transport and communication all the household both urban, rural farming and non-farming, urban households have benefited by the introduction of shock positively on transport and communication.

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Although, urban households at second quantile increase the expenses on transport and communication by 1.60%. This match with the findings by Abebe (2017) who founds that service sector of the Ethopian economy increase by 1.11%. whereas agricultural sector increase by 0.16%. The largest was the rural farming household at first quantile that introduction of stock increases household by 0.96%. A similar trend was observed in the trade margin. In all the households, positive changes were observed at the trade margin. Rural farming household top with 1.58% putting closely by a rural farming household with a 1.55% increase. Urban household at fourth quintile was marginal with 0.61% being the lease to benefit from the introduction of shock at trade margin. The effects of the introduction shock to the different household were reported by Figure 4, 5 and 6. The implication of the shock on rural and urban farming household stands at increasing spending on transport and communication and reducing trade margins hence making household spends more on transport and communication but reduces their purchases on food expenditure (Wolfgang *et al*., 2009) This makes life little stepper for them because they spend much on items that are not directly increase their production.

Table 6: Households Institutional Income

Institutions	Base value (Billion Naira)	Government Investment (%)	TFP in Transport and Communication (%)	Reduced Trade Margin (%)
Households - rural farming - quintile 1	2.48	-0.59	0.96	1.55
Households - rural farming - quintile 2	4.00	-0.55	0.98	1.49
Households - rural farming - quintile 3	4.34	-0.48	0.99	1.40
Households - rural farming - quintile 4	4.56	-0.38	1.01	1.31
Households - rural farming - quintile 5	6.61	-0.19	1.00	1.07
Households - rural non-farming - quintile 1	0.16	-0.37	1.45	1.58
Households - rural non-farming - quintile 2	0.37	-0.30	1.42	1.49
Households - rural non-farming - quintile 3	0.80	-0.23	1.38	1.34
Households - rural non-farming - quintile 4	1.38	-0.19	1.25	1.09
Households - rural non-farming - quintile 5	4.34	-0.21	1.10	0.83
Households - urban - quintile 1	0.27	0.68	1.39	1.00
Households - urban - quintile 2	0.84	0.98	1.60	0.86
Households - urban - quintile 3	2.55	0.94	1.59	0.80
Households - urban - quintile 4	6.08	0.59	1.52	0.73
Households - urban - quintile 5	20.40	0.42	1.36	0.61

Source: IFPRI, 2012 SAM and Datasets 2018

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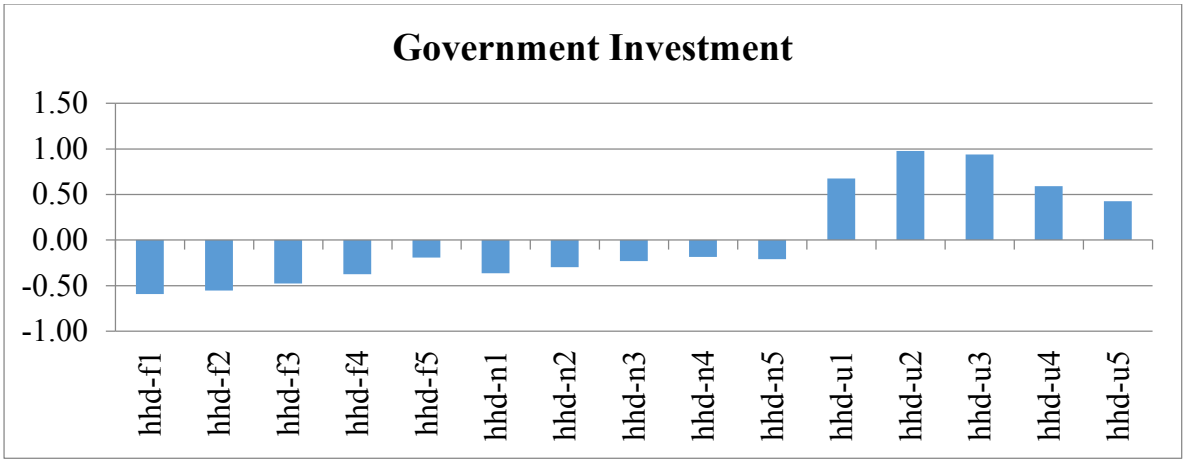

Figure 4: *Effect of shock in Government investments on households.*

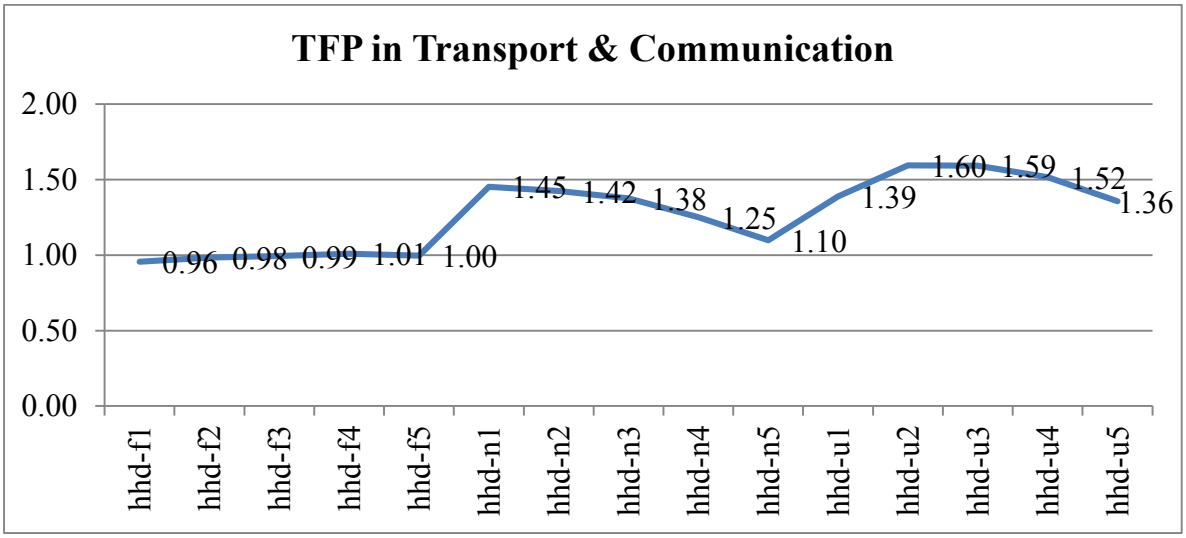

Figure 5: *Effect of shock in total factor productivity, transport and communication on households.*

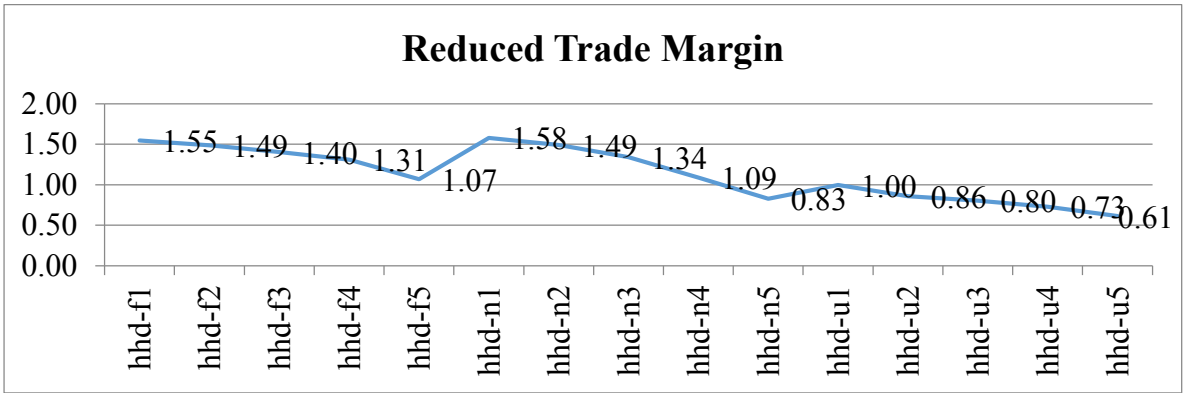

Figure 6: *Effect of reduction of trade margin on households*

CONCLUSION AND RECOMMENDATIONS

This paper developed a recursive dynamic CGE model to quantitatively assess the economy wide impacts of 10% increase in agricultural expenditure on the economy has shown

have a promising headway. The CGE-based model, is made up of a linearized system of equations describing the theory underlying the behavior of multiple participants and multiples sectors in Nigerian economy. Its structure enables the capturing of the various inter-linkages in the real economy in great detail, which in turn makes this model well-suited to analyzing policy questions such as the economy wide impact of increase expenditure on agriculture.

Therefore, the study concluded that applying 10% shocks in agricultural expenditure impacted using four (4) scenarios were analyzed in this model: (1) Impact of increase agricultural expenditure on government investments (2) Impact increase agricultural expenditure on transport and communication; (3) Impact increase agricultural expenditure on aggregated agriculture output; and (4) Impact increase agricultural expenditure on aggregated household incomes (5) others are sectorial output prices**,** total factor income, GDP at market prices, GDP at factor cost and export. The current classification of research into capital expenses have compound the capital expenditure of the economy and make isolation of effect of expenditure on research to be non-visible in the the analysis. Based on this findings it become imperative for Nigerian government, before introduction of any policy change, there is need to assess the effect of such policy on other sectors of the economy in order to avoid the consequential effect of major indices of the economy. The sudy therefore recommended as follows:

a. The government should heighten agricultural expenditure by 10% to stimulate productivity, output and consumption.
b. Government of Nigeria should support short term agricultural consumption and lending policy for small holder rural farming households.
c. Increase government at least 5.00% investment in research and development since such will decipher to wide range of economy.
d. There is need to isolate research from capital expenditure so that effect of research can be individually isolated in economy.

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