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ECONOMETRIC IMPACT OF AGRICULTURAL PRODUCTIVITY SHOCK ON NIGERIA'S ECONOMY

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Abstract

The concerns about agricultural productivity and its impact on the economy have been a recurring decimal within the sub-Saharan African terrain, given the abysmally low yields of most agricultural enterprises relative to best practice. Even though the continent witnessed some growth recently, it is unclear if these can be attributed to agricultural productivity, particularly in the crop sub-sector, thus suggesting the need for a robust tool in unearthing this fact. Using Nigeria as a case study, this research explored the impact of total factor productivity shocks on crops and those of associated variables on the Nigeria economy. The study employed the computable general equilibrium (CGE) approach based on the current Nigeria's social accounting matrix. The result showed that total factor productivity (TFP) impacted positively on numerous macroeconomic indices of the economy, comprising absorption, gross domestic product, export sales, labour supply and incomes, including institutional incomes of households across the various quintile categorizations. The results suggest that implementation of 7.23% TFP growth rate, reflective of the agriculture sector growth rate projected under the Economic Recovery and Growth Plan (2017-2020), 50% subsidy as operational under the on-going growth enhancement support scheme and adherence to 10 % funding of the agriculture sector as prescribed by the Maputo declaration, will to some extent, support the achievements Nigeria's development outcomes, particularly, institutional incomes, in line with its Economic Recovery and Growth Enhancement Plan (2017-2020). However, there is the need to change the direction of subsidy from agro-input support to projects with public good characteristics and for local fertilizer manufacturing, given the need to improve public investments in the agriculture sector and inevitably, the prospect for innovative private investments.
Keywords: Econometric Impact, Agricultural Productivity, CGE Approach, Nigeria.

1. Introduction

The issue of agricultural productivity and its impact on the economies of nations continued to reverberate across the globe, with varied outcomes, given differing interventions by states and peculiarities. In the sub-Saharan Africa for instance, and in Nigeria in particular, the inability to meet domestic food requirements has been partly attributed to productivity challenge, known to have been driven by the current input system and an inefficient farming model (Federal Government of Nigeria, 2016).The United States Agency for International Development (USAID) (2018) noted that Nigeria's situation is worsened by decades of neglect and diminishing productivity. For instance, productivity of maize, a major staple in the country, average only about 1.5mt/ha, compared to 4.4mt/ha and 5.7mt/ha recorded in South Africa and China respectively, while the country's overall productivity per hectare for all crops, ranged between 20% and 50% of thoseobtained in similar developing countries (USAID, 2018). Federal Ministry of Agriculture & Rural Development (2011) noted that low agricultural productivity compared to other developing countries led to loss of estimated 10 billion dollars in yearly export opportunities from key cash crops, such as groundnut, palm oil, cocoa and cotton. Arising from the evidence on ground, USAID (2018)posited that higher productivity and rising farm incomes would play a significant role in reducing rural poverty in Nigeria. Thus, given the priority of the Federal Government of Nigeria in improving productivity through a number of domestically

focused crop enterprises (rice, wheat, maize and sugarcane) and enterprises (poultry, aquaculture and horticulture) as detailed in its Road Map (2016-2020) and Economic Recovery and Growth Plan (2017-2020), this study determined the impact of total factor productivity shock on key crop enterpriseson all aspects of Nigeria's economy. The study hypothesized that total factor productivity shock does not impact on Nigeria's economy.

2. Theoretical and Conceptual Reviews

2.1 CGE and General Equilibrium Theory

Ghadimi (2007) affirmed that the CGE model falls into both the stylized and applied variants ofmodels, linked with the basic economic theory that ensures interaction of various actors as conceived in the neoclassical general equilibrium theory. This theory derives behaviour premised on micro theory optimization assumption that demand and supply sides of all markets are specified. The general equilibrium theory serves as an instrument for the analysis of market economies. Malinvard (2012) affirmed that the neoclassical general equilibrium theory was developed by Walras 1874 and modified by Vifredo Pareto in 1909, who affirmed the efficiency of competitive equilibrium. Kento (2018) further explained that the theory works through holistic functioning of the macro economy, rather than through individual market phenomena. According to the researcher, the theory differs from the partial equilibrium theory which focused on thematic sectors, associated with most economic model, based on partial equilibrium analysis; the price at which, supply equates demand and market in specific markets. General equilibrium theory further shows how all free markets move towards equilibrium in the long run, without necessarily reacting to it. General equilibrium theory focuses on a free market price system published by Adam Smith's Wealth of Nation (1776). However, Walras posited that individual market will be in equilibrium if all other markets are also in equilibrium, implying that the transactions between actors in a marketing system produces prices which allows other market actors to realign their resources and activities along profitable lines.

According to Bezabih *et al.* (2010), the CGE framework enables the isolation of the effect of specific variables on the overall growth of an economy, given that responsiveness to shock depends on the macroeconomic structure of the economy. Moreover, CGE is well placed to show interaction between agriculture and other sectors of the economy. It also allows easy incorporation of changes in other features of the economy. Robinson (2002) argued that the CGE models compared to other econometric models provide a consistent framework to determine the linkages and trade-offs among different policy packages and help to pass better-informed policy prescription.

2.2 Agricultural Productivity, Total Factor Productivity and the Economy

Agricultural productivity has severally beenviewedas a measure of states' production potentials of agriculture, without recourse to whether the potential is from natural endowment of nature or the activities of humans (Shodhganga, undated). However, the concept is shrouded in diverse conceptual interpretations. While some agricultural economists equated productivity to efficiency, others have taken it to mean output. However, some of the common consensus is that agricultural productivity is the ability to produce more economically and efficiently, implying that agricultural productivity is a measure of production system's efficiency.Generally, agricultural productivity can be represented in numerous forms, as either total factor productivity or partial factor productivity. Total factor productivity entails the ratio of output to the aggregation of inputs in same unit or value terms, while partial factor productivity relates to the ratio of output to individual agricultural factors of production, be it agricultural productivity per hectare, agricultural productivity per labour use or per capital.

Relative to the economy, Baier *et al.* (2007)affirmed that total factor productivity growth across countries is associated with negative indices. According to the study, only 14% of the average output growth per worker for all countries is associated with TFP growth. Also, in a study of total factor productivity growth in UK, Thirtle and Bottomley (1992) affirmed that total factor productivity grew at an average rate of 1.9% per annum and that total factor productivity growth increased as a result of increased aggregate output and decreased aggregate input. Ajayi *et al.* (2012) observed that total factor productivity in Nigeria had been low and unstable, depicting a situation of poor and unstable

technological growth in Nigeria. Specifically in the field of agriculture, Gollin (2010) argued that given the nature of developing countries, it is logical to expect agricultural productivity growth to have significant effects on macro variables, including economic growth. Specifically however, Awan and Alam (2015) showed that agricultural productivity has an effect on the economy. The study concluded that agriculture sector contributes more in economic growth.Chen *et al.* (2008) further revealed that the major source of productivity growth in China's agriculture sector is technical progress and that regional productivity diminishes over time. In the study of agricultural productivity, international competitiveness and economic growth, Matsuyama (1992) revealed a positive link between agricultural productivity and economic growth in a closed economy scenario, while for the small open economy,there was a negative link.In a related development, Udabah (undated) argued that productivity is necessary for rapid economic growth. The study established that productivity is low in agriculture and industrial sub sectors, thus causing poverty, low standard of living, limited growth rate and under development of the nation.

2.3 Measuring Impact of Agricultural Productivity Using the CGE

Towards investigating the impact of agricultural productivity on the economy, numerous researchers (Kinyondo *et al.* 2008; Reid *et al.* and Benzabih *et al.* 2010) have all worked on the impact of TFP on the economies of various countries. While some have used the regression approach, others have relied cointegration analysis, with researchers like Awan and Alam (2015) deploying the autoregressive distributed lag approach. This study used the computable general equilibrium approach premised on the 2012 social accounting matrix of Nigeria developed by the International Food Research Institute (IFPRI). While Reid *et al.* (2010) used the static CGE model to estimate the impact of changed agricultural productivity and altered fish availability on the Namibian economy, Benzabih *et al.* (2010) ascertained the impact of climate change and TFP on the Tanzanian economy. Cororation and Orden (2008), in the study on inter-sectoral linkages and poverty implications in the cotton and textile sector for Pakistan using CGE model, affirmed that 5% TFP improvement is welfare increasing for both rural and urban households, while achieving production expansion, export and poverty reduction. Berhane (2013), in ascertaining the effects of improved productivity of manufacturing industries on the Ethiopian economy, showed that the manufacturing sector is a determinant of economic growth, while productivity increase in agro processing, non-agro processing and overall manufacturing sector largely increases real GDP and sectoral output.

2.4 Nigeria'sEconomic Environment

The Nigeria's economic environmenthas been challenging and mainly skewed towards the debit side of development outlook. According to the Nigeria's Economic and Growth Plan (2017-2020), the country is characterised by structural challenges that hinders its ability to sustain growth, generate employment and ameliorate poverty. Without prejudice to the on-going diversification efforts, the country's economy is mono-commodity based for its revenue and foreign exchange with high raw material importation to sustain the manufacturing sector. The country is also largely consumption based, with little investment, with an investment GDP ratio of 13-14%. The country's GDP grew at an average of 6.3% between 2005 and 2015, but entered recession in 2016. The country is highly dependent on the oil and gas sector, which accounts for 94% of export earnings and 62% of government revenue between 2011 and 2015. According to theEconomic Recovery and Growth Plan (2017-2020), foreign exchange reserve declined from USD 53 billion in 2008 to USD 25 billion in November 2016. Inflation nearly doubled between January 2012 and October, 2016, but now down to 11.37%. Aside economic challenges, USAID (2018) affirmed that 53.3% of the population are poor with significant income inequalities along the north-south divide. Malnutrition is also high, with estimated 32% national stunting rates for children under five. The source further revealed that 52% (70.8 million ha) of the agricultural lands remained unutilised, 95% of lands is untitled, thus dis-incentivizing land management. Also of concern is the fact that only 40% of the farming households used fertilizer, estimated 20-27% adopted improved seeds, 6% had access to tractor services, irrigation practices covers 1% of farm lands, while farming is mainly on by smallholder, with 90% cultivating less than 2ha. From the down-stream sector, post-harvest losses accounts for an estimated 20% to 40%

of total production and about 60% perishable goods (Nigeria Institute for Social and Economic Research, 2014).

3. Methodology

3.1 Study Area

Nigeriais one of the 54 countries in Africa, located in West Africa, within both the eastern and northern hemispheres. The country lies between Latitudes 4^o and 14^oN and Longitudes 3^o and 14^o E. Nigeria boost of an estimated land area of 910,768 Km^2, water area of 13,000 Km^2,population of 186,053,386 and population density of 204.28/km^2. It is bordered by Benin, Cameroon, Chad and Niger, as well as the Atlantic Ocean. The climate is equatorial in the south, tropical in the centre and arid in the north. The southern lowland terrain merge into the central hills and plateaus; mountainous in the south east and plains in the north. The country comprises 36 states, a Federal Capital Territory and 774 Local Government Areas.

3.2 Data Sources, Collection and Analysis

This study is based on the 2012 social accounting matrix developed by the International Food Policy Research Institute (2018). The matrix covers 80 activities and commodities each, 13 factors, 15 households' categorization, 5 assorted taxes and 6 other accounts. Data analysis was undertaken using the 2012 Nigeria static CGE Model developed by Davies, Seventer and Thurlow (2012) based on GAMS program. Benzabih *et al*. (2010) and Ghadimi (2007) affirmed that CGE models have been used widely for policy analysis in both developed and developing countries to stimulate effects of external shocks, changes in economic policy or changes in economic structure, have strong links with basic economic theory, derive behaviour based on optimization and operate within a fully closed system, where supply and demand side of the market are specified.Two types of CGE were recognised, namely the static and the dynamic models. While the former simulates medium-term impact of a change in economic conditions, the latterrelates to long-term impact. This study depended on the static analysis.

3.3 Holistic and Thematic Model Specification

The generic CGE model is in three parts, comprising real flow, prices and equilibrium conditions as detailed by Ghadimi *et al.,* (2007)

Real Resource Flow:

$$X = G\,(E, D^s\ \Omega) \quad (1)$$
$$Q^s = F\,(M, D^D\ б) \quad (2)$$
$$Q^{D\,=}\ Y/P^q \quad (3)$$
$$E/D^s = g_2\,(p^e, p^d) \quad (4)$$
$$M/D^D = f_{2\,(}p^m, p^d) \quad (5)$$
$$Y = P^X \square\ X + R\square\ B \quad (6)$$

Prices:

$$P^X = g,\ (p^e, P^d) \quad (7)$$
$$P^m = R\square Pw^m \quad (8)$$
$$p^g = f_{i\,(}P^m, P^d) \quad (9)$$
$$R = 1 \quad (10)$$

Equilibrium Conditions:

$D^D - D^s = 0$ (11)
$Q^D - Q^s = 0$ (12)
$Pw^m \square M - pw^e \square E = B$ (13)
Where:
Endogenous Variables
E: Export good
M: Import good
D^S: Supply of domestic good
D^D: Demand for domestic good
Q^S: Supply of composite good
Q^D: Demand for composite good
Y: Total income
P^e: Domestic price of export good
P^m: Domestic price of import good
P^d: Domestic price of domesticgood
P^x: Price of aggregate output
P^q: Price of composite good
R: Exchange rate
Exogenous Variables
pwe: world price of export good
pwm: world price of import good
B: Balance of trade
σ: Import substitution elasticity
Ω: Export transformationelasticity

However, the abridged model specific for this study, as operationalized within the holistic CGE model comprises three exogenous variables, namely; total factor productivity, subsidy (proxied under sales tax) and government spendings. The endogenous variables covered included key macroeconomic variables, including absorption, export, import, gross domestic product, trade export and output prices. Others included total factor supply, total factor income, household commodity consumption and institutional incomes.

3.4 Summary of Model Policy Simulations and Macroeconomic Closures

The study covers three simulations, excluding the base scenario. These comprises (i) shocking the total factor productivity by 7.33%, ascribed to the projected agriculture sector growth rate for 2019 under the Nigeria's Economic and Growth Recovery Plan (ii) assumption of 50% targeted subsidy regime, which is a continuation of the status quo towards the targeted growth enhancement scheme under the current agricultural promotion policy; (iii) 10% shock of agriculture sector funding, in line with the Maputo declaration and (iv) combined effects of simulations (i) and (ii).

The selected macroeconomic closures considered for this analysis are that (i) the consumer price index, which is the numeraire, is fixed, while the domestic price index is flexible; (ii) savings-investment pathways assumed a uniform marginal propensity to save (MPS) rate point change for selected account institutions; (iii) current account is assumed to be flexible, while foreign savings are fixed; (iv) government savings are flexible, while direct tax rate is fixed. (v) labour as a factor of production is assumed under two scenarios, namely, unemployed and mobile for the rural labour, except for those with tertiary education, which is assumed fully employed and mobile and urban labour, which are also unemployed and mobile, except for urban tertiary labour, which is also fully employed and mobile; (vi) land is assumed fully employed and mobile; and (vii) all forms of capital (crop, livestock, mining and others) are assumed to be fully employed and activity specific.

4. Results and Discussion

In reviewing the outcome of this study, discussions cover the effect of the assorted simulations and shocks undertaken on the general macroeconomic variables, including the gross domestic product; thematic sub-sectors, with focus on the real sectors; trade, prices, factors of production and institutional incomes. These are discussed in subsequent sub-sections of this section.

4.1 Impact of Shock on Nigeria's Economy and General Macroeconomic Results

The results of the three simulations undertaken in support of the objectives of this studyare discussed under relevant sub-themes, comprising impact of shock on GDP, economic sectors, trade, prices, factors of production and institutional incomes.

4.2 Impact on Gross Domestic Product

The analysis from the demand side of the GDP (Table 1) shows that the total factor productivity (TFP) shock increased the total spending in the economy (absorption) by 0.33% while subsidy and government expenditure had significant expansionary impact of 1.66% and 2.0% on the economy. Expectedly, consumption increased significantly with subsidy implementation and increased government expenditure spending, likely due to increased household incomes which manifested in increased purchases of goods and services. While there was significant impact of subsidy and government expenditure on import, probably due to fertilizer importation, as a result of productivity increases. On the other hand, the impact on export was marginal. This may have been due to existing government policy on national food security, the difficult business environment and the existing tax regimes. The combined impact of the three simulations was marginal, ranging from 0-0.2%. Cororation and Orden (2008) affirmed that 5% TFP improvement is welfare increasing for both rural and urban households, while also resulting in output expansion. Berhane (2013) on the other hand revealed that the manufacturing sector is a determinant of economic growth, while productivity increases largely increased real GDP and sectoral output.

Table 1. Impact of Shock on Demand Side GDP Variables

Economic Variables	Base Value	TotalFactor Productivity	Subsidy	Government Spending	Combined Effect
Absorption	**60**	**0.33**	**1.66**	**2**	0.02
Consumption	43	-0.91	2.31	1.4	0.02
Investment	11	0	0	0	0
Stocks	0	0	0	0	0
Government	6	10	0	10	0
Exports	21	0.1	0.49	0.6	0.01
Imports	-9	0.23	1.1	1.36	0.02
GDP at market prices	71	0.281	1.4	1.68	0.01
Indirect taxes	1	0.1	0.82	0.93	0.02

Source: CGE Output

A review of the impact of the shocks implemented on the sub-sectors of the economy (Table 2), shows that that the TFP shock in agriculture sector impacted marginally on private and public services by 0.3% and 0.1% respectively, probably because of their involvement in the value chain activities on agro-input procurement and distribution, but ironically with a negative impact on the agriculture sector (-0.1%). However, subsidy and government spendings caused a significant expansionary effect on the sector by 1.0% each, probably due to the increased output arising from subsidy and expenditure policies. Ironically however, there was no change in the combined implementation of all the shocks. While TFP shock showed no effect on the individual crop subsectors, the impact of subsidy and

government spending was only marginal, that is, 0.1% each for sorghum, roots and vegetables.Meanwhile, while subsidy and increased spendings impacted mildly on the manufacturing and other industries, ranging from 0.1%-0.4%, TFP shock had no effect on manufacturing and other industries.

Table 2. Impact of Shock on Sectoral Contributions to GDP

Economy Sub-sectors	Base Value	TotalFactor Productivity	Subsidy	GovernmentExpenditure	CombinedEffect
GDP	**100**	**0.3**	**1.4**	**1.7**	**0**
Agriculture	20.3	-0.1	1	1	0
Mining	18.2	0	-0.3	-0.3	0
Manufacturing	8	0	0.1	0.1	0
Other Industries	19.7	0	0.4	0.4	0
Private Services	29.8	0.3	0.2	0.4	0
Public Services	4	0.1	0	0.2	0

Source: CGE Output

4.3 Impact on Trade Export

With respect to trade export quantities as detailed in Table 3, TFP shock, subsidy and increased government spendings significantly enhanced export quantities in the agriculture sector by 5.1%, 39.7% and 46.4% respectively. However, the combined effect of these simulations returned only a marginal increase of 0.1% only; impact on the other sub-sectors was negative. The impact observed in the agriculture sector is not unexpected given that productivity enhancement will likely improve output and hence, export of agriculture output as observed. As regards the impact on import quantities (Table 4), while TFP reported a negative impact of -0.6%, subsidy and enhanced spendings returned impact of 1% and 0.4% respectively. Thus, it is worthy of mention that subsidy and government expenditure caused significant impact on private and public services. These may have been due to their involvement across the crop production value chain with respect to importation of agro inputs. Generally, there was no change in import quantities as a result of the simulations implemented.

Table 3. Impact of Shock on Export Quantities

Sub-sector	Base	Total Factor Productivity	Subsidy	Government Spending	Combined Effect
Agriculture	1	5.1	39.7	46.4	0.1
Mining	14	-0.2	-1.7	-1.9	0
Manufacturing	2	-0.2	-1.7	-1.9	0
Other Industries					
Private Services	1	-0.5	0.3	-0.2	0
Public Services					

Source: CGE Output

Table 4. Impact of Shock on Sectoral Import Quantities

Sub-sectors	Base Value	Total Factor Productivity	Subsidy	Government Spending	CombinedEffect
Agriculture	0	-0.6	1	0.4	0
Mining	0	0.3	-0.8	-0.5	0
Manufacturing	9	0.2	0.7	0.9	0
Other Industries	0	0.2	0.6	0.8	0
Private Services	3	-0.6	1.3	0.7	0
Public Services	0	-0.2	1.5	1.4	0

Source: CGE output

4.4 Impact on Output Prices

The results as detailed in Table 5 reveal that the three simulations implemented decreased output prices in the agriculture sector, namely TFP (-0.2%), subsidy (-3.1%) and government spendings (-3.2%). On the other hand, impact on the manufacturing sector, other industries and private services were generally positive. The downward movement of output prices may have been to increased output arising from government spending, agro-input subsidy implementation and TFP enhancement. This has dual effect on the institutions, given that inflation may be on the decrease within the economy while to the farmers, decreased prices may likely reduce income and by extension farm household welfare. Kinyondo *et al.* (2008) revealed that productivity improves household's welfare due to reduced commodity prices.

Table 5. Impact of Shock on Output Prices

Sub-sectors	Base	Total Factor Productivity	Subsidy	Government Spending	Combined
Agriculture	1	-0.2	-3.1	-3.2	0
Mining	1	0.1	-0.3	-0.2	0
Manufacturing	1	0.1	1.2	1.3	0
Other Industries	1	0.2	1.5	1.7	0
Private Services	1	0.2	1.1	1.2	0
Public Services	1	0.9	0.8	1.7	0

Source: CGE Output

4.5 Impact on Total Factor Supply

The combined effect of the shocks implemented showed marginal increases of 0.1% on most rural and urban labour supply without education and those with secondary education (Table 6). Specifically, TFP shock impacted significantly on rural labour with primary and secondary education by 2.7% and 2.3% respectively. Similarly, subsidy and government spending increased most rural and urban labour supply significantly. There was howeverno effect on the other forms of factors, be it land, crops, livestock or mining.

Table 6. Impact of Shock on Total Factor Supply

Labour Types	Base	TotalFactor Productivity	Subsidy	Government Spending	Combined Effect
Labour - rural - no schooling	2.9	-0.6	3.2	2.7	0.1
Labour - rural – primary	3.8	2.7	2.2	4.9	0.1
Labour - rural – secondary	2.4	2.3	2.6	5	0.1
Labour - rural – tertiary	2.8	0	0	0	0
Labour - urban - no schooling	0.7	-0.3	4.1	3.8	0.1
Labour - urban – primary	3.2	0.4	-0.2	0.1	0
Labour - urban – secondary	2.9	1.8	3.4	5.2	0.1
Labour - urban – tertiary	2.8	0	0	0	0
Land	6.2	0	0	0	0
Capital – crop	3.1	0	0	0	0
Capital – livestock	0.8	0	0	0	0
Capital – mining	7.6	0	0	0	0
Capital – other	30.9	0	0	0	0

Source: CGE Output

The implication of this result, particularly for land, suggests that land may have been a limited factor. USAID 2018 affirmed that most rural farming households are small holders, cultivating less than 2 hectares. Kinyondo *et al.* (2008) also noted that economy-wide productivity shock resulted in output led employment demand and increased earnings for all skilled workers. The study affirmed that skilled men benefitted most in the sector, while partial productivity increases was observed to exhibit negative employment impact. Also, Benzabih *et al.* (2010) affirmed that TFP growth measures the production increases which are caused by more efficient application of technology or more efficient use of inputs, rather than by increased use of the factors of production. The authors argued that increased TFP serves as incentives for farmers to use resources efficiently.

4.6 Impact on Shock on Total Factor Income

Table 7 shows that TFP shock impacted significantly on rural labour with primary and secondary education, with 2.7% and 2.3% increases respectively, with varying outcomes obtained for the other factors. For subsidy shock, urban labour with no schooling and those with secondary education mostly impacted by 4.1% and 3.4% respectively.

Table 7. Impact of Shock on Total Factor Incomes

Labour Types	Base	TotalFactor Productivity	Subsidy	Government Spending	Combined Effect
Labour - rural - no schooling	2.9	-0.6	3.2	2.7	0.1
Labour - rural – primary	3.8	2.7	2.2	4.9	0.1
Labour - rural – secondary	2.4	2.3	2.6	5	0.1
Labour - rural – tertiary	2.8	0.9	0.7	1.6	0
Labour - urban - no schooling	0.7	-0.3	4.1	3.8	0.1
Labour - urban – primary	3.2	0.4	-0.2	0.1	0
Labour - urban – secondary	2.9	1.8	3.4	5.2	0.1
Labour - urban – tertiary	2.8	0.9	0.9	1.8	0
Land	6.2	-0.3	1.1	0.9	0
Capital – crop	3.1	-0.3	0.8	0.5	0
Capital – livestock	0.8	-0.5	1.5	1	0
Capital – mining	7.6	0.1	-1.1	-1	0
Capital – other	30.9	0.2	2.2	2.4	0

Source: CGE Output

Ironically, subsidy shock impacted mostly on urban labour without schooling at 4%. However, increased government spending impacted mainly on urban secondary labour by 5.2%. The combined impact across board was marginal, particularly for the rural labour. Arndt and Tarp (2003) affirmed that a 30% increase in agricultural productivity for Mozambique decreased men's wages in commercial agriculture, while women's wages in food crop production rose due to their concentration in the food crop sector.

4.7 Impact on Household Consumption of Commodities

Generally, the impact of TFP shock was negative on all sub-sectors of the economy. However, subsidy implementation showed positive impact, which ranged from 0.5% for other industries to 4.5% in the agriculture sector. Increased government spending shock caused impact which ranged from -0.5% under other industries to 3.8% for agriculture. Combined impact was generally non-existent, except for the manufacturing sector, which returned 0.1% marginal increase (Table 8).Specific outcomes across the sub-sectors tend to suggest that in-spite of the impact of subsidy and government spendings, total factor productivity in the crop sub-sector witnessed a decrease, probably due to climatic variation, inexperience in technology application, given initial adoption, weak agronomic practices, bureaucratic challenges, among others.

Table 8. Impact of Shock on Households Consumption of Commodities

Sub-sectors	Base Value	Total Factor Productivity	Subsidy	Government Spendings	CombinedImpact for all Simulations
Agriculture	31	-0.7	4.5	3.8	0
Mining	0	-0.8	1.1	0.3	0
Manufacturing	22	-0.9	1.3	0.5	0.1
Other Industries	1	-1.1	0.5	-0.5	0
Private Services	42	-1	1.3	0.3	0
Public Services	4	-1.7	1.5	-0.2	0

Source: Output of CGE model

4.8 Impact of Total Factor Productivity on Household Institutional Incomes

The results, as detailed in Figure 1 shows that TFP shock impacted more on the rural non-farming household income of the third, fourth and second quintiles by 0.76%, 0.70% and 0.64%. respectively. This development may not be unconnected to the activities of the households across the value chain, probably those involved in processing and marketing of agricultural output which arose as a result of increased output emanating from productivity increases.

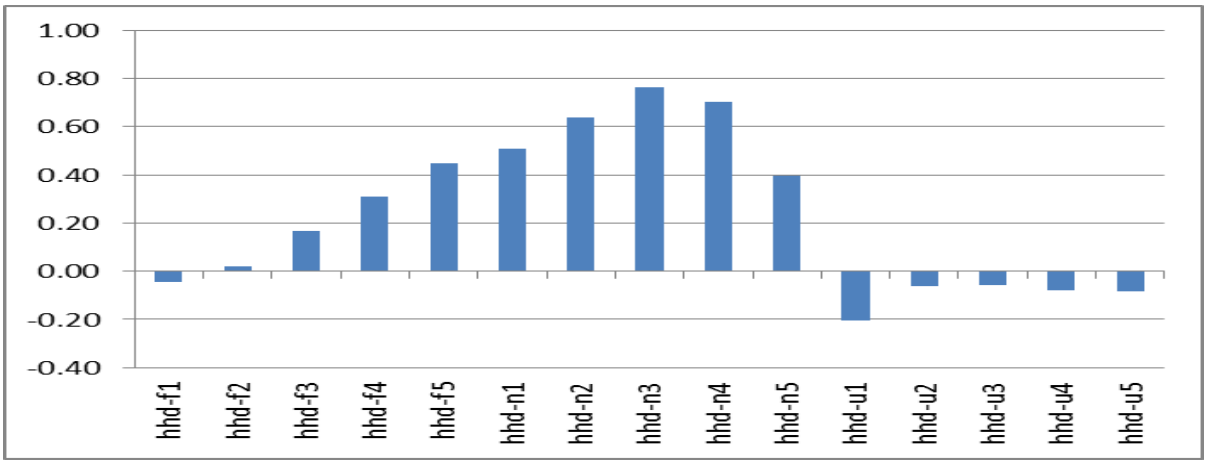

Figure 1. Effect of Total Factor Productivity Shock on Household Incomes

4.9 Impact of Subsidy on Household Incomes

Figure 2 shows that fertilizer subsidy shock impacted on all categories of households in the economy. However, the impact was more on the rural no farming households within the first, second and third quintiles by 2.66%, 2.59% and 2.43% respectively. This development may be as result of the fact that the implemented subsidy scheme enhanced output, which allowed enhanced participation of the rural non-farming households in downstream activities of processing, marketing and transportation.

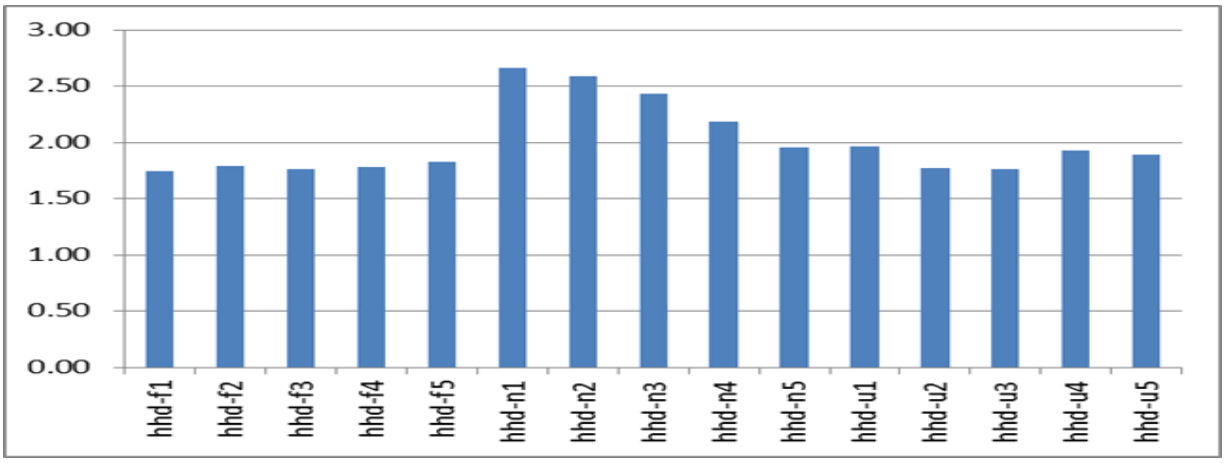

Figure 2. Effect of Subsidy Shock on Household Incomes

4.10 Impact of Government Spending Shock on Household Incomes

Figure 3 reveals that government spending shock impacted on all categories of households within the economy, particularly, households within the first, second and third quintiles non-farm households by 3.1%, 3.0% and 2.9% respectively. Impact ranged from 1.7% for the urban household to 3.26% under the rural non-farming households within the second quintile.

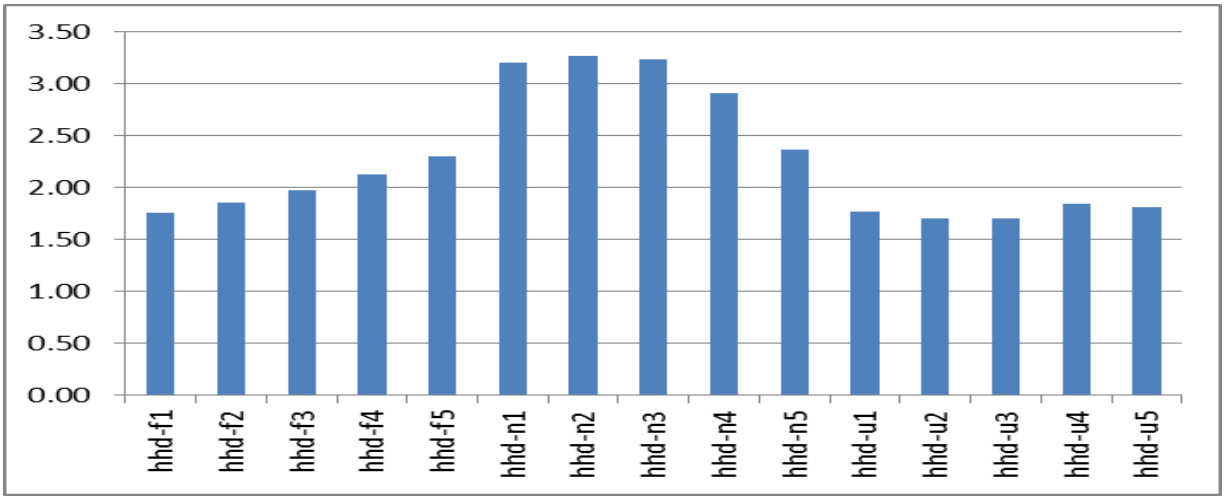

Figure 3. Effect of Government Expenditure Shock on Household Incomes

4.11 Impact on Combined Impact of Total Factor Productivity, Subsidy Regime, and Increased Government Spendings

The combined impact ofproductivity, subsidy and increased government spendings on household incomes across the economy was generally marginal, ranging from 0.02% on the urban households to 0.05% on the first and second quintile households (Table 4).

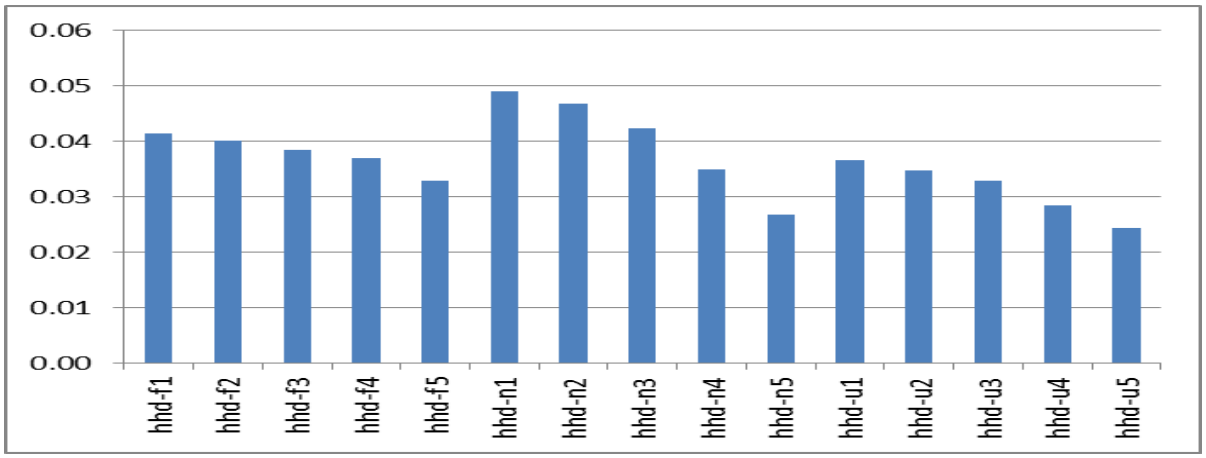

Figure 4. Combined Effect of Total Factor Productivity, Subsidy and Government Expenditure Shocks on Household Incomes

5. Conclusion and Recommendations

Arising from the outcome of the analysis, the result showed that TFP shock had varying impacts on Nigeria's macroeconomic variables, including institutional incomes. The results suggest that implementation of 7.23% TFP growth rate, 50% subsidy and adherence to 10 % funding of the agriculture sector will to some extent, enhance the achievement of the country's development outcomes. However, there may be need to change the direction of subsidy from agro-input support to projects with public good characteristics and for local fertilizer manufacturing, given the need to improve public investments in the agriculture sector and inevitably the prospect for innovative private investments.

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