Assessing the Impact of Rice Sector Policy Reforms on the Income Mobility of Rural Households in Nigeria

Henry Okodua

About the Author

Henry Okodua is a Senior Lecturer in the Department of Economics and Development Studies at Covenant University, Ota, Nigeria.

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Abstract

Nigeria's agricultural policy has evolved considerably since the country gained political independence in 1960. The priority at that time was to boost domestic production, particularly of cash crops, and the country has had good results to show for these efforts, becoming the largest producer of rice in West Africa. However, Nigeria also remains a notable global net rice importer. Nigeria's rice production is primarily undertaken by small-scale producers and is characterized by low productivity owing to inefficient production systems and the country's aging farming population. The Nigerian government recently introduced a number of initiatives under its Agricultural Transformation Agenda to address these issues and achieve the government's goal of rice self-sufficiency. In August 2014, the Dangote Industries Limited signed a Memorandum of Understanding with the Federal Government of Nigeria for a US$1 billion investment in commercial rice farming and modern integrated rice mills. The Nigerian government has also agreed on similar collaborations with other private investors. Using a static computable general equilibrium (CGE) framework, the study investigates the potential additional income benefits or losses for rural Nigerian households stemming from the government's current initiative of tariff barriers on imported rice and increased domestic rice production. The study also probes into the potential of the policy to produce considerable employment gains for rural households in Nigeria under the assumption that local rice production will displace imported rice. The findings reveal that the implementation of the new policy on domestic rice production will produce considerable employment gains for all households and for most sectors of Nigeria's economy. The policy will also result in an overall income gain for both rural and urban households, although these gains will be larger for rural households. There is therefore the compelling need for the current administration of the Federal Government of Nigeria to sustain the implementation of these rice policy reforms.

Résumé

La politique agricole du Nigéria a considérablement évolué depuis que le pays a acquis son indépendance politique en 1960. La priorité à cette époque était de stimuler la production nationale, en particulier de cultures de rente, et le pays a obtenu de bons résultats pour devenir le plus grand producteur de riz En Afrique de l'Ouest. Néanmoins, le Nigéria reste également un important importateur net mondial de riz. La production de riz du Nigéria est principalement réalisée par les petits producteurs et se caractérise par une faible productivité due à des systèmes de production inefficaces et à la population agricole vieillissante du pays. Le gouvernement nigérian a récemment lancé un certain nombre d'initiatives dans le cadre de son programme de transformation agricole pour aborder ces questions et atteindre l'objectif du gouvernement en matière d'autosuffisance en riz. En août 2014, Dangote Industries Limited a signé un protocole d'entente avec le gouvernement fédéral du Nigéria pour un investissement de 1 milliard de dollars US en riziculture commerciale et en rizières modernes intégrées. Le gouvernement nigérian a également convenu de collaborations similaires avec d'autres investisseurs privés. À l'aide d'un modèle d'équilibre général calculable statique (EGC), l'étude examine les avantages ou les pertes de revenus supplémentaires potentiels pour les ménages ruraux nigérians découlant de l'initiative actuelle du gouvernement en matière de barrières tarifaires sur le riz importé et l'augmentation de la production nationale de riz. L'étude examine également le potentiel de la politique à produire des gains d'emploi considérables pour les ménages ruraux au Nigeria sous l'hypothèse que la production locale de riz remplacera le riz importé. Les résultats révèlent que la mise en œuvre de la nouvelle politique sur la production nationale de riz produira des gains d'emplois considérables pour tous les ménages et pour la plupart des secteurs de l'économie nigériane. Cette politique se traduira également par un gain de revenu global pour les ménages ruraux et urbains, bien que ces gains soient plus importants pour les ménages ruraux. Il est donc impératif que l'administration actuelle du gouvernement fédéral du Nigéria soutienne la mise en œuvre de ces réformes de la politique rizicole.

1. Introduction

Nigeria's agricultural policy has evolved considerably since the country gained political independence in 1960. The priority at that time was to boost domestic production, particularly of cash crops, and the country has had good results to show for these efforts. Nigeria was the world's top producer of rubber, groundnuts, and palm oil and the second-largest producer of cocoa during the period between 1960 and 1970. The 1970s and the early 1980s saw a surge in government revenues from enormous exports of crude oil. However, this period also unfortunately saw a total neglect of the agricultural sector. As a consequence, there was a strong decline in domestic agricultural production and a rapid increase in the country's dependence on imported foodstuffs.

Nwanze et al. (2006) observes that domestic demand for rice has been growing at a rapid pace in many African countries due to changing consumer preferences, rising incomes, and growing urban populations. Nigeria is no different, with rice becoming of growing importance. Akinbile (2007), cited in Johnson, Takeshima and Gyimah-Brempong (2013), notes that Nigeria has a rich history of rice production and consumption, as indigenous rice species (local rice) have been grown in the country for more than 300 years. According to Akinbile, over time rice has developed into a major staple crop in the Nigerian diet, with a demand profile cutting across all regions and socioeconomic groups. The UN Comtrade database (UN, 2012) shows that Nigeria's rice imports were about 2.1 million metric tons.

Nigeria has been the largest rice producer in West Africa; however, the country also remains a notable global net rice importer. Nigeria's rice production is primarily undertaken by small-scale producers and is characterized by low productivity owing to inefficient production systems and the country's aging farming population. Thus, local production of rice has not been able to meet the country's growing appetite for the crop. This discrepancy has brought about an increasing dependence on rice imports, despite the risk this poses to the economy and the increased exposure of Nigeria's citizens to the problem of food insecurity.

The perceived risks of import dependency have motivated the Nigerian government to introduce a number of initiatives under its Agricultural Transformation Agenda (ATA) to address the problems surrounding domestic rice production. The overall goals of the ATA are to re-define agriculture as a business, to promote private sector investment in agriculture, to encourage the development of private sector-driven marketing organizations, and to promote Incentive-based Risk Sharing for Agricultural Lending. The government utilizes a combination of import restrictions and input policy and institutional reforms, as well as direct investments to improve product output and quality (Johnson, Takeshima and Gyimah-Brempong, 2013). Adesina (2012) reports that about 210,000 metric tons of new rice capacity (representing 10 percent of current imports) was produced locally between 2011 and 2012, a very good sign that the government's new rice policies are paying off.

According to Adesina (2012), the Federal Government of Nigeria's new policy on agriculture provides fiscal incentives to encourage domestic import substitution and private sector investment in the agricultural sector. These incentives include: removal of restrictions on areas of investment and maximum equity ownership in investment by foreign investors; no currency exchange controls, meaning the free transfer of capital, profits, and dividends; constitutional guarantees against nationalization/expropriation of investments; zero percent (0 %) duty on agricultural machinery and equipment imports; a pioneer tax holiday for agricultural investments; and duty waivers and other industry-related incentives (e.g., based on use of local raw materials, export orientation, etc.). These policy incentives have additional private investors into the rice sector; some of the major investors that have either invested or have indicated interest in doing so include: Flour Mills of Nigeria (Bidda-Badeggi, Niger State); Ebony Rice, Ebonyi Govt., UNDP, SME'S (Ikwo, Ebonyi State); and Dominion Farms (Gassol, Taraba State).

In August 2014, the Dangote Industries Limited signed a Memorandum of Understanding (MoU) with the Federal Government of Nigeria for a US$1 billion investment in commercial rice farming and modern integrated rice mills. The chairman of the Dangote Group, Aliko Dangote, promised that once his company begins producing rice, the price of that locally produced rice will be cheaper than the price of imported rice and that this will create room for further investments in the sector. Dangote also added that his firm had acquired farmlands in Edo, Jigawa, Kebbi, Kwara, and Niger states, totaling 150,000 hectares to be used for the commercial production of rice paddy. In addition, the Dangote Group will also establish two state-of-the-art, large-scale rice mills, each with a capacity to mill 120,000 metric tons of rice paddy, bringing total capacity to 240,000 metric tons, with plans to double that figure in two years. This installed capacity means that the project will become the largest integrated rice mill in Africa. It is hoped that this massive investment in rice production and processing by the Dangote Group will make Nigeria a net exporter of rice within four years of the commencement of the project and will boost inclusive wealth creation and employment generation in the country.

The Nigerian government believes that this development will significantly boost small-holder rice production through a nucleus and out-grower farming model. The sites selected for the program are rural rice-growing communities that will be supported by Dangote's provision of agro-inputs, training, and marketing linkages to improve community-farming. Employment opportunities for at least 8,000 Nigerians will also be created by the massive investment.

The Nigerian government's current policy initiative aims at promoting the overall performance of the domestic rice sector and is comprised of two key strategies. The first has to do with the use of import barriers/tariffs in order to enhance the competitiveness (in terms of relative price) of domestic rice. The second has to do with the expansion of paddy production and the processing of premium-quality rice, with the long-run objective of replacing rice imports with domestic production. These strategies are embedded

in the government's rice transformation agenda (RTA). The final goal of the RTA is to reduce the country's rice import bill and make Nigeria self-sufficient within a 5-year timeframe. It is also expected that the RTA will promote inclusive wealth creation and employment generation in the country. Of course, an improvement in the local rice quality will be needed to make the local product a viable alternative to current imports.

The foregoing description of the rice policy environment gives the impression of a policy with great potential to succeed. However, looking back in time, a number of previous similar initiatives by Nigeria to become self-sufficient in rice production were not very successful. The 1999 Presidential Initiative on Rice and the 2001 National Program for Food Security are recent examples of such initiatives. These initiatives included import barrier policies and other incentives to stimulate local production and achieve self-sufficiency in rice production. However, the initiatives clearly failed to achieve their defined goals, as Nigeria remains heavily dependent on rice imports for its consumption needs.

The current initiative faces several risks that call for further study. First, it is possible that the RTA could displace smallholder rice farmers of rice. Second, the potential of the current initiative to promote local rice production and increase its competitiveness with imported rice also demands further examination. For example, what is really new or different in this current initiative that will make it succeed where previous attempts have failed? What will be the additional income benefits to rural households from the current initiative of tariff barriers on imported rice and increased domestic rice production? Will there be considerable employment gains for rural households, supposing that locally produced rice does in fact displace imported rice? The goal of this study is to assess the impact of the current rice policy initiative on the income mobility of rural households in Nigeria, using a framework of policy experimentation. It is hoped that our findings will provide additional insights to guide policymakers in the implementation of the current rice production initiative.

The rest of the paper is organized as follows. Section two provides a review of the related literature on the Nigerian rice economy; section three comprises the distribution of rice production by major rice producers in West Africa. Section four addresses the methodology and data. Section five provides a description of the Nigerian economy using the 2006 SAM. Section six presents the simulation results and discussions, while section seven concludes.

2. Review of the Related Literature on the Nigerian Rice Economy

The average rice consumer in Nigeria prefers parboiled rice, which can be either imported or locally produced. Nigeria has the largest market for parboiled rice in West Africa; other West African countries demonstrate a preference for regular milled white rice (USDA, 2010). Overall, imported rice is preferred to locally grown rice, due to the imported product's superior quality (Diagne, 2011). Domestic rice is

normally semi-milled brown rice that is de-hulled and not polished; it has great color variation and can contain different varieties in the same bag. In general, there is limited investment in the processing of local rice in Nigeria, specifically in packaging and in improved technology for cleaning and de-stoning paddy (USAID, 2009). Alternatively, imported rice is generally processed milled rice.

Domestic rice is normally 20-30 percent less expensive than imported rice. The main determinants of this price difference include the appearance, cleanliness, swelling capacity, taste, and homogeneity of imported rice (Ogadinma 2009). However, despite the price and quality differential, there is still an overall acknowledgment of higher organoleptic properties of local rice (Lançon et al, 2003). In general, the marketing segment of high-quality imported rice consumers, mostly in urban areas, is mainly concerned with quality and is less sensitive to price changes, while consumers of local rice are normally more price-sensitive (USAID 2009).

According to Ogazi (2009), self-sufficiency in rice production has remained one of the Nigerian government's political-economic goals to end hunger, reduce poverty, and ameliorate the country's food security. It is also a developmental strategy aimed to reduce foreign exchange disequilibrium arising from rice imports. However, Johnson, Takeshima, and Gyimah-Brempong (2013) argue that while meeting the demand for higher quality premium rice in the short term is only feasible through the use of large scale millers (which the government is already promoting), this will not lead to job creation and wealth in rural areas nor will it help poorer consumers who have to spend a higher proportion of their income on food. They also provide evidence that rice now ranks first among all staple food items in Nigeria in terms of expenditures and second only to cassava in terms of quantity consumed.

In terms of performance of the policy measures to boost local rice production in Nigeria, Misari et al; (1996) report that the 1986 ban on rice importation led to increased rice production, from 0.94 million tons in 1986 to 2.54 million tons in 1994. The ban on rice was for the period 1986-1995. During the ban on rice period, it was prohibited to import rice into the country though illegal importation through the country's porous borders increased (Ogazi, 2009). As a consequence, Nigeria's rice import bills remained heavy. According to Abdullahi (2002), of the N250 billion spent yearly to import agricultural products, N60 billion is devoted to rice. FAO data suggest an estimated 500 percent rise in the foreign exchange expenditure on rice imports over the eleven year period between 1990 and 2001. The values rose from 224,000 metric tons of rice, valued at US 60 million dollars, in 1990 to 345,000 metric tons in 1996, with a value of US130 million dollars. Nigeria's rice imports increased to 1.51 million metric tons, valued at US288.1 million dollars, by 2001 (FAO, 1994). Nigeria has suitable ecologies and a potential land area for rice production, and the country's potential rice yield has not been fully realized (Akande, 2002). Bello (2004) argues that Nigeria has the potential to produce enough rice for its domestic needs, and even to export a surplus.

It is important to note here, however, that government policies alone may not be effective in stimulating local rice production of the desired quantity and quality. A good understanding of the factors driving rice demand in the country, as well as accurate timing of policies, also matter. Moreover, private economic agents engaged in rice production activities are very sensitive to government policies and must be included in the policymaking process. Inconsistencies and a lack of continuity in agricultural policies have been blamed in the literature as an impediment to domestic rice production and a constraint on poor rice farmers' welfare. (Daramola, 2005). Making Nigerian rice more competitive in terms of price and quality therefore requires a combination of factors, including appropriate policy measures.

3. Distribution of Rice Production by Major Rice Producers in West Africa

Historically, rice is cultivated in most West African countries. Nigeria has been the dominant producer of rice in the sub-region. Table 1 shows that Nigeria remains on the top in absolute terms on annual basis between 2007 and 2008, followed by Mali, Guinea, Serra Leone, and Cote d'Ivoire. However, Table 1 also shows that Nigeria's rice production has consistently been on the decline in recent years. While the other top rice-producing countries continue to increase their annual production, Nigeria's production has remained stable at about an average of 4,500,000 tons per annum.

Table 1: Share of Top Five Rice Producers in West Africa

Country	Total Annual Output (Tons)						
	2007	2008	2009	2010	2011	2012	2013
Nigeria	3186000	4179000	3546250	4472520	4567320	4833000	4700000
Mali	1082384	1624246	1950805	2305612	1741472	1914867	2211920
Guinea	1401592	1534088	1455932	1498962	1670000	1919000	2053000
Serra Leone	588004	680097	888417	1026671	1078005	1141417	1255559
Côte d'Ivoire	606310	679969	687721	1206153	846153	1513846	1874641
W. Africa Total	13635831	16332134	16261798	19378699	19062274	21182959	21726275

Source: Authors' calculations based on FAO 2013

Table 2 presents the share of the top five rice producers in West Africa. Annual output is reported in percentages; the figures show clearly that rice output in Nigeria has actually been on the decline in relative importance. The country produced 23.36 percent of the sub-region's total rice output in 2007. It peaked in 2008 with about 25.59 percent of total rice output and then dropped thereafter, never recovering that level of output throughout the reference period. The most recent figures from 2013 shows that Nigeria's share of rice output in West Africa stood at 21.63 percent. It is also interesting to note that rice production in Mali and Côte d'Ivoire has been growing faster than that of the other countries. While Mali has added over 2 percent share, from 7.94 percent in 2007 to 10.18 percent in 2013, Cote d'Ivoire has added over 4 percent share, from 4.45 percent in 2007 to 8.63 percent in 2013.

Table 2: Share of Top Five Rice Producers in West Africa

Country	Total Annual Output (%)						
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Nigeria	23.36	25.59	21.81	23.08	23.96	22.82	21.63
Mali	7.94	9.95	12.00	11.90	9.14	9.04	10.18
Guinea	10.28	9.39	8.95	7.74	8.76	9.06	9.45
Côte d'Ivoire	4.45	4.16	4.23	6.22	4.44	7.15	8.63
Serra Leone	4.31	4.16	5.46	5.30	5.66	5.39	5.78
Group Total (%)	50.34	53.25	52.45	54.23	51.95	53.45	55.67
West Africa Total (%)	100	100	100	100	100	100	100

Source: Authors' calculations based on FAO 2013

Table 3 shows the share of the top five rice producers in West Africa in per capita annual output. Ironically, Nigeria is at the bottom in terms of relative importance – the figures show that the country only produces about 27 kilograms of rice per capita annually. This is a far cry from Cote d'Ivoire's 307 kilograms per capita annually. In fact, Nigeria produces less than half of what is produced on a per capita basis in any of the other four top rice producers in the West African sub-region. This is suggestive of a lot of inefficiency in Nigeria's rice sector, as well as a lot of opportunity to expand production.

Table 3: Share of Top Five Rice Producers in West Africa

Country	Per Capita Annual Output (kg)						
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Côte d'Ivoire	111.95	122.91	121.91	209.69	144.26	253.21	307.72
Guinea	139.5	148.73	137.44	137.82	149.62	167.58	174.79
Mali	85.06	123.63	143.87	164.85	120.8	128.92	144.55
Serra Leone	32.76	37.25	47.76	54.1	55.6	57.53	61.8
Nigeria	21.65	27.64	22.82	28	27.82	28.63	27.07

Source: Authors' calculations based on FAO 2013 and WDI online database

4. Methodology & Data

This study uses a computable general equilibrium (CGE) model to assess the impact of Nigeria's domestic rice production policy on the income mobility of rural Nigerian households. A CGE model is formally defined as "a set of simultaneous equations relating variables, some of which are endogenous (determined within the model), the rest being exogenous" (Lemelin. 2015: 9). The advantages of using a CGE model as a methodological tool in an applied research work of this nature are well documented in the literature. A survey of the literature on some of the known advantages of the CGE model is found in Hosny (2013), and a number of these advantages are summarized in what follows.

The most commonly cited advantage of the CGE approach is its theoretical consistency. According to Borges (1986), the most important strength of the general equilibrium methodology is its solid microeconomic foundation; the production and demand functions for all agents in the economy are

explicitly specified in CGE models. Moreover, the CGE model takes into account the interdependence among all markets and regions and provides numerical estimates of growth and distributional effects caused by changes in policy. This can be contrasted with a partial equilibrium model, which often misses important inter-market relationships and ignores macroeconomic impacts. A second advantage of CGE models derives from their ability to impose accounting consistency on a system. This is because a CGE model usually builds on a closed accounting system which details all the basic identities for the modeled economy. Expenditures and incomes have to match in these types of models, such that households cannot spend more than they earn. In this case, any external shock and the consequences of changes in domestic policy can be quantitatively measured.

CGE models can also provide concrete measures of changes in welfare due to policy changes. In addition, CGEs can accurately measure not only aggregate welfare changes, but also welfare consequences of changing economic policies in specific sectors. This is important because in reality, policymakers maybe concerned more about the impact of trade or agricultural policies on individual sectors and special interest groups than about their impact on the whole economy. This point is particularly important because it provides a framework for analyzing the tradeoff between efficiency and equity/distributional issues. Questions regarding who will win and who will lose from changing trade or agricultural policies can be answered using the CGE framework, thus providing policymakers with a better understanding of the possible social results of the impacts of different policies. Kehoe and Kehoe (1994) assert that CGE models are good tools for identifying winners and losers under a policy change because they emphasize the impact of reallocating resources across different sectors of an economy.

The PEP-1-1 (1 period – 1 country) model – version 2.1 (Robichaud, Lemelin, Maisonnave and Decaluwé, 2013) is adopted for this study. The PEP-1-1 model is a static computable general equilibrium (CGE) model designed for the study of a national economy. The principal characteristics of the PEP-1-1 model are described in (Robichaud, Lemelin, Maisonnave and Decaluwé, 2012). The static model as applicable to the Nigerian economy is built on the assumption that a typical agent optimizes an objective function subject to some constraints. Calibration of the model parameters was carried out using the 2006 Social Accountability Matrix (SAM) developed for the Nigerian government by the International Food Policy Research Institute, (IFPRI). The structure of this SAM is described in Nwafor, Diao, and Alpuerto (2010). The SAM was re-formatted and re-aggregated for the purpose of this study.

4.1 Main Elements of the Re-aggregated 2006 Nigeria SAM

The re-aggregated 2006 Nigeria SAM comprises five sectors (rice, agriculture, industry, services, and public administration). It also considers two factors of production - labor (homogenous type) and capital (physical capital and land). The SAM includes four agents – a representative firm, households (12 in

number, representing households in the rural South-South zone, South-East zone, South-West zone, North-Central, North-East zone, and North-West, zone as well as households in the urban South-South zone, South-East zone, South-West zone, North-Central, North-East zone, and North-West zone), government, and rest of the world (ROW). The SAM covers six commodities - rice, food, agriculture, industry, services, and public administration. Only four of the commodities were exported – food, agriculture, industry, and services. There was no export of rice.

### 4.1.1 Description of the Static CGE Model

Lemelin (2015) explains that the core of a CGE model consists of equations representing consumer- and producer-optimizing behavior and market equilibrium. A model solution is a Walrasian competitive general equilibrium: all optimizing economic agents meet their (first-order) optimality conditions, subject to their budget constraints, and all markets are in equilibrium. Without money, the set of equations which constitutes the model is homogenous with degree zero in prices.

The static CGE model used in this study has five building blocks – production, demand, income and savings/investment, equilibrium, and prices. As already stated, the model recognizes five sectors or activities, six commodities, one representative firm, and four types of agents. Of the four agents, only households are assumed to be sensitive to relative price changes.

4.1.2 Production

Production technology is represented in this study by a nested production function as shown in Figure 1. Here, the domestic production of sector j uses a constant elasticity of substitution (CES) production function to combine production inputs, which typically include intermediate outputs from the other sectors and primary factors (labor and capital). Primary factors are combined using the CES aggregation function to provide the value added by each sector, VAj. Total production Qj is the result of combining domestic production XDj with imports, Mj, through a CES aggregation function that conforms to Armington's (1969) hypothesis, which indicates that the Nigerian economy is small enough not to have an influence on foreign trade. Producers are assumed to maximize their profits, and this maximization results in supply functions of each good.

Figure 1: Model's Block - Production
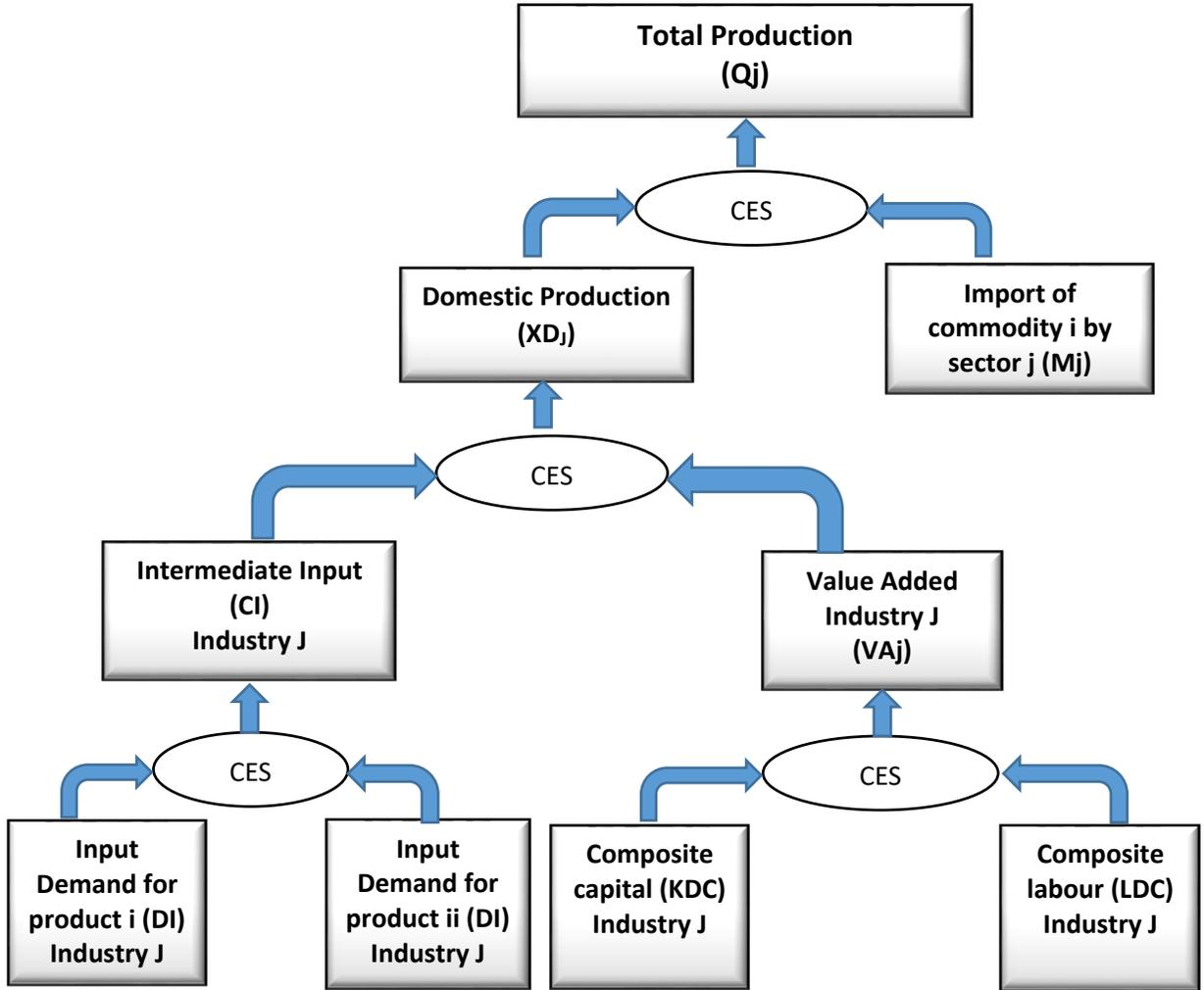
4.1.3 Demand, Income, and Savings/Investment

Final demand represents the aggregate of investments and export demand, as well as household consumer goods demand. Each household has initial endowments and a set of preferences. The available household income not used for consumption is savings. The representative household's purchases are financed mainly by revenues from the sale of the initial factor endowments. The representative household's disposable income (YDH_h) is calculated by adding up all capital (YHK_h) and labor (YHL_h) earnings, plus transfers ($YHTR_h$) received and minus the direct taxes (TDH_h) for which the household is liable, minus household transfers to government ($TR_{gvt,h}$):

$$YDH_h = YHL_h + YHK_h + YHTR_h - TDH_h - TR_{gvt,h} \qquad (1)$$

Figure 2: Model's Block – Income, Saving and Demand
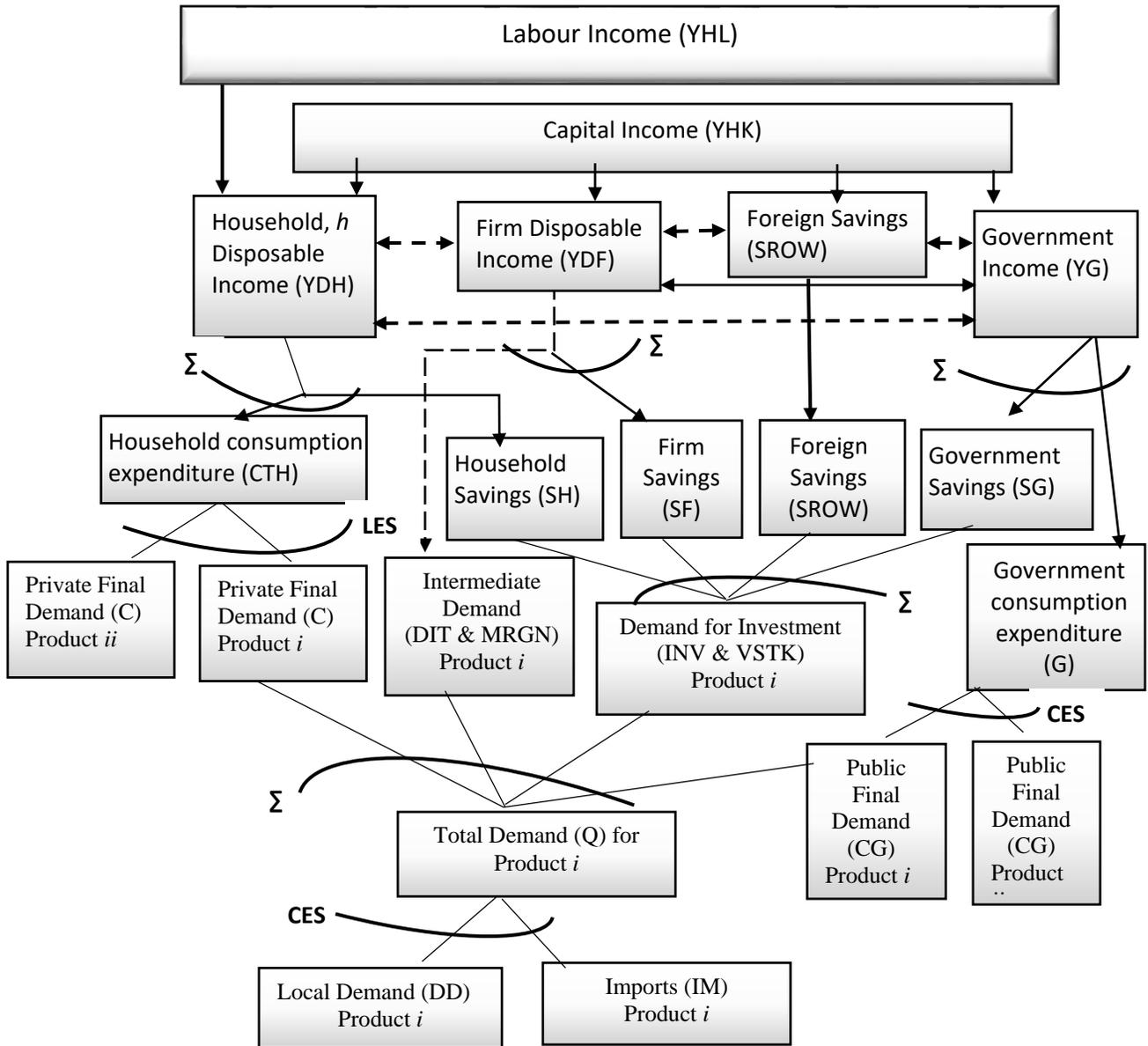
Market demands are the result of adding up each household's demands. Market demands are price-dependent and they are also continuous, non-negative, homogeneous of zero degree, and satisfy the Walras' law.

There are 12 representative households, which are modelled to have Stone-Geary type of preferences. They earn their income from labor, capital, and transfers received from other agents. Each household category receives a fixed share of the earnings from labor. Total capital income is distributed among agents in fixed proportions. Transfer income is the sum of all transfers received by the different household category.

Household disposable income is obtained by subtracting direct taxes from the household's total income. Household saving is modelled as a linear function of disposable income.

Firm's income is the aggregate of rental on capital paid to firms and transfers from other agents earned by the firm. Firm's disposable income is arrived at after deducting direct taxes paid by firms from their total income. Firm's saving is obtained as the net of firm's disposable income and firm's transfers paid to other agents. Government revenue is the sum of direct tax revenue from households, as well as indirect taxes on products and on imports. In this model, government also earns capital income and receives transfers from ROW. Government savings is derived after accounting for its consumption expenditure and transfers to households. The aggregate of Nigeria's import expenditure, capital income, and transfers from other agents represent the income of ROW in this model. ROW saving is the difference between ROW income and total export earning of the country, plus transfer income received by other agents from ROW. ROW saving is equivalent to the negative of the current account balance (CAB). The study assumes a savings-driven model of investment and savings.

4.1.4 Equilibrium and Prices

Equilibrium conditions and prices are shown in Figure 3. The assumption of market equilibrium invokes the familiar condition of *market clearance,* which presupposes that supply equals demand in all markets within the economy given that all consumers and producers are rational or able to make optimal choices. Finding equilibrium therefore implies the solution for the model such that the relative prices and the productive sector activity levels (and perhaps public and foreign deficits) are allowed to operate as endogenous variables in equilibrium fitting. However, finding the equilibrium also implies solving a system of equations strictly from a computational point of view. The basic ingredients of the equilibrium and prices blocks include the supply functions (one for each output and input), the demand functions, the market clearing conditions, and some accounting identities. Only relative prices are significant in this model. Therefore, equilibrium is characterized by a set of relative prices and by certain production levels in each industry in which market demand equals supply for all goods.

Figure 3: Model's Block – Equilibrium and Prices
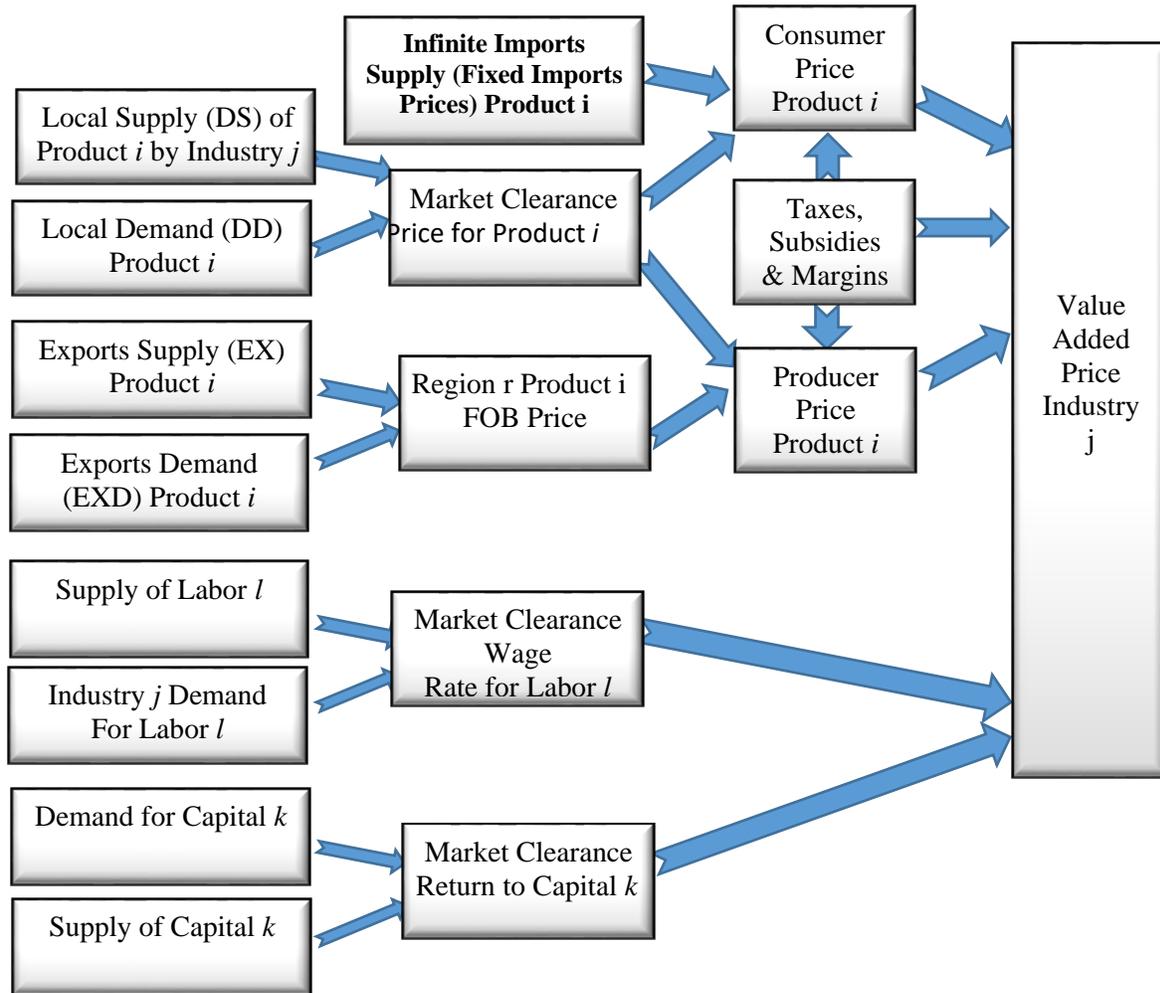
4.1.5   Model Assumptions

First, the study recognizes the recent change of government in Nigeria through peaceful and credible democratic processes and assumes that there will be no major policy shift from the Federal Government's rice transformation agenda. This is a plausible assumption given that rice is a staple food consumed by all households in Nigeria and that food security is a basic desire of all Nigerians. It would therefore be politically suicidal for the government of the day to abandon a policy that promotes local production of an affordable staple food. Moreover, the dramatic fall in government revenue as a result of falling global crude oil prices, and the subsequent economic recession currently being experienced in Nigeria, make it compelling for the Nigerian government to diversity the country's economy into other sectors. Increasing domestic rice production remains one logical way of doing so.

Second, the model also assumes that large-scale private sector investment in the production and processing of premium quality rice will only complement existing investments by smallholder farmers in the rice sector. The implication of this assumption is that such investment will be regarded as an endogenous shock in the model. This assumption is in conformity with the investment-driven closure (in which the value of investment adjusts).

Third, the model assumes that private investors will be able to produce premium quality parboiled rice in an efficient manner, such that imported rice would be significantly displaced from the economy.

Fourth, households are assumed to act collectively as a single representative agent who rents out factors to industries in exchange for income. Households then use the income received to purchase commodities for the purpose of consumption and investment.

Fifth, each industry is assumed to behave as a representative firm that hires inputs of the primary factors and uses quantities of commodities as intermediate inputs to produce a given quantity of its own type of output.

4.1.6   Macroeconomic Closures

A standard CGE model includes three macroeconomic balances: the government balance, the external balance, and the Savings-Investment balance (Lofgren, Harris, and Robinson, 2002). Each researcher is at liberty to choose between different closure rules for these balances. The choice of closure rule, however, will define the direction of causality in a model, and the choices made can have significant implications for the behavior of the model. Mathematically, ensuring that a model is closed amounts to ensuring that we have enough independent equations to explain the endogenous variables. The choice of closures for this study is guided by the default PEP-1-1 model closure. In addition, the closures are presented with the understanding that in a static comparative framework, closure rules should be discussed under short-run or long-run perspectives.

The government closure rule, consisting of fixing real expenses and adjusting its income by its saving (SHORT RUN), leads to the so-called intergenerational "free-lunch" situation, in which today's welfare gains might be supported by future generations. To avoid encouraging such a situation, a closure rule that emphasizes the LONG-RUN perspective and which consists of "fixed expenses and fixed savings and adjustment by endogenous tax rates" is adopted here. The results of simulations with a model closed this way can be interpreted as capturing the full impact of the today's policy shock.

For external balance, the closure could be that the real exchange rate is flexible while the current account balance is fixed. If the current account surplus is below the exogenous level, for example, a depreciation of the real exchange rate would correct this situation by simultaneously reducing spending on imports and increasing earnings from exports. Under the alternative external balance closure, the real exchange rate is

fixed while the current account is flexible. However, a flexible/endogenous current account balance will imply a "free lunch" situation between resident and non-resident institutions.

In this model, the nominal exchange rate is chosen as *numeraire*. Thus, changes in domestic price indices can be interpreted as changes in domestic prices relative to world prices, which have been fixed in the model. The current account balance (CAB) is fixed directly. The reason for the choice of this closure is that for a developing economy with a low level of foreign reserve, as is presently the case in Nigeria, access to foreign credit may in fact be very limited; thus, a fixed current account is simply a reflection of economic reality and emphasizes what is sustainable in the LONG RUN. The results of simulations with such a closure can be interpreted as representing the economic effect of a policy for a given level of foreign borrowing and investment in future consumption.

Finally, for the Savings-Investment balance, closures could either be investment-driven (the value of investment adjusts) or savings-driven (the value of savings adjusts). Savings-driven investments (SHORT RUN) leads to a wealth transfer between periods (today and tomorrow) within a static comparative framework; the wealth effect of the shock cannot be fully captured today. Therefore, an investment-driven closure rule (LONG RUN) which allows investments to be fixed only in real terms (volume) is preferred for this study.

4.1.7   Simulation Scenarios

The study involves simulations of two agricultural trade policy scenarios:

- A 35 percent increase in import tariffs on rice accompanied by import substitution elasticity of 0.8 for rice (assuming locally produced rice is less competitive with imported rice in terms of price and quality) - SIM1

    The assumption under SIM1 is based on a scenario of inefficiency in local rice production or policy ineffectiveness

- A 35 percent increase in import tariffs on rice, accompanied by import substitution elasticity of 4.0 for rice (assuming locally produced rice has become more competitive with imported rice in terms of price and quality) - SIM2

    The assumption under SIM2 is based on a scenario of greater efficiency in local rice production or policy effectiveness.

A positive shock to import tariffs on rice will make the market price of imported rice relatively more expensive vis-à-vis domestically grown rice. Given the Armington condition and that the elasticity of substitution between imported and locally produced rice is 0.8 (as estimated by Zhang and Verikios (2006)), demand for and consumption of imported rice will reduce marginally as consumers will be less sensitive to marginal price changes. This is expected to impose some downward pressure on imported rice and

encourage a slight increase in the output of locally produced rice. The implication is that consumers will suffer a welfare loss but will also be expected to shift some of their demand rice to locally produced rice.

Suppose that locally produced rice is now competitive in terms of price and quality. The second policy simulation assumes a 35 percent increase in import tariffs on rice, accompanied by import substitution elasticity of 4.0 for rice. The goal here is to measure the improvement in the quality of locally produced rice and its overall impact on the rest of the economy. In this case, demand for and consumption of imported rice will reduce substantially, as consumers will be more sensitive to marginal price changes. This is expected to impose some substantial downward pressure on imported rice and encourage a sizeable increase in the output of locally produced rice. The implication is that consumers will not suffer much welfare loss, as the quality of locally produced rice becomes much more comparable with that of imported rice. Consumers in this case will be expected to considerably shift their demand to locally produced rice.

5. Description of the Nigerian Economy Using the 2006 SAM

The description of the Nigerian economy using the 2006 Social Accounting Matrix (SAM) represents an effort to identify a number of key sectors of the economy during the base period for this study. The sectors identified are considered key owing to their relative importance in terms of the magnitude of their contributions in the following areas:

Table 4: Sectorial Contribution to Government Tax Revenue (based on 2006 SAM)

Revenue Source	Sector	Amount (₦' Million)	Percent
Import Taxes	Rice	161379.82	54.37
Import Taxes	Industry	42705.60	14.39
Indirect Taxes	Agriculture	42135.46	14.20
Import Taxes	Other Cereals	20418.87	6.88
Import Taxes	Agriculture	15514.62	5.23
Indirect Taxes	Food	7799.09	2.63
Import Taxes	Food	5181.05	1.75
Indirect Taxes	Other Cereals	1665.45	0.56
Total		296799.96	100.00

Source: Author's computation from Nigerian SAM (2006)

Government tax revenue sources for 2006 by major sectors of the Nigerian economy are shown in Table 4. Import taxes on rice were clearly the most important tax revenue source for the government during the year under review. Rice provided about 54.37 percent of the total tax revenue, amounting to ₦ 161,379.82 million. Import taxes on industry goods provided about ₦ 42,705.60 billion, which represented about 14.39 percent of revenue to the government during the period. Indirect taxes on agricultural commodities was the next, with tax revenue of about ₦ 42,135.46 million, representing about 14.20 percent of the total tax

revenue for the government in 2006. Import taxes on other cereals provided revenue amounting to about ₦ 20,418.87 million, representing 6.88 percent of total tax revenue for the government in 2006. At the same time, indirect taxes on other cereals was the lowest commodity in terms of revenue generation for the government during the year under review. It generated a total of N 1, 556.45 million in tax revenue in 2006; this represented some 0.56 percent of the total tax revenue for the year.

These figures indicate the relative dominance of rice among all commodities that were subject to tax during the year under review. They also highlight the preference for rice demonstrated by consumers in Nigeria. Another way of looking at the high value of import tax revenue from rice is that the government may have deliberately imposed high taxes on rice imports just to discourage importation of the commodity and encourage domestic production.

Table 5: Sectorial Contribution to GDP (based on 2006 SAM)

Sector	Output (₦' Million)	Percent
Industry	9374177.64	34.89
Services	6633696.96	24.69
Agriculture	6108250.09	22.73
Administration	3108960.07	11.57
Other Cereals	1073138.95	3.99
Rice	570166.03	2.12
Total	26868389.74	100

Source: Author's computation from Nigerian SAM (2006)

The contributions of the different sectors of Nigeria's economy to the country's gross domestic product (GDP) in 2006 are shown in Table 5. The industry output of ₦ 9,374,177.64 million for 2006 was the highest contributor to the country's GDP for the year, amounting to about 34.89 percent of total GDP. Understandably, domestic rice production was just about 2.12 percent of total GDP for the year under review. This low share of rice production in total GDP clearly suggests a heavy dependence on imports.

6. Simulation Results and Discussions

Table 6: Quantity of Products Imported

Definition	Variable Symbol	Base Period Value	Sim1: ($tariff_{rice} + 35\%$) Sigma_M = 0.8	Sim2: ($tariff_{rice} + 35\%$) Sigma_M = 4
Rice	M_{rice}	71118.74	61197.53	37553.01
Variation (%)			-13.95	-47.19
Other Cereals	$M_{cereals}$	144448.59	145888.65	152602.26
Variation (%)			0.99	5.64
Agriculture	M_{agr}	180155.89	150790.77	156319.90
Variation (%)			-16.30	-13.23
Services	M_{ser}	1091371.84	1089720.66	1109524.99
Variation (%)			-0.15	1.66
Food	M_{food}	92455.49	93833.31	97658.38
Variation (%)			1.49	5.63
Industry	M_{ind}	3387513.01	3425072.11	3419719.48
Variation (%)			1.11	0.95

Note: Sigma_M is the Import Substitution Elasticity for Rice
Source: Author's computation using GAMS 24.1.3

The results in Table 6 show imports of different commodities during the year under review (base period). The results also include variations in quantity of imported commodities that would occur under the two separate policy scenarios assumed in this study. Simulation 1 shows what would happen if a 35 percent import tariff were imposed on imported rice. The import substitution elasticity for rice under this policy scenario is fixed at 0.8, in line with Zhang and Verikios (2006), suggesting that locally produced rice is not easily substituted for imported rice. Precisely, the value of imported rice will reduce by -13.95 percent following a 35 percent tariff imposition on imported rice. The value of other cereals imported into the country would expectedly increase slightly by about 0.1 percent, showing that some substitution will occur. The value of imported agricultural commodities and services will decline under the same policy scenarios, by -16.29 and -0.15 percentage points, respectively. However, food and industry imports, the two commodities at the bottom of the list, will see variations in the upward direction (by 1.49 and 1.11 percentage points, respectively) in response to a 35 percent tariff imposition on imported rice.

In terms of the quantity and quality of domestically produced rice, suppose that rice production in the domestic sector becomes more efficient following the implementation of the new policy and the subsequent involvement of large-scale producers. This situation will be aptly captured by an increase in the import substitution elasticity for rice, meaning that consumers will become more indifferent in their preferences for imported or locally produced rice. Looking at simulation 2 in Table 6, if the import tariff on rice is increased by 35 percent and the import substitution elasticity for rice is assumed to be 4.0, the value of

imported rice will fall by -47.19 percent. Imports of other cereals will increase by 5.64 percent, suggesting that consumption preferences will shift slightly to other cereals that are close substitutes for rice. Expectedly, imports of all other commodities and services will also vary. For example, given the policy scenario under simulation 2, imports of agricultural commodities will be reduced by -13.23 percent, while those of services, food, and industry will increase by 1.66 percent, 5.62 percent, and 0.85 percentage points, respectively. These results strongly suggest that the average Nigerian will be spending more on imported cereals (other than rice), services, food, and industry goods in response to a 35 percent tariff imposition on imported rice and assuming a more competitive business environment for domestically produced rice.

Table 7: Industry j Production of Commodity i

Definition	Variable Symbol	Base Period Value	Sim1: ($tariff_{rice} + 35\%$) Sigma_M = 0.8	Sim2: ($tariff_{rice} + 35\%$) Sigma_M = 4
Rice	Q_{rice}	570166.03	587126.9461	675242.74
Variation (%)			2.97	18.43
Other Cereals	$Q_{cereals}$	1073138.94	1095055.51	1090705.60
Variation (%)			2.04	1.64
Agriculture	Q_{agr}	2123709.22	1944020.38	1938616.17
Variation (%)			-8.46	-8.72
Food	Q_{food}	3984540.86	4024572.94	4022536.39
Variation (%)			1.00	0.95
Industry	Q_{ind}	9374177.64	9396768.06	9365638.88
Variation (%)			0.24	-0.09
Services	Q_{ser}	6633696.96	6707706.19	6657440.08
Variation (%)			1.12	0.36
Administration	Q_{admin}	3108960.07	3127861.54	3090243.17
Variation (%)			0.61	-0.60

Note: Sigma_M is the Import Substitution Elasticity for Rice
Source: Author's computation using GAMS 24.1.3

Table 7 shows what the level of domestic production of various commodities would be if a 35 percent tariff were imposed on imported rice and if the import substitution elasticity for rice were 0.8 (simulation 1) and 4.0 (simulation 2). In both policy simulation scenarios, domestic rice production will trend upward: by 2.97 percent in simulation 1 and 18.43 percent in simulation 2. This indicates greater substitutability of domestic rice for imported rice. Understandably, the combined forces of an increased tariff on imported rice and the efficiency spillover from the domestic rice production sector will drive an increase in production in many other sectors of the economy as well. As can be seen from Table 7, apart from the agriculture, industry, and administration sectors, production of other sectors will increase by varying percentage points under the two policy simulation scenarios. The reduction in domestic production of the agriculture sector strongly suggests the existence of incentives for factor mobility from the agriculture to the rice sector. This is also

consistent with this study's assumption that capital input is mobile across sectors. In general, the results show considerable sensitivity to the import substitution elasticities used; these are more pronounced in the rice, industry, and administration sectors when results under the two simulation scenarios are compared.

Table 8: Total Income of Type h Households

Definition	Variable Symbol	Base Period Value	Sim1: $(tariff_{rice} + 35\%)$ Sigma_M = 0.8	Sim2: $(tariff_{rice} + 35\%)$ Sigma_M = 4
Rural HH	YH_{hrr}	6289097.01	6207134.05	6355109.44
Variation (%)			-1.30	1.05
Urban HH	YH_{hur}	9164102.57	9104735.88	9226584.71
Variation (%)			-0.65	0.68

Note: Sigma_M is the Import Substitution Elasticity for Rice
Source: Author's computation using GAMS 24.1.3

Although the central focus of this study is income mobility of rural households in Nigeria, we do not look particularly at capturing the income distribution among various groups of representative households in the country. It will therefore be sufficiently informative to examine what will happen to household income if a policy shock triggered by a 35 percent tariff imposition on imported rice is accompanied by an increase in import substitution elasticities for rice from 0.8 to 4.0. The likely results are shown in Table 8. Under simulation 1, the income of households in rural areas will fall by -1.30 percent, while that of households in urban areas will fall by -0.65 percent. However, given policy simulation 2 scenario, the income of households in rural areas will increase marginally by 1.04 percent and that of households in urban areas will increase marginally by 0.68 percent. Households in rural areas will experience a greater income (nominal) gain than households in urban areas (under simulation 2) because most of the rice farmers that will be integrated into the large-scale rice production process actually reside in rural areas.

Table 9: Demand for Labor by Industry J

Definition	Variable Symbol	Base Period Value	Sim1: $(tariff_{rice} + 35\%)$ Sigma_M = 0.8 Variation (%)	Sim2: $(tariff_{rice} + 35\%)$ Sigma_M = 4 Variation (%)
Rice	LD_{rice}	312363.14	2.29	18.74
Other Cereals	$LD_{cereals}$	617836.59	1.39	1.89
Agriculture	LD_{agr}	3028425.05	-2.64	-2.24
Industry	LD_{ind}	300773.42	1.85	-1.29
Services	LD_{ser}	3925373.41	1.35	0.18
Administration	LD_{admin}	914883.61	0.61	-0.60

Note: Sigma_M is the Import Substitution Elasticity for Rice
Source: Author's computation using GAMS 24.1.3

Table 9 presents the changes in demand for labor (employment level) by industry J that occur in response to the policy shocks described by simulations 1 and 2. Expectedly, demand for labor will increase in all sectors except the agriculture sector under simulation 1. Demand for labor will also increase in all sectors except the agriculture, industry, and administration sectors under simulation 2. Demand for labor in the rice sector under both simulations will increase by 2.29 percent and 18.73 percentage points, respectively. Labor demand in the other cereals sector under simulations 1 and 2 will increase by 1.39 percent and 1.89 percentage points, respectively. However, labour demand in the agriculture sector will fall by -2.63 percent and -2.24 percent under simulations 1 and 2, respectively. Clearly, this fall in labor demand in the agriculture sector can be explained by the fall in the sector's output. All other sectors will experience a slight increase in labor demand under simulations 1. However, employment levels in the industry and administration sectors are expected to decline under simulation 2.

6.1 Policy Implications of Findings

This study's findings have a number of policy implications. The use of tariff barriers (SIM1) as opposed to a policy aimed at improving the competitiveness of locally produced rice (SIM2) in the Nigeria's domestic market have varying implications for the Nigerian economy. Although the imposition of import tariffs is generally tantamount to a loss of welfare, evidence from this study shows that a tariff policy of up to 35 percent on imported rice, accompanied by an improvement in the quality and quantity of home grown rice, will help the domestic product to compete freely with imported rice. This policy will also translate into some marginal income gains for households in both rural and urban areas. At the same time, the policy will produce significant employment gains in all sectors except agriculture, industry, and administration, which are expected to suffer slight decreases in employment levels. The other observed benefits of an increased tariff on imported rice will be in terms of a reduction in the quantity of imported rice, a reduction in the burden on the nation's foreign reserve, and an increase in production of locally produced rice.

7. Conclusion

The study evaluates the economy-wide impact of the Nigerian government's rice transformation policy under its Agricultural Transformation Agenda. The main thrust of the current rice transformation policy initiative is a combination of tariff barriers on imported rice and increased domestic rice production through collaboration with large-scale private producers. Evidence from this study reveals that the import burden on the Nigerian economy will be largely reduced in some sectors by the implementation of this policy. Domestic production of rice and other commodities (with the exception of agricultural and industry products and administrative services) will also increase following the full and effective implementation of the rice production transformation policy.

The implementation of the domestic rice production transformation policy is likely to result in overall income gains for both rural and urban households. Expectedly, the households in rural areas will experience greater income gain than the households in urban areas. The implementation of the new domestic rice production policy is also expected to produce considerable employment gains in all sectors of the economy except the agriculture, industry, and administration sectors.

The study results would have been more informative if the productive factors and the representative household groups could be further disaggregated to effectively capture the income distribution among the various household groups. While the required disaggregation could be easily accomplished for the representative household groups based on available information from the 2006 SAM for Nigeria, data for the productive factors proved elusive, as this data is highly aggregated in the SAM. One way of getting around this challenge would be to rely on any relevant 2006 survey information from other sources in order to split the aggregated data on productive factors in the 2006 Nigerian SAM on a pro-rata basis. This may effectively serve as the subject of a future study.

Nigeria has a long history of rice cultivation and consumption. However, although the country is the largest rice producer in West Africa, domestic demand for rice is far in excess of what the country currently produces. There is therefore a huge market for local rice production in Nigeria. Successive governments have designed policies to encourage the cultivation and consumption of locally produced rice, but most of these policies have been largely ineffective. The current policy on rice production promises to be more successful because it is designed to be private sector-driven. The potential gains inherent in the current domestic rice cultivation, processing, and consumption policy makes it critical that the current federal administration retain and sustain the policy.

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