EFFECTS OF RICE TRADE POLICIES ON HOUSEHOLD WELFARE IN NIGERIA

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ABSTRACT

Inconsistent trade policies have characterised Nigeria's rice importation, leading to planning and decision-making challenges for producers and consumers, and with fluctuating consequences on welfare status. However, studies on Rice Trade Policy (RTP) have been carried out within the partial equilibrium framework which do not reveal the welfare effects on all sectors and households in the economy. For effective RTP, an understanding of the economy-wide welfare effects is necessary which is possible within a general equilibrium framework. The economy-wide welfare effects of RTPs on households in Nigeria were therefore investigated.

Value of domestic production, inputs and intermediate products were obtained from Nigerian Institute for Social and Economic Research's Input-Output (I-O) table. From the I-O, the economy was grouped into rice, Other Agriculture (OA), Oil and Mining (OM) and Manufacturing and Services (MS) sectors. Household incomes were collected from National Bureau of Statistics' Nigerian Living Standards Survey (NLSS). From NLSS, households were classified into Rural North Household (RNH), Rural South Household (RSH), Urban North Household (UNH) and Urban South Household (USH). Value of imports and import charges, as measures of Import Tax (IT), were gathered from the Central Bank of Nigeria's trade summary. All data were for year 2004. Two trade protection policy instruments: Import Ban (IB) and Eighty Percent Tariff Increase (EPTI); and two trade liberalisation policy instruments: Five Percent Tariff Reduction (FPTR) and Tariff Elimination (TE) were identified for simulation. Data were analysed using computable general equilibrium model and Hicksian measures of equivalent variation.

Total output valued at ₦11,065 billion comprised MS (42.9%), OM (28.9%), OA (27.5%) and rice (0.7%). Household Income (HI) totaled ₦8,260 billion comprising USH (43.1%), UNH (32.8%), RSH (13.5%) and RNH (10.6%). The IT contributed 77.5% of government revenue. Rice output increased most by 3.1% under TE followed by 1.1% under FPTR. Least increase in rice output of 0.1% occurred under EPTI. Output decreased most in OA (21.7%), OM (0.01%) and MS (0.1%) under TE. However, output increased by 0.5% in OA and decreased least in OM and MS with 0.1% and 0.6% respectively under FPTR.

Rural north household had the highest increase in HI of 0.3% under IB but recorded the highest decrease of 17.9% under TE. Least decrease in HI was recorded for RNH (0.1%), RSH (0.01%) and USH (0.2%) under FPTR whereas, UNH income increased by 0.1%. Import ban improved RNH welfare most by ₦2.3 billion while TE decreased it most by ₦115.0 billion. Social welfare loss occurred under all RTPs but was lowest (₦8.0 billion) under FPTR. Highest loss in welfare of ₦694.1 billion occurred under TE.

Rural households benefitted under protectionist rice trade policies but the social welfare effect on the economy was negative. However, mild rice trade liberalisation of 5% tariff reduction would minimise Nigeria's welfare loss from rice trade policies.

Keywords: Rice trade and tariff, Household welfare, Trade protection and liberalisation policies.

Word count: 461

DEDICATION

This work is dedicated to the glory of God, my Lord and Savior Jesus Christ; the source of all wisdom, strength and grace; who saved me and has kept me in His continual yet undeserved mercy even unto academic excellence.

ACKNOWLEDGEMENT

CERTIFICATION

I certify that this work was carried out by Mrs. Ogheneruemu Obi-Egbedi in the Department of Agricultural Economics, University of Ibadan.

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INTRODUCTION

1.1   Importance of rice in the Nigerian economy

Rice is the most important staple in the world (Wailes, 2003 and Griswold, 2006). It dominates the diets of billions of people in the world and constitutes the principal source of caloric intake for about half the world's population. This is especially true for the world's poor as rice accounts for one in five calories consumed worldwide (FAO, 2004a). The popularity of rice has also been increasing in Africa with per capita rice consumption growing rapidly in many Sub-Saharan African countries. Rice has indeed become important to food security in Africa (Akpokodje*et al*, 2001). Nigeria is the largest consumer of rice in sub Saharan Africa although, the country's food sub-sector comprises a wide array of staple crops such as sorghum, maize, millet, rice, yam, cassava, groundnut, cowpeas, fruits and vegetables. Rice is the fastest growing food commodity in the country's food basket (UNEP, 2005). It is the only staple for which demand has been soaring at 10% annually compared to 6% in Africa as a whole and less than 6% in the world (WARDA, 2008). Rice consumption has been increasing at an unprecedented rate since after independence. In 1961, national consumption was only 0.23Mt (million tons). This increased to 0.40Mt in 1975, 2.76Mt in 1990 and 4.70Mt in 2007. This shows that rice consumption has increased more than twenty times between the period of 1961 and 2006 (see Figure 1). The average Nigerian now consumes 30.7 kg of rice per year, representing 9% of total caloric intake (FAO, 2007). Rice indeed is no longer a luxury food in Nigeria but has become a major source of calories even for the poor and its purchases represent a major component of cash expenditures (World Bank, 1991).

Akanji, (1995) advanced several reasons for the increasing consumption of rice over the years. These include: accelerating population growth rate (over 2.8% per annum), changing consumer preferences, rapid urbanization, ease of preparation that fits easily to the urban lifestyle of workers, general availability among food vendors and restaurants located in work places in urban areas. Other reasons include associated changes in family occupational structures and increased income levels (Akande, 2002).
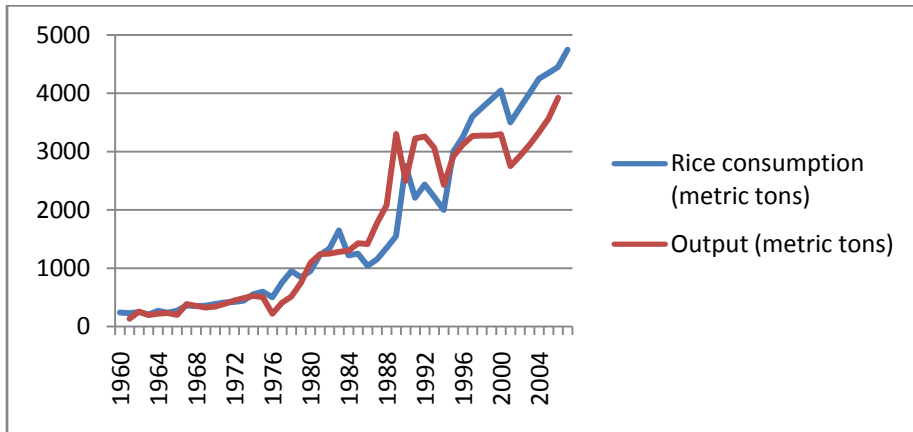
Figure 1: Trend in rice consumption and output from 1960-2006
Source: FAO, 2008.

1.2   Rice production in Nigeria

Nigeria is currently the largest producer of rice in West Africa (FAO, 2008). The increase in rice production in the country has been impressive since 1961 to date. As shown on Figure 2 (III), only 0.13Mt(million tons) of rice was produced in 1961. This increased to 0.50Mt in 1975, 2.50Mt in 1990 and 3.92Mt in 2006. Much of this increase was brought about by the expansion of the area under rice cultivation. It can also be seen on Figure 2 (II), that rice cultivation area increased from 0.15Mha (million hectares) in 1961 to 0.17Mha in 1975, to 1.21Mha in 1990 and 2.73Mha in 2006 (FAO, 2008). Rice production has had an average growth rate of 9.3% per annum since 1970. The area of land cultivated with rice has also had an average growth rate of 7.9% per annum. However, yield has only had a growth rate of 1.4% per annum (UNEP 2005).

Rice farmers are mainly small-scale, with farms of 1-2 ha. Traditional varieties are mainly cultivatedincluding: *Ofada* commonly cultivated inOgun state, *Igbemo*in Ekiti state,*Abakaliki* rice in Imo state, *Baro* rice in Niger state and *Makurdi* rice in Benue state. Yield per hectare is low; ranging between 1-2.5 ton/ha [see Figure 2 (I)], coupled with other problems of improper production methods, scarcity and high cost of inputs,

rudimentary post - harvest and processing methods, inefficient milling techniques and poor marketing standards particularly in terms of polishing and packaging which bedevils domestic production (UNEP, 2005). Little or no mechanization is used to carry out all farm operations thus cost of labour accounts for over 60% of production cost (Akpokodje*et al* 2001). However, rice production is profitable across rice-based production systems and in relation to other crops. Nweke*et al* (1999) and NBS (2005) found that rice was the food crop that generated the largest amount of cash income for farming households. At the farm level, rice is primarily produced for cash income and the long chain of economic activities associated with rice production, processing and marketing ensures ready employment for the very vulnerable segments of the Nigerian population such as women and children. This makes rice an important crop to the average farm family.

Rice is successfully grown in a wide range of agro-ecologies in Nigeria. These production systems include: rain-fed upland, rain-fed lowland, irrigated, deep water and mangrove rice. According to Singh *et al*. (1997) and Daramola (2005), the mangrove swamp ecology is the least important in terms of area, accounting for less than 1% of total rice area. Another 5% of the rice production area is generally estimated to fall in deep-water environment. Irrigated systems account for 16% of total rice area while rain-fed upland systems account for 30% and rain-fed lowland systems, the remaining 47%.The largest rice producing state is Niger State while Kaduna State is the second largest (FAO, 2013). Although the country has the potential to become a major rice granary in Africa (Nwanze*et al*, 2006), Nigeria has not attained self-sufficiency as the domestic production capacity is far below the national requirements.
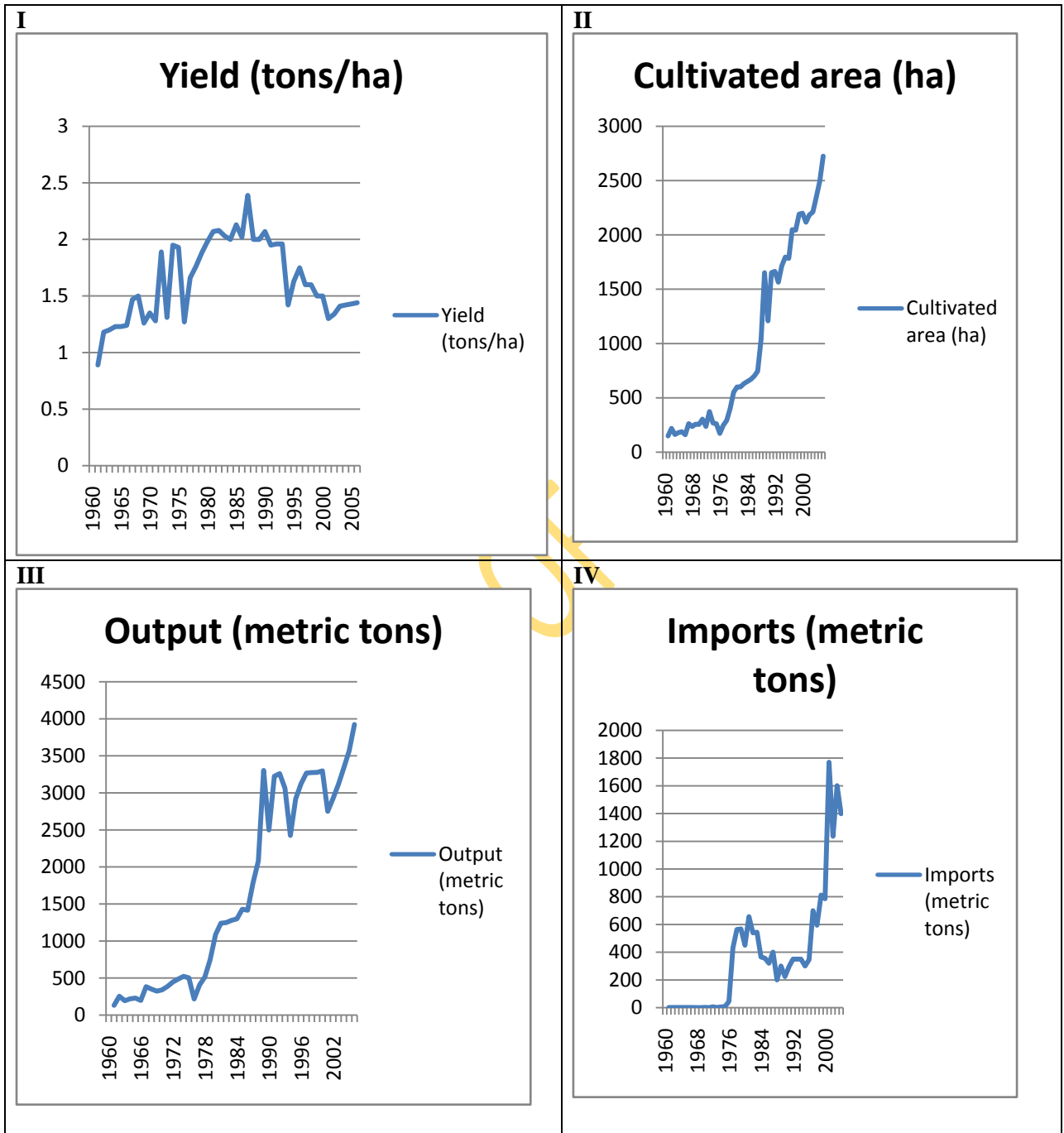
Figure 2: Trend in rice yield, cultivated area, output and imports from 1960-2006

Source: FAO, 2008.

1.3   Domestic policies and trade policies in Nigeria's rice sub-sector

The importance of rice in the Nigerian economy over the years makes it necessary for the Nigerian government to continually intervene in the sector. Government interventions were mainly through trade protection using different measures, especially tariffs. Figure 3 represents the trend in rice imports tariffs that have been applied since 1970. A chronologyof the country's rice trade policies is also described in Table 23 (in Appendix I). Four important periods describe Nigeria's rice trade policy.These are the pre-ban, import quota period, ban and post-ban periods. The pre-ban period was the era prior to the introduction of absolute quantitative restriction on rice imports (i.e., 1970-1978). It was largely characterized by liberal policies on rice imports. Government policies had lowered domestic rice and fertilizer prices relative to the world price level. For instance, it can be seen on Figure 3that prior to 1974 tariffs stood at 66%, however by 1974, tariffs were lowered to 20% and later to 10% in 1975. Increased export earnings coupled with the highly over valued naira exchange rate made it possible for Nigeria to finance huge food imports. Exchange rate of a dollar to the naira ranged between ₦0.6 to ₦0.7 during the period (NgEx, 2001). The naira overvaluation cheapened food imports and consequently helped to depress domestic prices. Large importation of food items especially rice was allowed into the country at relatively cheap prices.Rice imports increased from about 6.7MT in 1975 60 about 534MTin 1978 (FAO, 2007). This eroded the competitiveness of domestically produced rice and served as major disincentive to rice farmers (Daramola, 2005). Government wasinvolved in the distribution and marketing of the imported rice with non-transfer of actual costs of marketing to consumers.It was rather absorbed by government. This inadvertently led to depressed farm gate prices.

The direct involvement of government in imports coupled with the massive importation undertaken served to deplete the nation's foreign reserves. This led to a period of economic crisis which resulted in the use of more restrictive trade policy measures for rice imports. Hence, in October 1978, a six month ban on imports of rice in containers

below 50kg (also see Table 23 in Appendix I). This was the beginning of the period of quantitative restrictions or import quota period and it spanned 1979- 1984. The period was characterized by protectionist policies which placed quantitative restrictions (quota) on imported rice with only few individuals and government agencies issued import licenses. A maximum quantity of rice imports of 20,000 tons was set at the beginning of 1980. From late 1980 to 1984, import quota policy ranged betweengeneral import license with no quantitative restrictions and issuance of allocations to customers.The period from 1985-1994 was the period of outright ban on imported rice into the country. Hence, from 1979-1994, tariffs were not the policy tools of rice trade. This can be seen on Figure 3.Alongside the ban,the Structural Adjustment Program (SAP) was also introduced in 1986. Under SAP, various trade policies were put in place, in addition to the depreciation of the naira arising from exchange rate deregulation. The ban on rice importation was expected to stimulate domestic production through increases in the price of the commodity. However, illegal importation of the commodity through the country's porous borders thrived during this period due to the increased price of rice in Nigeria proved inevitably lucrative and was much higher than what obtained in neighboring countries.
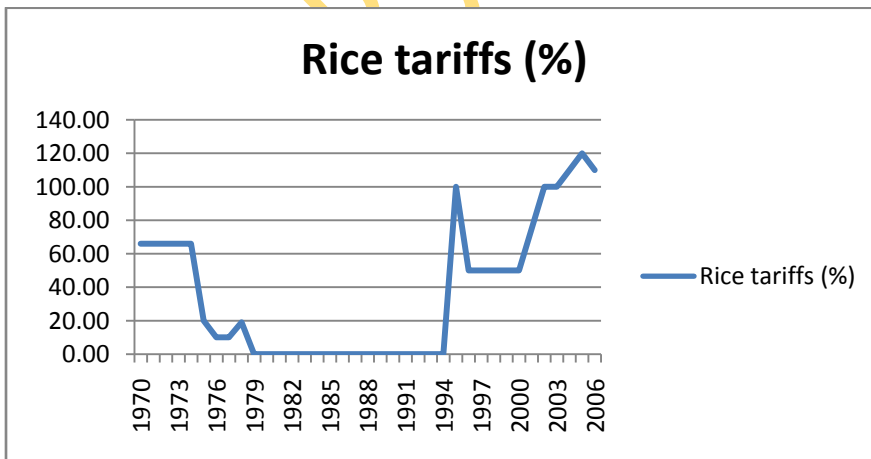
Figure 3: Trend in rice tariffs from 1960-2008

Source: Federal Government Budgets, 1984 – 1986; 1995 – 2005 modified fromAkande et al
        (2002),Daramola (2005) and Obih et al (2008)

In the post-ban period (1995 – 2004), the ban on rice importation was lifted while the country generally adopted a relatively more liberal trade policy towards rice. In addition, increased efforts were made by the government to help domestic producers take advantage of the policy protection of tariffs. For instance, in August, 2002, the Presidential Initiative on Increased Rice Production Processing and Export was set up to close the existing gapbetween demand and supply of rice and also to attain self-sufficiency and export level in rice production. The primary objective of the Presidential Initiative on Rice was to enhance household food security and income, eliminate imports and generate exportable surpluses. The Initiative involved the mobilization of all stakeholders in the rice sub-sector nationwide to achieve the production of 6MT of milled rice from 10.3 million tons of paddy by 2005. About 3 million hectares was proposed to be put under rice cultivation in order to produce about 15 million tons of paddy or 9.0 million tons of milled rice. A 100% import duty, as well as 10% levy for rice development was paid on imported rice in order to encourage local rice production. The federal government also encouraged the entry of private rice processing companies such as Olam and Veetee by granting them concession to import paddy at 50% import duty tariff. In addition, a low tariff of only about 22% was charged on agricultural equipment imported into the country.

The country's move to a relatively more liberal tradepolicy was also a step to joining the on-going globalization trend occurring in all nations of the world being championed by the World Trade Organization (WTO) of which Nigeria is a member. Since January 1995, when the WTO was created, member governments have been committed to ensuring the reduction and even elimination of agriculture taxes and subsidies that distort agricultural trade. This was the outcome of the first round of negotiations during the 1986-1994 Uruguay Round Agreement on Agriculture (URAA). The goal of the agreement was to reduce barriers to agricultural trade, thus making trade more transparent and ensuring that market forces rather than government intervention would increasingly direct agricultural markets (Bos 2003). The three main areas of national agricultural policies that were affected by the agreement were: market access (tariffs,

quotas and other trade barriers), domestic support and export subsidies. The Doha Development Agenda (DDA) followed in 2001 to emphasize expanding market access for agricultural products and other issues of special importance to developing countries. The DDA round of trade negotiations resumed but was stalled in 2003 and 2006 because major participants were unable to bridge differences over limits on domestic subsidies, tariffs reductions and exclusion of sensitive or special products (Griswold, 2006). This shows that there is still no agreement among governments especially of developing countries on the effects that trade liberalization will have on the economic welfare of their countries. Hence, protectionist policies such as high tariffs are still being applied by governments.

Nigeria's journey through the different rice trade policy periods may have led to some increase in production of rice over the years but this was mainly through increased land area cultivated to rice (Daramola, 2005). However, the demand-supply gap still exists and the country is still unable to produce enough for national consumption. Nigeria's self-sufficiency has ranged between 50%-75%leaving a demand-supply gap of about 25%-50% (WARDA, 2008).Hence, rice imports have continued massively with imports rising from 0.3MT in 1995 to 1.6MT in 2004 (FAO, 2007). Productivity in the domestic sector has also remained low, yields are low - about 1.4 tons/ha (FAO, 2007)whiledomestic rice still remains less competitive than its imported counterpart. In addition, a lack of sustainable domestic policy and trade policy still exists. For instance, the country adopted a relatively moreliberalisedtrade policy in 2009 with a rice import tariff rate of 30%(see Table 23 in Appendix I).However, in early 2013, rice import tariffwasincreased to 100%. By late 2013, the government stated that a downward review of the rice tariff would soon be implemented (NAN, 2013). This shows that the country is still oscillating between protectionist and liberalisation policies of rice trade.

1.4 Problem statement

Domestic supply of rice has continued to fall short of demand (see Figure 1) and massive importation is undertaken to make up for the shortfall (UNEP, 2005). Rice importation costs the economy over ₦356 billion annually (FGN, 2011) despite the fact that Nigeria

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has been found to have comparative advantage in rice production among other countries of sub-Saharan Africa (Nwaeze et al, 2006). On the other hand, Nigeria's self-sufficiency goal has continued to seem further and further away from being realizedasthe country's rice self-sufficiency (see Figure 1) has also been falling in recent times (FAO, 2012). The country's failure to attain rice self-sufficiency has been attributed to inconsistent trade policy and domestic policy which has left the self-sufficiency goal unrealized (Akande, 2002; Daramola, 2005; Ezedinma, 2005 and Nwaeze et al, 2006). No consistent and sustainable rice trade policy is in place to ensure attainment of this goal but the country has oscillated between bans and non-bans, high and low (even zero) tariffs and also quantity restrictions on imported rice. These trade policies have always been applied as adhoc measures taken to address problems in the short run. Moreover, policy inconsistency is expected to have negative implications for not only producers' income (Lancon et al, 2003; Ezedinma, 2005 and Umeh, 2005) but also for consumers (Griswold, 2006) and the entire economy considering the importance of rice in the Nigerian economy. However, neither the welfare implications of these rice trade policies on the household groups nor their effects on other sectors and key economic indicators are known as past studies have only used partial equilibrium models which can not reveal these distributional effects (Warr, 2005).

A full consideration of a public policy must address the question of how the policy affects the welfare of individuals in the country (Slesnick, 1998) because an improvement in welfare will likely contribute to poverty reduction (Rojas, 2003 and World Bank, 2005). Furthermore, Nigeria is committed to achieving the Millennium Development Goals (MDGs), the first of which is to halve poverty and hunger by 2015, suggests that the government must be committed to improving the welfare of her people. However, government policy stance has been identified as an important cause of rising poverty in Nigeria over the years (Aigbokhan, 2008). Furthermore, Nigeria's commitment to the World Trade Organisation (WTO) Agreement on Agriculture (AoA) which seeks free trade among all countries of the world, suggests that protectionist rice trade policies may ultimately give way to liberalized ones. However, the effects of rice trade liberalisation on the economy are not clear cut in the literature.

Thus, important questions arise for the country's rice sector and the entire economy:

1. What is the trend in performance of the rice sub-sector under the different rice trade policies that have been used in the country?
2. How is the rice sector interrelated with the rest of the Nigerian economy?
3. What are the effects of the rice trade policy on the Nigerian economy?
4. Which rice trade policy improves overall welfare of Nigerian households?

1.5 Objectives of the study

Following from the above research questions, the broad objective of this study is to determine the effects of rice trade policy on welfare of households in Nigeria. Specifically, the objectives are to:

1. Examine the performance of the rice sub-sector under the different rice trade policy periods.
2. Examine the interrelationship of the rice sector with other sectors in the economy of Nigeria in an accounting period.
3. Determine the effect of the government's rice trade policies on the Nigerian economy.
4. Identify the welfare implications of the government's trade policies on rice for all household groups in Nigeria.

1.6 Justification of the study

Policies of governments have been identified severally in literature (Bos, 2003; Warr, 2005 and Nwafor et al, 2007) as an important factor in poverty reduction hence, their formulation must be literature tailored towards improving social welfare and reducing poverty. Empirical evidence on the welfare improving rice trade policies for Nigeria are scanty and not clear cut, hence the intermittent changes in rice trade policies over the years (Akande, 2002;Daramola, 2005 and Ezedinma, 2005; UNEP, 2005). The findings of this study will reveal which rice trade policy improves social welfare and ultimately, contributes to poverty reduction in Nigeria. The study will also reveal the households and sectors that are the winners and losers of the rice trade policies in the Nigerian economy.

These results will assist in formulating appropriate and sustainable trade and domestic policy for the rice sector. In addition, as the global economy moves towards greater openness, the findings of the study will reveal the most welfare-improving liberalisation policy for Nigeria's rice trade. The study will also contribute to the scanty literature that exists on the welfare implications of the rice trade policy in Nigeria.

The study uses a general equilibrium framework to analyse the effect of rice trade policies on the welfare of household groups in Nigeria. Methodologically, the study departs from past studies (Wailes, 2003; UNEP, 2005 and Obih et al, 2008) which have used partial equilibrium models to elucidate the welfare implications of rice trade policies. These models could neither incorporate households nor show the effects of rice trade policies on other sectors of the economy. However, a general equilibrium models such as the Computable General Equilibrium model (CGE) incorporate households, other sectors and the macroeconomic aggregates in the model and this will make for better targeting of policy. Further, the study uses a north-south disaggregation by rural and urban sectors of households whereas; past CGE studies on trade policy have only used rural and urban disaggregation. Thus, the results of this study will show the distributional effects of the rice trade policies on the entire economy and particularly, on which rural or urban households the policies affect. General equilibrium models have been used similarly for the rice sub-sector of a number of countries such as the Philippines (Corroratan, 2005), IndonesiaWarr (2005) and Madagascar (Coardy et al, 2008). The findings have been used to guide policy in the rice sector of these countries.

Finally, since Nigeria's failure to attain rice self-sufficiency has been blamed on rice trade and domestic policy inconsistency(Akande, 2002;Daramola, 2005 and Ezedinma, 2005), the findings from this study will also reveal which rice trade policy best increases domestic production. Such a policy may be more likely to ensure the attainment of the country's rice self-sufficiency goal. Moreover, since high levels of protection or liberalization have been shown to have varying welfare effects on the producing and consuming households in a country (Wailes, 2003, Warr, 2005), the findings of this study

will reveal which rice trade policy best improves the welfare of producing households. This will further encourage rice production and contribute to rural poverty reduction.

1.7   **Plan of the study**

The rest of the study is organized in the following order. Chapter two contains the conceptual framework and literature review. Chapter three contains the description of the methodology used in the study. Chapter four contains the results and discussion of the findings of the study and lastly chapter five contains the summary of major findings, the conclusion and policy recommendations.

CHAPTER TWO
THEORETICAL FRAMEWORK AND LITERATURE REVIEW

This chapter presents the theoretical underpinning which supports the study and also a review of methodological issues, empirical literature on trade, trade policy and welfare, tariff adjustment studies in Nigeria, rice trade liberalization and protection studies and the concept of welfare and trade. The subsequent subsections describe the theory of trade and welfare, concept of trade and welfare, trade policy and welfare, review of empirical literature on trade and welfare, a review of empirical trade related studies, trade liberalisation studies in the rice sub sector and a methodological review of policy analysis tools.

2.1   **Theory oftrade and welfare**

According to the Heckscher-Ohlin theorem of trade, a country exports a commodity which intensively uses a factor that is relatively abundant in that country. Thus, the relative availability and supply of factors largely determine the pattern of production, specialisation and trade among countries. Trade provides an opportunity for countries to exchange goods and servicesthereby increasing their utility and welfare. The welfare of the individuals in a country is measured as their level of utility which is obtained by maximising their utility function for a given income and price system. Consider a situation of a closed economy, as shown in Figure 4, where consumption is constrained by a country's production possibilities, *PP* represents the Production Transformation Curve, U_i represents consumers' utility and *Ei* represents equilibrium; the point where marginal rate of transformation, marginal rate of substitution and price ratio are equal. DD represents the domestic demand. It can be seen that a country maximizes welfare subject to the fixed distribution U_1U_1 which is derived by producing and consuming a quantity $Q_1$of a commodity X_1,and also$Q_2$of a commodity X_2at equilibrium pointE_1 (Yusuf, 2000 and Jhingan, 2004).
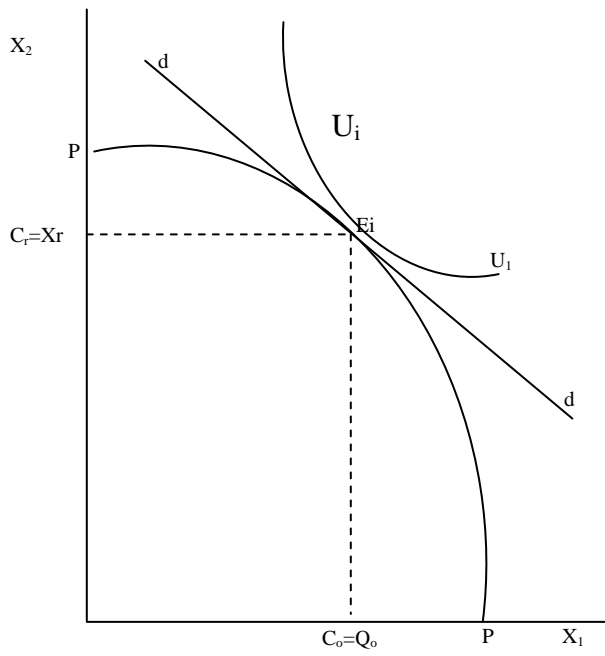
Figure 4: Welfare gains without trade/closed economy (Adapted from Yusuf, 2000)
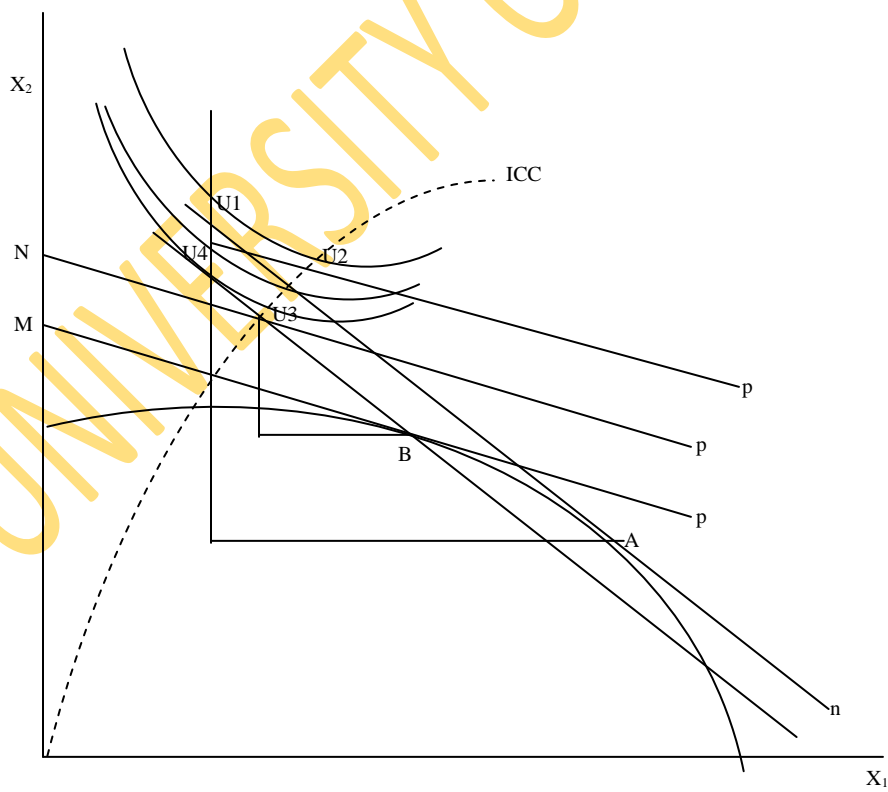
Figure 5: Welfare gains/loss with trade policy (Adapted from Dervis et al, 1982)

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Consider the case of an open small economy and the effect of an introduction of a trade policy on the economy. This is illustrated on Figure 5. We assume that the country concerned is small; this means that it has no power to affect world prices of traded goods, and that labor markets function well in the sense that nominal and real wages are flexible. As can be seen in Figure 2, there are two traded sectors X_1 and X_2 and production in the free trade economy occurs at A while consumption occurs at U_1. Also, N represents the world price ratio, PW_1/PW_2 (where PW_1 = world price of X_1 and PW_2 = world price of X_2). The world price ratio equals the domestic price ratio P_{X_1}/P_{X_2} (where P_{X_1} = domestic price of X_1 and P_{X_2} = domestic price of X_2). Thus, the country can either sell or purchase goods at the world relative prices rather than domestic prices as in closed economy in Figure 1. World price of the commodities X_1 and X_2 are exogenously determined and the exchange rate is the link between world price and domestic price. If relative price P_{X_1}/P_{X_2} increases, consumers shift demand for X_2 from home to foreign produced goods. The difference between consumption of X_2 and domestic output equals import of X_2. Domestic resources then shift to production of more of X_1 and the excess production that can be exported. If the government introduces a trade policy such as the imposition of a tariff on the imports of sector X_2, this lowers the relative domestic price below the world price as shown by the lines p in Figure 5. This raises the price of not only the imported commodity but also that of the import-competing commodity and results in a price increase which creates an incentive for domestic production of the importable. The tariff imposition thus results in:

1. A production effect- producers shift towards the production of the importable; from A to B.
2. Government-revenue effect- government revenue increases due to tariff collection; from M to N.
3. The volume of trade reduces; as indicated by the relative size of the two trade triangles.
4. The welfare effect- society loses welfare as it moves to a lower indifference curve U_3. This social welfare loss occurs due to:

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a. The cost of producing inefficiently; from U_1 to U_4.

b. The cost of consumption at distorted prices; from U_4 to U_3

The effects of trade policy on the society depend mainly on the consumption and productionof the goods from importable, exportable and home sectors. The effects of reforms also differ in the short and long run. In the short run we assume that the factors of production are immobile, while they are mobile in the long run.

2.2 Methodological review ofpolicy analysis tools

Koutsoyiannis (1985) posits that in any economic system, there exists inter-dependence among its constituent parts such that commodities and productive markets are interrelated and prices in all markets are simultaneously determined. This complex and simultaneous changes in the economy depend on the domestic policies and external events such as changes in international prices (Dervis et al, 1989). This means that the partial equilibrium analysis is not sufficient for the determination of price and quantity in a given market since they are simultaneously determined. Thus, the partial equilibrium analysis is also insufficient to analyze the effect of a policy since it is expected to have a multisector effect. Hence, multisector models provide a more useful framework for understanding the effect of a given policy on the economy. De Janvry and Sahoudalet, (1987), assert that, generally, the inter-sectoral, interclass and inter-temporal effects of policies, particularly price policies, have been poorly modeled even though these effects are key to understanding the growth and welfare effects of the price policy. Their study of six countries which analyzed alternative policies towards agricultural pricing, food subsidies and inter-sectoral allocation, showed that usingmultisector models gave results which were quite different and more robust than those obtained using the partial equilibrium models. The multisector model used in their study was the Computable General Equilibrium (CGE) model. Multisector models incorporate the interdependence in production, demand and trade in a mixed market economy thus; they are able to capture general equilibrium relationships. Earlier multisector models were input-output models which captured very simple general equilibrium relationships but more recent

models have achieved higher levels of disaggregation such that it can incorporate various market mechanisms and policy instruments (Dervis et al, 1989).

Anderson and Wincoop (2001) posit that two commonly used tools to evaluate the effects of policy on border barriers are gravity equations and computable general equilibrium models. Gravity equations are used in the gravity model of trade to predict bilateral trade flows based on the economic sizes (often using GDP measurements) and distance between two units. The model can be used in international relations to evaluate the impact of treaties and alliances on trade, and to test the effectiveness of trade agreements and organizations such as the North American Free Trade Agreement (NAFTA) and the World Trade Organization (WTO).Gravity equations generally find that borders have a substantial negative effect on trade, while integration has a positive effect. But the estimated equations are a very crude tool for policy analysis because they are based on ad hoc specifications that can be seriously questioned on theoretical grounds. The ad hoc nature of standard gravity equations also precludes welfare analysis. CGE models are potentially more useful for policy analysis.

Computable General Equilibrium (CGE) Models are economy-wide models widely used in policy analysis which have model solution that can be computed. The model recognizes that an exogenous change in policy or some other important source that affects any part of the economy can produce repercussions throughout the system (Lofgren, 2003). The model derives from the input-output and linear programming models which portrays the system of inter-industry linkages in the economy such that the purchase of an intermediate input by one sector represents the sale of that same input in another sector. Essentially, the CGE analysis attempts to convert Walrasian principles into realistic operational models of actual economy by specifying production and demand parameters through the use of data that capture the particular economy involved (Yusuf, 2000).

Francois and Rojas-Romagosa (2007) assert that the following assumptions usually hold in order to be able to define the core general equilibrium system for demand and production in terms of expenditure and revenue functions.

i. Rational behavior by households and firms.

ii. Complete and perfectly competitive markets.

iii. Convex technology, with neoclassical production functions.

iv. Goods are tradable and factors are not.

v. Every household has the same neoclassical technology for producing the composite consumption good.

Computable general equilibrium models have traditionally been used to simulate the impact of exogenous shocks (such as changes in international terms of trade, and a recession in importing countries) and changes in policies on the socioeconomic system and, in particular, the income distribution. Fiestas (2005) notes that given the complexity of trade-welfareand trade-poverty relations, the use of CGE models to analyse these links has become widespread in literature. The first stage in CGE analysis is the presentation of an aggregateSocial Accounting Matrix (SAM). This is a summary of the structure of an economy which shows the circular flow of incomes and payments, internal and external links and the roles of different actors and sectors in an economy, in the form of a square matrix and for a period of time (usually one year). Thus, a SAM includes information on simple share relationships, input -output coefficients, sectoral quantities as regards production, exports and imports in the base year, tariffs and taxes, allocation of investments, and income and expenditure of various institutions.CGE models are fully calibrated on the basis of an initial yearSAM that provides a set of consistent initial conditions however, they do not contain information on intra socioeconomic household group income distribution. Hence, conventional CGE models can only simulate the impact of a shock on the representative household in each group and not within the group.

Decaluwe et al (2005) identifies two ways by which the question of income distribution can be approached. These are using the Deciles approach and the SAM approach. The

Deciles approach consists of a simple disaggregation of the household agent into groups or categories according to their level of income (by quintiles or deciles) and independently of their factor endowments or their socioeconomic characteristics. Thus the groups could be: very poor in the first decile, less poor in the second, and so on. On the other hand, the SAM approach consists in disaggregating the household agent based on given household characteristics such as human and physical capital endowments (i.e. qualified versus non-qualified head of household)or their socioeconomic characteristics and the organic link between the welfare level and the income drawn from their respective endowments.

In these two approaches the representative agent hypothesis, which sees each identified group as a single representative of the household, is maintained. The authors however, flawed the use of the deciles approach because for some analyses such as that of poverty, the heterogeneity which exists within the poorest households especially in terms of factor endowments will be hidden. For example, there are very poor households in cities drawing their income from the informal sector; there are also many very poor households in rural areas drawing their income from agriculture. These differences are not usually taken into account in the model. The implicit assumption underlining the deciles approach is that given a level of income all household in the group are affected in the same manner albeit their characteristics are different. Another problem related to this approach is targeting. If there is an objective of targeting policies to specific groups, the approach will not provide answers for policy makers to resolve specific issues since the group is a mixture of household from all horizons.

2.3   Review of empirical studies on trade,trade policy and welfare

Due to the negative effects that trade could have on a developing economy, the government may attempt to influence (or restrict) a country's openness to trade; this is called trade policy (World Bank, 2001). Trade policy is therefore a deliberate attempt by the government to influence the flow of goods and services into a country. Such barriers to trade are usually put in place to protect the domestic producers from international competition. Trade policy creates some restrictions to free trade which leads to an

alteration in the prices of importable and exportable goods. Yusuf (2000) posited that trade policy will affect domestic price of an exportable produce relative to its importable counterpart and this in turn affects the domestic price of the exportable produce relative to domestic goods. Balance of trade occurs when there is equilibrium in the market for either goods that can be traded (tradable) or goods that are not traded (non-tradable). A country's trade policy is also the key link in the transmission of price signals from the world market to the national economy. Thus, trade policy inherently has the effect of redistributing income.

Barriers to trades, otherwise known astrade restrictions are usually implemented through the use of trade policy instruments which could be either a tariff or a non-tariff barrier or restriction. The tariff barrier serves as a source of revenue to the government which is implied by the difference between the world price and the tariff-inclusive price. The non-tariff barriers are in the form of restrictions to imports and the revenue is captured by those who hold the license to import. These include: Non-Tariff Barriers (such as quotas, licenses and monopoly rights to import), Tariff Regime, Emergency Protection and Antidumping, Special Custom Regime for Exporters (drawbacks and duty-free access to imported intermediaries for exporters), Export Subsidies, Export Taxes and Export Processing Zones (EPZs). The government's policy could also be closed to trade in a given sector. This is a situation of complete restriction to trade such as an outright ban on trade in a particular commodity or a range of commodities. Anyone of these instruments when used could have positive or negative effects on the welfare of the people (World Bank, 2001).However, this study limits itself to the tariff regime as the trade policy instrument. Tariff regime is a price policy which brings about an increase in the price of an importable relative to exportables and non tradables (Yusuf, 2000). This serves as incentives for domestic producers to expand their production of importables while consumers switch to consumption of non tradables and exportables thereby leading to increase in their prices. These price increases have implications on the welfare of both producers and consumers.

Trade policies affect the welfare of the society through what they consume and what they produce. The most common transmission mechanism to the society is through the impact of trade policies is on commodity prices. This means that producers or consumers especially at the local level will face the new price levels (Fiestas, 2005).Hence, trade policy will affect the society and more importantly the poor through the impact on wages and employment because the poor are characterized by low-skilled labour (World Bank, 2000 and 2001). Tariff serves as a source of revenue to the government and this is implied by the difference between the world price and the tariff-inclusive price. Obi, (2007), notes that as the government strives to stamp out poverty improve welfare of the people, any poverty alleviation strategy of government must have the foundation of appropriate macroeconomic policies and programmes. However, Rodrick, (1998) opines that trade protection usually benefits powerful interest groups and not the poor as they transfer income to the rich, away from the poor. Nwafor, (2005) also asserts that trade policy could have positive or negative effects on the national poverty level. For instance, border price shocks can be transmitted to poor households when unfavourable competition arises between imported products (in this case rice) and the domestic substitute. Also, markets for domestic goods may be either suppressed or destroyed as demand may shift to cheaper and/or higher quality imported products. This will lead to increased vulnerability of rural producers while declining output, due to decreased incentive to produce,will result in reduced income and negative effects on employment and migration. On the other hand, increased government revenue from tariffs may benefit the poor through increased government spending on social and community services.

Although there is agreement in literature that trade improves the welfare of people however, divergent views are held about the effect of trade liberalization on welfare of the poor. While advocates of trade liberalization claim that this policy will improve the welfare of poor households and the entire economy, opponents argue that the economy and also poor households, will be worse off. One of the ways trade policy influences the welfare of poor households is through prices of food they consume. A protectionist trade policy tends to increase price of composite goods and the poor are affected by increasing prices of food products making them worse off. On the other hand, trade liberalization

tends to lower prices of goods thereby bringing about an improvement in welfare. This has implication for food security (Baumann *et al*, 2010).

Giovani and Levchenko (2010) examined the link between trade barriers and per-capita income. The authors assert that in a cross section of countries trade barriers are negatively correlated with per-capita income and other measures of welfare. They found that a reduction in trade barriers will cause an imported variety of a good to become cheaper and this increases welfare of consumers. However, the domestic variety also tends to disappear causing a negative welfare impact and the two invariably, partially cancel out. However, the size of the negative impact could not be ascertained. This is because they used cross-country econometric models in their study and to quantify the size of the impact is difficult, if not impossible using this methodology.

Francois and Rojas-Romagosa (2007) examined the relationship between trade openness and wages. The authors show that trade policy is linked to wages through its effect on factor incomes and the functional distribution of income, hence trade policy affects the welfare of the poor with respect to the wages they receive. The study shows how general equilibrium distributional aspects of social welfare related to import protection may be examined alongside corresponding efficiency aspects in a dual framework. The study asserts that relatively high average tariffs across a subset of capital-rich countries are a consequence of greater inequality considerations by the relevant policy-makers, as well as the presence of influential unions. Likewise in poor countries, high tariff rates are a direct consequence of the investor lobby overcoming both equity and efficiency concerns of the government. Tariff reductions are expected to improve welfare while tariff increase will result in efficiency losses and hence make the people worse off. Specifically, tariff reductions in poor labor-abundant countries are expected to increase the real income of workers and hurt capital owners (or skilled labor). In developed countries the opposite effect is expected. The empirical evidence remains mixed and somewhat contradictory. Basically, when the distributional effects are not significant enough to upset the efficiency losses imposed by the tariff, the common results of the literature emerge and higher tariffs are directly associated to the weight and the contributions of special interest

groups. At the same time, in the presence of distributional concerns, rich countries tend to impose higher tariffs than otherwise.

Anderson and van Wincoop (2001) opine that most international trade policy lead to border costs that involve rents. Barriers involving rents involve a transfer between those who pay the rent and those receiving the rent. With tariffs the rent accrues to the government, and is rebated to the general public through tax and spending policy. Hence, rent border barriers have welfare implications. Tariffs have welfare effects due to the gap they create between marginal social costs and benefits. A reduction in the tariff will expand imports, an activity for which the marginal benefit exceeds the marginal cost. This raises real income by reducing dead weight loss. Deardoff (2001) also posits that if trade costs exist on all trade flows and if these costs were to be reduced by the same proportion on all of these flows, then this would be beneficial for the world. This has been shown by Bruno (1972) from tariff theory that a proportional reduction in all ad valorem tariffs is welfare improving. It also suggests that a non-proportional reduction in trade costs could reduce welfare as in the case of tariffs, where a preferential tariff reduction such as in a free trade area can reduce welfare due to its possible trade diverting effects. Hence, tariffs distort behaviour by artificially altering the price signals that guide behaviour. A change in a tariff can cause a good that was imported by a country to become exported and another good that was exported to become imported. This is because tariffs drive a wedge between domestic and foreign prices; therefore, changing tariffs can potentially alter not just the size but even the direction of trade flows. This means that a comparative disadvantage can become a comparative advantage since cost has been reduced.

2.4   Review oftariff adjustment studies on Nigeria

As has been shown in section 2.3, tariff is widely used in the literature as a trade policy instrument which can be lowered or increased to reflect the inclination of a government either towards protectionism or trade liberalization. Tariff adjustment is a price policy which when introduced on an importable tends to increase the prices of the importables relative to exportables and non tradables (Yusuf, 2000). This serves as incentives for

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domestic producers to expand their production of importables while consumers switch to consumption of non tradables and exportables thereby leading to increase in their prices. The tariff adjustment price policy is one whose effects are expected to spread wide to the different sectors and classes of the economy.

There have been many studies on the impact of tariff adjustment in Nigeria. The bulk of these studies analyzed tariff reduction impacts on the macroeconomy. Olofin et al, (2001), used a CGE to analyze the impact of a 50% tariff reduction on all imports. They found that real GDP would increase by 0.11%, price level falls but real income falls as well. However, the analysis made use of only one household and this makes it difficult to trace how the increased income from the increase in real GDP was distributed. Kuji, (2002) and Soludo and Oji, (2003), also agree that a reduction in tariff will lead to a depression in domestic price level. Kuji, (2002) used a partial equilibrium model from which he obtained negative price elasticity for imports. Soludo and Oji, (2003), on the other hand reviewed the reduction in import tariff over time and stated that effective demand shifted towards imports since they were cheaper and this created a disincentive to produce. None of the above studies examined the welfare effect of tariff adjustment or trade liberalization in Nigeria.

Obih et al, (2008), however examined the welfare implications of tariff adjustment on rice imports using a partial equilibrium model. The paper analyzes the protective and welfare impacts of the tariffs and ban on imported rice from 1974 to 2005. The study found tariff adjustment to have positive implications on national welfare while imposition of a ban resulted in higher losses of production and consumption efficiency than under tariffs. Tariffs were found to be more effective in raising the domestic price rather than discourage imports. However, consumers were found to be worse off than producers under both policy measures while producers were found to be more efficient under the tariff regime than under the ban. This was the only studythat was found to focus on Nigeria to analyze the welfare impacts of the country's rice trade policy, although Wailes(2003)analysedwelfare impacts for several countries' rice trade policy including

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Nigeria. The authors' argument for the employ of a partial equilibrium analysis was that policy shifts in the rice sector do not have any trickle-down effect.

However, Warr, (2005), argues that an adequate analysis of the distributional effects of rice import restrictions needs to consider its effects on households' expenditures, disaggregated by household group and also its effects on their incomes. This requires taking account of its effects on the labour market as well as the returns to land. In doing this, the rice industry cannot be considered in isolation. This is because a change in the productive sectors and factor incomes will ultimately affect household incomes. Drawing from our current experience in Nigeria, an increase in the price of rice has had implications for the demand for other staple foods, such as maize, cassava, yam and wheat flour and also on their prices. This has repercussions on household incomes which lead to demand for wage increasesand its attendant effectson the economy. An increase in skilledand unskilled wages would affect profitability in other industries, with effects on outputs and prices in those industries as well. These effects would then have to be balanced against the effects on consumers of an increase in the price of rice. Thus, the consumption of rice or the rice sector cannot be considered in isolation.

Yusuf (2000) used a CGE model for Nigeria to analyze the effect of liberalized trade and exchange rate polices on agriculture. The policy measures analyzed were a 10% reduction in import tariff, a 10% reduction in export duties and a 50% devaluation of the naira. The analysis of the welfare impact did not employ any analytical tool of welfare measurement, only the change in income after each policy change was used to infer a welfare gain or loss. The study found that agricultural production decreased under trade liberalization while a mix of policy scenarios led to increased agricultural production. The study found that import liberalization gives the highest welfare gains compared to reduction in export duties and devaluation. However, the policy impact on each of the two household used (rural and urban) were hidden due to aggregation of two households into one. Also, the non-use of a standard tool for welfare measurement makes the results less robust since only the change in household income was used.

Nwafor et al, (2007) also used a dynamic CGE model for Nigeria to examine the effect of trade liberalization on poverty. Their analysis made use of two households (rural & urban) and two factors (labour& capital). Investments were found to be reallocated from the agriculture sector while rural income was found to fall faster than urban incomes with trade liberalization both in the short run and long run. The rural households also increase in poverty while urban households' poverty level reduces. Hence, the study found positive implications for urban households and sectors that were capital intensive and otherwise for the rural households and labour intensive sectors such as agriculture. However, the impact of the shocks on the households may be underestimated since the households were not disaggregated beyond rural and urban. This makes the information on intra-group income distribution to be difficult to trace within the group. This also may not allow for proper targeting on the part of policy makers.

Olopoenia and Aminu, (2007) examined several revenue-neutral tax policy reform options for Nigeria one of which was tariff. They used a computable general equilibrium model to assessthe impact of taxpolicy reforms of trade liberalization on welfare. Their results show that implementing high tariff is not welfare-improving and that households and the economy gain more from a maximum of 10 percent tariff reduction implemented atonce while the shortfall in revenue should be generated from value-added tax (VAT). However, their study did not focus on the rice sector or on rice imports.

2.5   Rice trade liberalisation and protectionstudies

UNEP (2005) carried out a country study on the Nigerian rice sub sector to assess the impact of trade liberalisation on the sub sector. The study applied a series of approaches; gross margin, benefit-cost and willingness to pay analyses; and found that gross margin from one hectare of rice-field rose appreciably from about ₦3,388 in the pre-liberalisation period to about ₦19,465 after liberalization but the return on farmers' investments declined from 0.57 per naira invested in pre-liberalisation to 0.36 after liberalization. However, only social, economic and environmental impacts were assessed and not welfare. Also, an econometric model would have better quantified these effects of trade liberalisation on the sub sector. Obih et al, (2008), analyzed the protective and

welfare impacts of the tariffs and ban on imported rice from 1974 to 2005 using a partial equilibrium model. The study found that increase in tariff had positive implications on national welfare while imposition of a ban resulted in higher losses of production and consumption efficiency than under tariffs. This was the only study that was found to analyze the welfare impacts of the Nigerian rice trade policy. However, since their analysis only took into account the commodity prices without considering factor prices and employment, their results are likely to underestimate the welfare impacts. In addition, the welfare implications of liberalization in the rice sector were not analyzed.

Warr (2005) used a general equilibrium model of the Indonesian economy to analyse the effects of an import ban on rice on poverty in Indonesia. The results indicated that the rice import ban raised poverty incidence by almost one per cent of the population with poverty rising in both rural and urban areas. It also showed that only the richest farmers gained from the ban.

Cororatan (2004) also used a CGE model to analyse the poverty and distributional effects of a removal of quantitative restrictions and the reduction in tariff on rice imports in the Philippines. Although these market reforms led to a reduction in the overall headcount poverty index, both the poverty gap and the squared poverty gap indices increased; implying that the poorest of the poor are adversely affected. Also, as consumer prices reduced, imports of rice surged and paddy production and its output price declined. This led to lower demand for factor inputs in the sector, lower factor prices in agriculture, and lower factor incomes for households that rely on agriculture.

2.6   Concept ofwelfare and trade

Welfare means different things to different people. Generally, it is related to happiness, prosperity, well-being or health. It is also commonly described as either social programmes that make payments to poor people living in poor areas or just helping people. Welfare is a concept which has also been severally defined in the literature from both social and economic viewpoints.The Collins dictionary (2005) describes welfare as being dependent on the value judgments of individuals or society in decisions about

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production and distribution of wealth. Darwall (2011) sees welfare as an unobservable but normative phenomenon that is equivalent to wellbeing, doing something in the best interest of someone or for the good of someone. Dasgupta and Mäler (2001) also equate welfare to wellbeing either of an individual or the society. Coudouel*et al.*(2002) describes wellbeing as the converse of poverty, hence, welfare is the converse of poverty. The study sees anindividual's well-being as the command over commodities in general; people are better off if they have a greater command over resources and worse off if vice versa. Poverty, therefore, means either lack of command over commodities in or a specific type of consumption (e.g., too little food energy intake) deemed essential to constitute a reasonable standard of living in a society, or lack of ability to function in a society. According to the World Bank (World Bank 2000), "poverty is pronounced deprivation in well-being", where well-being can be measured by an individual's possession of income, health, nutrition, education, assets, housing, and certain rights in a society such as freedom of speech. Welfare can thus be related both to the individual and to the society.

In the economic sense,Smith (1975) defines welfare first generally as an intellectual process which assists in judging states of a society as better or worse. Specifically, he defines welfare as the only field of inquiry in which a rigorous attempt is made to distinguish between states of a society with the aim of providing a basis for judging the desirability of alternative states of society. Welfare has been often related to utility in the literature.Greve(2008) describes the concept of welfare as deriving from the historical and cultural context within which it is embedded. Welfare can also be equated to utility and can be seen as the evaluation assigned by the individual to income or, more generally, to the contribution to our well-being from those goods and services that we can buy with money. Individual welfare can thus be described as maximising utility by choices made by the individual whilesocial welfare is described as the sum of all individuals' welfare in a society (Walker, 2005).

Just like utility, welfare is unobservable (Koutsoyiannis, 1985) hence,it is simply described as that which a society seeks to maximise. Although welfare is not an

observable phenomenon, it can be ranked on an ordinal scale of better or worse so as to arrive at which option best maximises welfare in a society (Mishan, 1964). The economic analysis of individuals' utility leads to money being a proxy for welfare, indeed Pigou, (1950) sees money as the only measurement of welfare. For example, the GDP per capita is used as an indicator for social welfare. However, arguments against the concept of using income and utility as a proxy for welfare have arisen in recent times.

In this study welfare was for households in the country using income as proxy.

According to the neo-classical school of thought, trade is the exchange of produce between a country and the rest of the world at given terms (World Bank, 2001). This is specifically called international trade since we can have inter-regional trade which is the exchange of goods between a region and other regions within a country. A country which engages in exchange of goods and services with the rest of the world is referred to as an open economy, that is, it is open to trade (Jhingan, 2004). There are different levels of openness, hence;trade could be free (very open) or restricted (minimally open) and this is determined by the government of the country. When trade is done in the absence of any price distorting policy (free trade), the economy is said to be fully liberalised and this is expected to lead to an increase in the growth rate of income and output and therefore is beneficial to the poor overall (Sachs and Warner, 1995; Dollar, 1992; Edwards, 1993 and 1998; Frankel and Romer 1999, Bhagwati, 2008, Nayyar, 2008). It is argued that the benefits of free trade should accrue to developing countries especially because it gives them the opportunity to specialize in the goods and services in which they have efficiency of production. In addition, they have better choices, better goods and services produced by other countries at lower prices to choose from and can become innovative due to the competitive global environment that free trade creates (Servilla, 2007).

However, arguments against free trade also abound in the literature especially that for developing economies as they are likely to suffer negative consequences of free trade. These negative effects include: suffocating of domestic infant industries, denial of an opportunity of raising government revenue, exposure to dumping and balance of payment problems, among others (Corden, 1974 and OXFAM, 2005). Rowley, (2004) argues

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against the theory that deviations from free trade seldom improve efficiency. He posits that the reason why free trade is not 'the rule' but an 'exception to the rule' in the real world is because the aggregation of the economic efficiency of the policy will create winners and losers. Winners are supposed to pay compensation to losers although, in reality, this seldom occurs. Hence, some countries are often worse off and the domestic producers in developing countries usually, are the losers (OXFAM, 2005).

Consequently, governments resort to protectionism which is the effort (of government) to shield domestic producers from international competition. The most commonly used tool is import tax, usually tariffs levied on imported goods. Trade protectionism is not only practiced by developing countries but also by developed countries in Europe, America and other parts of the world. Tariff-protected goods range from agricultural to manufactured goods such as automobiles to safeguard the domestic industries. However, Stokes (2007) asserted that trade protectionism imposes economic costs on national economies, especially poor ones. Younkins (2000) opines that protectionism cannot help producers without hurting others. The victims are usually the consumers who buy the tariff protected good at high prices, the non-consumers who would have entered the market if the price were not increased due to the tariff, domestic firms who would have to sell fewer goods due to decreased demand arising from the increased price and foreign producers who have to export less due to the imposed tariffs. Hence, the debate for or against free trade (and trade protectionism) remains inconclusive in the literature.

CHAPTER THREE
METHODOLOGY

This chapter presents the methodological framework adopted for the study. The subsequent subsections describe the scope of study, sources and methods of data collection, method of data analysis and the limitation of the study.

3.1   Scope of study

The study set out to investigate the effects of Nigeria's rice trade policy on the welfare of households. In assessing the performance of the rice sector, the study limited its scope to the period between 1970 and 2004. This period was categorized into four rice trade policy periods namely: pre-ban (1970-1978), import quota (1979-1984), ban (1985-1994) and post-ban (1995-2004). The study used the most recent input-output (I-O) table available at the time of the study. This was the 2004 I-O table developed by the Nigerian Institute of Social and Economic Research (NISER). The study covered the entire country as rice is both consumed and cultivated in all parts and vegetation zones of Nigeria respectively. The study limited itself to a north-south dis-aggregation of households rather than using the six geo-political zones (the northern part of Nigeria is the higher producer of rice and other cereals while the southern part produces less rice). The study restricted itself to two major barriers to rice trade: tariffs and ban. Rice trade liberalisation was modeled as a reduction or elimination of tariffs on rice imports while trade protectionist policies were modeled as increase in tariff and an import ban. Other barriers to rice trade such as: quotas, licenses and monopoly rights to imports were not considered in the policy simulations.

3.2   **Data type andcollection**

The study relied on data obtained from secondary sources.Hence, secondary data was used. Data were collected from the following sources:

i.   The Central Bank of Nigeria (CBN) Annual Reports and Statement of Accounts, from where data on import tariffs were obtained,

ii.   The Food and Agriculture Organisation (FAO) FAOSTAT Database from where data on yield, area cultivated to rice, domestic output, import, rice consumption and producer price from 1970-2004 were obtained,

iii.   The National Bureau of Statistics (NBS)

- Nigerian Foreign Trade Summary where trade data were obtained,
- Agricultural Survey Report 1994/95-2005/06 from where production data of rice and other agricultural crops were obtained,
- Government Revenue on Importation 2000-2010 from where data on national revenue accruing from import duties was collected,
- Nigerian Living Standards Survey (2004) from where households' income and expenditure shares were obtained, and

iv.   The Nigerian Institute for Social and Economic Research (NISER) from where the Input-Output Table for Nigeria (2004) was obtained.

3.3 **Method of data analysis**

A number of analytical procedures were employed in order to explain fully the effect of rice trade policy on household welfare in Nigeria. These include the following:

i.   Growth rate and trend analyses,

ii.   Social Accounting Matrix (SAM),

iii.   Computable General Equilibrium Model,

iv.   Hicksian equivalent variations which used marginal utility derived from the CGE model.

3.3.1   **Growth rate and trend analyses**

The growth rates of each variable of interest to the study were calculated for each year using growth rate calculations as shown in equation 1. The trends of the variables were described using tables and bar charts. The variables described were: the growth rates of yield, area cultivated, domestic output, import volume, national consumption and producer prices. This was achieved using Microsoft EXCEL.

$$\text{Growth rate} = \left[\frac{Y_{it} - Y_{it-1}}{Y_{it-1}}\right] \times 100 \qquad (1)$$

Where:

i = variables considered in the trend analysis. These included: yield, area cultivated to rice, domestic production, import volume, national consumption and producer price.

t = year under consideration

Y_{it} = value of i in year t

Y_{it-1} = value of i in the previous year t

3.3.2 Social Accounting Matrix (SAM)

The SAM for this study was built to show the interrelationship of the rice sector with other sectors of the Nigeria economy forthe accounting period of 2004. The SAM consists of a 17 by 17 square matrix constructed from the 2004 Input-Output (I-O) table for Nigeria. The SAM is presented on Table 22 in Appendix I. The values in the SAM represent monetary values in naira. Table 2 shows the sectors in the I-O table which wereaggregated to form the sectors in the SAM. This is followed by the description of the building of each account in the SAM.

i.   **Production sectors in the SAM**

As seen on Table 1, three sectors of importance to the study were first aggregated from the 2004 I-O table including: agriculture, Oil and mining (OM) and manufacturing and services (MS). The entries (in activity rows, under commodity columns) for these sectors represent the domestic production and these were obtained by the difference betweengross output and export. The domestic production refers to the locally produced commodities that are available for domestic consumption. Production data from NBS

(2007) agriculture survey data was then used to first obtain the share of rice in total agricultural production in 2004. This share was then used to disaggregate the rice sector from the agriculture sector.

Table 1: SAM sectors aggregated from the I-O table.

SAM sectors	Components from the I-O sectors
Rice	Disaggregated from crop production
Other agriculture (OA)	Crop production excluding rice, livestock, forestry and fishing.
Oil and mining (OM)	Crude petroleum, natural gas, coal mining, metal ores, other mining and quarrying.
Manufacturing and services (MS)	Food Drink, Beverages & Tobacco, Textiles, Wearing Apparel & Leather, Wood, Wood Products & Furniture, Paper, Printing & Publishing, Chemical & Plastics, Refineries (Refined Petroleum), Basic Metals Products, Fabricated Metal, Machinery, Transport, & Equipment, Cement, Other Manufacturing Products, Electricity, Water, Building & Construction, Road Transport, Rail Transport & Pipelines, Water Transport, Air Transport, Transport Services, Telecommunications, Post, Distributive Trade (Wholesale & Retail Trade), Hotels & Restaurants, Financial Institutions, Insurance, Real Estates, Business Services (Not Health or Education), Public Administration, Education, Health, Private

Source: 2004 input-output table for Nigeria by NISER.

The share of rice in total agricultural production (RSA) was obtained by:

$$RSA = \frac{\text{Total rice production}}{\text{Total agricultural production}} \times 100 \qquad (2)$$

Othersharescalculatedinclude- share of rice in total crop production (RSC), riceshare in foodcrop production (RSF) and share of food crop in total crop production (FCS) obtained by:

$$RSC = \frac{\text{Total rice production}}{\text{Total crop production}} \times 100 \qquad (3)$$

$$RSF = \frac{\text{Total rice production}}{\text{Total foodcrop production}} \times 100 \qquad (4)$$

$$FCS = \frac{\text{Total foodcrop production}}{\text{Total crop production}} \times 100 \qquad (5)$$

RSA was found to be 2.5% of total agricultural production in 2004. RSC, RSF and FCS were found to be 3.00%, 3.30% and 91.18% respectively in 2004. This followsOsemeobo (1992), although he found that FCS was 82.3% of crop production.The entries for the rice sector were thus obtained by netting out this percentage (2.5%) from the agricultural sector while the difference between the share of the agriculture and rice sectors were computed under the OA sector. The gross output for rice was also entered as the total amount of domestically produced rice since rice is not exported in Nigeria. The rice

account, along with other sectors' accounts, was then balanced by taking out the excess expenditures of each sector from the investment income and adding it to their investment income.

ii.   **Commodities in the SAM**

The entries (in commodity rows and under activity columns) represent the flow of transaction among the sectors and how the different sectors in the economy relate/interact with one another. These were obtained directly from the I-O table and were computed from the sectors' output, personal and government consumption and investments. The SAM was made to reflect the fact that the rice sector sells to other agriculture sector and thus receives income from it. A share of 2% was deducted from the initial value of the rice commodity account and put under the other agriculture account. The same percentage was deducted from the other agriculture commodity account and put under the rice account to indicate the fact that the rice sector also buys from other agriculture and this helped to balance the accounts. This follows Olagunju (2010) and Taylor (2010) who find that about 2% of rice farmers revenue comes from the sale of bran and other residue from rice production to livestock farmers.

iii.   **Factors in the SAM**

The SAM has two factors of production: labour and capital. Capital comprises every other factor with the exclusion of labour. For instance, capital included land, buildings, machinery and tools, among others. Labour account entries were computed from the compensation of employees' entry in the I-O table while capital account entries were computed from the sum of consumption of fixed capital and operating surplus.

iv.   **Households in the SAM**

The SAM also has four households namely: rural north, rural south, urban north and urban south. The choice of this household categorization was informed by the fact that majority of rice farmers reside in the rural areas with the rural north having the larger

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proportion of rice producers than the rural south, the rural households are modeled as producing households while the urban households as the consuming households. The rural households are also poorer than the urban households especially the rural north households (NBS, 2005) therefore; they were likely to be worse off in terms of welfare. The urban households were considered mainly as consumers of rice who do little or no production and who were better-off in terms of welfare. The household income was calculated as the sum of the receipts from labour and capital sources by the households. To achieve the four households' structure in the SAM, the single household in the 2004 SAM was disaggregated into four using income and expenditure data from the Nigerian Living Standard Survey (2004) and the Agriculture Survey Report (2007).Other existing SAMs for Nigeria such as Olopoenia and Aminu (2007) and IFPRI (2010) were also consulted to compare shares and ensure consistency. The shares obtained were used to calculate the labour and capital incomes earned from the different sectors by the households and also what each sector received from each household.

v. **Government and other accounts in the SAM**

Government income was obtained from the sum ofsubsidies, indirect tax paid by all the activity sectors and import tax charged on imported goods for both intermediate and final imports as contained in the I-O table. Although the subsidies are a leakage from government, they were computed as part of government income but with negative signs in the SAM. Also, the total indirect tax paid to government was obtained by the summation of the indirect tax paid by each of the four activity sectors. The row entry of the indirect tax income account was also obtained from the I-O table entry of indirect tax while the sum of indirect tax from the three activities that was paid to government accounted for the column entry.

The total import tax received by government was obtained from the sum of all the import tax charged on imported goods, both intermediate and final goods. Intermediate imports entries were obtained from the noncompetitive imports on the I-O table while the final imports entries were obtained from the import entry also on the I-O table. This constituted a preliminary income-received for the Rest of the World (ROW) account.

Next, intermediate and final import duty rates for the four sectors obtained from the CBN (2005) and the actual import tax collected in the base year from the NBS (2010) were used to obtain shares to provide the actual SAM entries for import tax and the ROW. This was achieved by multiplying import duty rates for each sector by the total import tax collected in the base year and then divided by the total nominal rates. The result was then netted out from the preliminary ROW entry to give the import tax paid by each sector. The preliminary entries less the import tax which was netted out gave the ROW account of the SAM.

The incomereceived by the investment account for each sector were computed from theconsumption of fixed capital on the I-O table for each of the four sectors. Investment is also known as the depreciation and is equated to the firms' savings. The investments of the households, government and ROW are also referred to as savings. These were computed from the difference between the income and expenditures of these accounts (i.e. households, government and ROW accounts) to balance the SAM.

3.3.3 Computable General Equilibrium model (CGE)

This sub-section presents a description of the CGE model used in the study which follows from the SAM described in the previous sub-section. The CGE model was used to determine the effect of rice trade policieson the Nigerian economy. The model adopted for the study follows from Dervis, de Melo and Robinson (1982) and Olopoenia and Aminu (2007). It is a static CGE model based on the 2004 SAM which was constructed from the 2004 I-O as described in sub section 3.3.2. In line with the small open economy, thefour production activities or sectors in the SAM produce output for both the domestic and international markets, although rice only supplies the domestic market. Output produced in the different sectors consists of value added which is a function of factors (labour and capital) and intermediate inputs. The intermediate inputs are derived from inter-sectoral input demand and from the external market. Similarly, domestic demand for composite goods is satisfied by the goods produced by the production activities and imports (i.e. final imports). However, imports and domestic demand as well as exports and domestic supply were assumed to be imperfect substitutes in line with the Armington

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assumption (Armington, 1969). The model was divided into six blocks: price block, output block, demand and income equations, utility block, savings and investment block and lastly, market clearing and factor market equilibrium. The parameters and variables in the model are first defined. This is followed by the description of each equation block in the model in turnafter which, the simulation experiments are discussed. The calibration of the model is given in Appendix II.

A.　Definition of parameters and variables in the model

Parameters and variables used in the CGE model are defined as follows:

i.　Parameters in the model

$h\exp s_{(h,i)}$	-	household expenditure shares for h household on i sector
$savr_{(h)}$	-	savings rate of household h
$h\exp s_{(h,i)}$	-	household expenditure shares for h household on i sector
$hfyls_{(h,i)}$	-	household shares of factor income from labour for h household from isector
$hfyks_{(h,i)}$	-	household shares of factor income from capital for h household from i sector
$savr_{(h)}$	-	savings rate of household h
IO_{ij}	-	input output coefficient
$\alpha_{(i)}$	-	value-added share parameter by sector
$\partial_{(i)}$	-	Armington function share parameter by sector
$\beta_{(i)}$	-	CET function share parameter by sector
$av_{(i)}$	-	value-added shift parameter by sector
$ac(i)$	-	Armington function shift parameter by sector
$at(i)$	-	CET function shift parameter by sector
$rhov_{(i)}$	-	sectoral value-added exponent
$rhoc_{(i)}$	-	Armington function exponent by sector
$rhot_{(i)}$	-	CET function exponent by sector

$g\sec_{(i)}$	-	government sectoral consumption
$depr_{(i)}$	-	sectoral depreciation rate
$ksh_{(i)}$	-	sectoral investment share
$pwts_{(i)}$	-	consumer price index weights by sector
$sigv_{(i)}$	-	sectoral value-added elasticity
$sigc_{(i)}$	-	composite good elasticity by sector
$sigt_{(i)}$	-	CET elasticity by sector
$tm_{(i)}$	-	import duty rate on final good by sector
$tn_{(i)}$	-	import duty rate on intermediate good by sector
$td_{(i)}$	-	excise duty rate on domestic good by sector
$te_{(i)}$	-	export duty rate by sector
$sub_{(i)}$	-	sectoral subsidy
$nx_{(i)}$	-	ratio of imported intermediate to output by sector
$ta_{(i)}$	-	tax and subsidy rates by sector
$govsavr$	-	government savings rate

ii.   **Variables in the model**

$HEXP_{(i)}$	-	household expenditure by sector
$HFYL_{(i)}$	-	household factor income from labour by sector
$HFYK_{(i)}$	-	household factor income from capital by sector
$SAV_{(h)}$	-	savings of household h
$HHY_{(h)}$	-	households income (gross)
$HHYN_{(h)}$	-	households income (net)
$HEXPQ_{(h,i)}$	-	quantity of composite commodity consumed by households

$HHU_{(h)}$	-	household utility
ALO_{ij}	-	input-output entries
$QSUM$	-	variable for calibration of pwts
$PX_{(i)}$	-	price of goods produced by sector
$PP_{(i)}$	-	producer price by sector
$DFI_{(i)}$	-	price of domestic foreign input by sector
$PD_{(i)}$	-	price of goods sold locally by sector
$PK_{(i)}$	-	price of capital by sector
$PV_{(i)}$	-	price of value-added by sector
$P_{(i)}$	-	price of composite by sector
$PE_{(i)}$	-	domestic price of export by sector
$PM_{(i)}$	-	domestic price of import by sector
$PN_{(i)}$	-	domestic price of intermediate import by sector
$LAB_{(i)}$	-	labour demanded by sector
$CAP_{(i)}$	-	capital demanded by sector
Q_i	-	composite final good by sector
$X_{(i)}$	-	domestic output by sector
$D_{(i)}$	-	domestic supply of good produced locally by sector
$E_{(i)}$	-	export of goods produced locally by sector
$M_{(i)}$	-	import of final good by sector
$N_{(i)}$	-	imported intermediate good by sector
$XV_{(i)}$	-	value-added output by sector
$INTO_{(i)}$	-	sectoral intermediate input supply
$CD_{(i)}$	-	households private consumption on sector i
$IDO_{(i)}$	-	investment demand in sector i

$INTDO_{(i)}$	-	sectoral intermediate input demand
W	-	wage rate
$PK_{(i)}$	-	price of capital
$LABY$	-	labour income (total)
$NCAPY$	-	capital income (net)
$CAPY$	-	capital income (gross)
$PINDEX$	-	price index
GDP	-	gross domestic product
$GDP2$	-	gross domestic product expenditure approach
$RGDP$	-	gross domestic product real
$IMTAX$	-	import duty collected on all goods across sectors
$INDTAX$	-	indirect tax collected on all goods across sectors
$GR\mathrm{T}$	-	government revenue
$GE\mathrm{T}$	-	government expenditure
NGE	-	net government expenditure
$GOVSUB$	-	subsidy
$HSAV$	-	households savings
$GOVSAV$	-	government savings
$DEPT$	-	total depreciation
$SAVINGS$	-	total savings
$INVEST$	-	investment
$FSAV$	-	foreign savings
$SECGOV_{(i)}$	-	sectoral expenditure of government
$PWE_{(i)}$	-	world price of export
$PWM_{(i)}$	-	world price of final import
$PWN_{(i)}$	-	world price of intermediate import
$DPRE_{(i)}$	-	depreciation value by sector
L	-	total labour supply
K	-	total capital supply
$TMR_{(i)}$	-	import duty revenue on final goods by sector

$TNR_{(i)}$	-	import duty revenue on intermediate goods by sector
$TDR_{(i)}$	-	indirect tax revenue by sector
$SUBR_{(i)}$	-	government subsidy by sector

B.   Equation blocks in the model

Six blocks with equations namely: the price, the output, the demand and income, the utility, the savings and investment and the market clearing and factor market equilibrium blocks were constructed in the modeland are described as follows:

i.   Price block

This consists of seven equations including:

1. Value added price of a commodity iwas given by the difference between the value of production and the value of intermediate inputs used in producing the commodity.

$$PV_i = PX_i \left(1 - (td_i - sub_i)\right) - \sum (IO_{ji}.P_j) - PN_i.nx_i \qquad (6)$$

2. Domestic price of final imports, were a function of the nominal exchange rate, the world price of the commodities and import taxes. Exchange rate was endogenized in this model.

$$PM_{im} = ER.PWM_{im} \left(1 + tm_{im}\right) \qquad (7)$$

3. Domestic price of intermediate imports were a function of the nominal exchange rate, the world price of the commodities andtaxes on intermediate goods. Thus,

$$PN_{in} = ER.PWN_{imn} \left(1 + tn_{in}\right) \qquad (8)$$

4. Domestic price of exportswere a function of the nominal exchange rate, the world price of the commodities and export taxes. Thus,

$$PE_{ie} = ER.PWE_{ie} \left(1 + te_{ie}\right) \qquad (9)$$

5. The composite price was a function of the value of production of domestic goods and value of imports. Thus,

$$P_i = PD_i.D_i + PM_i.M_i.\frac{M_i}{Q_i} \tag{10}$$

6. The value of domestic output was a function of the value of production of domestic goods and value of exports. Thus,

$$PX_i.X_i = PD_i.D_i + PE_i.E_i \tag{11}$$

7. The price index was the sum of the shares of the output from the sectors multiplied by the price of composite. The price index was also the *numeraire*.Thus,

$$PINDEX = \sum pwts_i.P_i \tag{12}$$

ii.   **Output block**

8. Output produced in each sectors comprises value added which was a function of two maininputs: factors (labour and capital). Thus,

$$XV = avLAB_i^{\alpha}.CAP_i^{(1-\alpha)} \tag{13}$$

9. The minimization of the value added equation above gave the demand for the primary inputs or factors. Hence, demand for capital was given as

$$CAP_i = (1-\alpha_i)PV_i \frac{X_i}{PK_i} \tag{14}$$

10. Demand for labour in each sector was specified as a function of value added price, wage rate and production in each sector. Hence

$$LAB_i = \alpha_i.PV_i \frac{X_i}{W} \tag{15}$$

11. Total production by exporting sectors is given by the sum of goods produced for export and those supplied to the domestic market. It was given by

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$$X_{ie} = \left[at_{ie}\beta_{ie}E_{ie}^{rhot_{ie}} + \left(1-\beta_{ie}\right)D_{ie}^{rhot_{ie}} \right]^{\left(\frac{1}{rhot_{ie}}\right)}$$

(16)

12. Total production in non-exporting sectors equals domestic supply and it was given by

$$X_{ien} = D_{ien}$$

(17)

13. Export of goods produced in each sector is a function of domestic demand, domestic price and export price of the good.

$$\frac{E_{ie}}{D_{ie}} = \left(\frac{PE_{ie}}{PD_{ie}}\right)\left(\frac{1-\beta_{ie}}{\beta_{ie}}\right)^{\left(\frac{1}{rhot_{ie}-1}\right)}$$

(18)

14. The composite commodity for each sector's good was a function of the imported final (finished) good and its domestic supply. It was given by

$$Q_{im} = \left[ac_{im}\partial_{im}M_{im}^{-rhoc_{im}} + \left(1-\partial_{im}\right)D_{im}^{-rhoc_{im}} \right]^{-\frac{1}{rhoc_{im}}}$$

(19)

15. Composite in a non-importing sector equaled the domestic supply of goods by the sector which is given by

$$Q_{imn} = D_{imn}$$

(20)

16. Import of final good in each sector was a function of domestic supply of import competing good and its import and domestic prices.

$$\frac{M_{im}}{D_{im}} = \left(\frac{PD_{im}}{PM_{im}}\right)^{\left(\frac{1}{rhoc_{im}+1}\right)}\left(\frac{\partial_{im}}{1-\partial_{im}}\right)^{\left(\frac{1}{rhoc_{im}+1}\right)}$$

(21)

iii. **Demand and income equations**

17. Capital was modeled as being immobile across sectors. Gross capital income wasthe sumof capital income of each sector multiplied by the price of capital in the sector. Thus,

$$CAPY = \sum_i CAP_i PK_i$$

(22)

18. Labour was modeled as being mobile across sectors. Gross labourincome was the sum of labour income of each sector multiplied by the ruling wage rate.Thus,

$$LABY = \sum LAB_i.W \tag{23}$$

19. Netcapital income was the sum of capital income of each sector multiplied by the price of capital in the sector and the depreciation of capital in that sector. Thus,

$$NCAPY = \sum CAP_i PK_i \left(1 - depr_i\right) \tag{24}$$

20. Total household income was the sum of labour and capital income earned by each household from each sector. This was given by

$$HHY = \sum hfyls_{hi} \left(LAB_i.W\right) + \sum hfyks_{hi} CAP_i PK_i \left(1 - depr_i\right) \tag{25}$$

21. Domestic input supply to the sectors was the sum of product purchased from other sectors. Thus,

$$INT_j = \sum IO_{ij} X_i \tag{26}$$

22. Imported intermediate input supply of each sector was obtained from the share of each sector's imported intermediate and its output. It was given by

$$N_{in} = nx_{in} X_{in} \tag{27}$$

23. Intermediate input demand of a sector was obtained by the sum of intermediate input purchased from other sectors. It was given by

$$INTD_i = \sum IO_{ij} X_j \tag{28}$$

24. Total subsidy from government to the sectors was obtained from the sum of the product of each sector's share and the value of its product. It was given by

$$GOVSUB = \sum sub_i.PX_i X_i \tag{29}$$

25. Total import tax collected by government was obtained from the sum of import taxes from final and intermediate imports. It was given by

$$IMTAX = \sum tm_{im}.PWM_{im}.ER + \sum tn_{in}PWN_n.N_{in}$$

(30)

26. Total indirect tax collected by government was obtained from the sum of indirect taxes paid by each sector. It was given by

$$INDTAX = \sum td_i PX_i X_i$$

(31)

27. Total government revenue was obtained from the sum of all import and indirect taxes less subsidy to the sectors. Thus,

$$GRT = IMTAX + INDTAX - GOVSUB$$

(32)

28. Government expenditure was equal to government revenue. Thus,

$$GET = GRT$$

(33)

29. Expenditure of government on each sector was a function of government revenue. Thus,

$$SECGOV_i = g\sec.GRT(1 - govsavr)$$

(34)

30. Total composite commodity consumed by households was a function of total household income and composite price. Thus,

$$HEXPQ = \frac{h\exp s_{hi}.HHY}{P_i}$$

(35)

31. Total private consumption on a sector was the sum of the composite commodity consumed by households from hat sector. Thus,

$$CD_i = \sum HEXPQ_{hi}$$

(36)

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iv.**Utility block**

32. The four households in the model each maximize a Cobb-Douglas utility function subject to their income. This was given by

$$HHU = \sum h \exp s_{hi} \log HEXPQ_{hi}$$

(37)

v.**Savings and investment block**

33. Household savings was specified as the difference between household income and itsexpenditure. Thus,

$$SAV_h = HHY_h - \sum h \exp s_{i.} HHY_h$$

(38)

34. Total household savings was given by the sum of all households' savings.Hence

$$HSAV = \sum SAV_h$$

(39)

35. Total firm savings or depreciation on capital equipment was the sum of the depreciationin each sector. Thus,

$$DEPT = \sum depr_i CAP_i.PK_i$$

(40)

36. Foreign savings or external balance was obtained by the expenditure on final and intermediate imports less the revenue from exports. Thus,

$$FSAV = \sum PWM_{im}M_{im} + \sum PWN_{in}.N_{in} - \sum PWE_{ie}.E_{ie}$$

(41)

37. Government savings was a share of its revenue. It was given by

$$GOVSAV = govsavr.GET$$

(42)

38. Total savings of the nation was given by the sum of foreign savings, total household savings, government savings and firm savings. Thus,

$$SAVINGS = FSAV.ER + HSAV + GOVSAV + DEPT$$

(43)

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39. Savings equal investments. It is given by

$$INVEST = SAVINGS$$

(44)

40. Investment was financed by savings in all sectors. It was given by

$$ID_i = ksh_i.INVEST$$

(45)

vi. **Market clearing and factor market equilibrium**

41. In line with the neo-classical assumption of full employment, the goods market was cleared when the sum of demand for commodities equal the composite supply. Hence,

$$Q_i = INTD_i + CD_i + SECGOV_i + ID_i$$

(46)

42. The factor markets were in equilibrium when total labour demandequals total labour supplied

$$L = \sum LAB_i$$

(47)

43. Also the factor markets are in equilibrium when total capital demandequals total capital supplied

$$K = \sum CAP_i$$

(48)

44. The objective function gave the Gross Domestic Product (GDP) as the sum of the value of production and all taxes collected. Hence, it was given by

$$GDP = \sum PV_i.X_i + IMTAX + INDTAX$$

(49)

44. Similarly, the Real Gross Domestic Product (RGDP) was given by the sum of private consumption, investment demand, government expenditure on sector goods and exports less imports. Hence,

$$RGDP = \sum CD_i + \sum ID_i + \sum SECGOV_i + \sum E_{ie} - \sum(1 - tm_{im})M_{im}$$

(50)

C. **Description of simulation experiments**

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Four policy scenarios were simulated in this study. These policy scenarios largely represented the various rice trade policy measures that have been used in Nigeria since 1970 till date or are under consideration by government to be used because of pressure from local and international sources such as rice farmers and WTO respectively.The four policy scenarios were grouped under two main types of rice trade policies:

a. trade protectionist policies: this consisted of aban and increase in tariffs (80%)

b. tradeliberalisation policies: this consisted of a small reduction in tariff (5%) and no-tariff charge/ elimination of tariff on rice imports (0%).

i.   **A ban on importation of rice**

The ban on importation of rice was used by the government from 1978 to 1979 and also from 1985 to 1995. In 2007,the government again considered placing a ban on rice imports. Pressure groups such as the Rice Farmers Association on Nigeria (RIFAN),are still calling for this protectionist policy. This is considered as an extreme protectionist policy in this study. Two methods were followed to achieve the ban. Firstly the model specified the import duty on final imports across sectors ($tm_{(i)}$) as a parameteras described in 3.3.3A, hence, it could not change. Thus, the import of final good in the rice sector ($M_{(rice)}$), which is specified as a variable, was equated to zero. This meant a complete closure to rice trade and no tariffs were collected. However, some quantity of imported rice will still be brought into the country even under a ban, especially inthe case of government waivers. Thus the study sought to calculate an effective tariff rate at which riceimports would be discouraged. This was the second ban scenario. To achieve this, $tm_{(i)}$was specified as a variable to be calculated by the model. This was the only experiment for which$tm_{(i)}$was specified as a variable. All sectors'$tm_{(i)}$were fixed except for the rice sector ($tm_{("rice")}$) while lower and upper bounds of $M_{(rice)}$were set at 0.00001 and 10% of the $M_{(rice)}$in the base year. The study assumed that in a real life ban situation, no than 10% of the current quantity of imported rice may be allowed into the country.

ii.   **An eighty percent increase in tariff rate**

The 80% increase in tariff was the highest increase that occurred in Nigeria under the tariff regime. This was an increase from 19% in 1978 to 100% in 1995 (in between these

periods, no tariff was charged as the quota system and bans were in effect). Protectionist policy of high tariffs stillcharacterised Nigeria's rice trade policy up to 2004 as can be seen on Figure 3 and also on Table 23 in Appendix I. To achieve this experiment, 80% was added to the base year tariff and the model was run to obtain the percentage changes in the variables due to the shock.

iii.   A five percent reduction in tariff rate

Reduction of tariffs on rice imports occurred severally since 1970 till date. Tariff cuts have ranged from as small as 1% and 5% to as large as large as 69%. However, the study considered a small reduction in tariff of 5% for three reasons. Firstly, simulating 1% reduction may not show any appreciable change in the base solution to inform policy. Secondly, 5% and 10% change in import tax hardly differfrom one another (see Olopoenia and Aminu, 2007). Thirdly, 5% is an approximate mean value of the two lowest reductions in rice import tariffs that have been done in Nigeria. This is considered as a mild liberalisation policy by the study. To achieve this experiment, 5% was deducted from the base year tariff rate and the model was run to obtain the percentage changes in the variables due to the shock.

iv.   Elimination of tariffs

The fourth policy scenario of a no-tariff charge on rice imports was used in 2008 in the wake of the global grain crisis. This is considered as an extreme liberalisation policy by the study.The WTO would have all countries of the world adopt this policyin other to ensure free trade. To achieve this experiment, a tariff rate of 0% was specified for $tm_{(\text{"rice"})}$ and the model was run to obtain the percentage changes in the variables due to the shock.

3.3.4   Hicksianmeasure of equivalent variation (EV)

Following Olopoenia and Aminu (2007), Annabi et al (2006) and Devarajan et al (2001), welfare gains/losses were estimated with Hicksian equivalent variation (EV). This measure was used to make equilibrium comparison of before and after each policy

change.EV thus describes the harm to the consumer due to a price change in naira terms. The EV answers the question of how much is equivalent to the harm done to a consumer by a price increase. Thus, EV estimation makes it possible to measure how much of a change in income is necessary to offset a change in price so that a consumer's utility remains at a given level.A positive value of the EV signifies an improvement in welfare while a negative value of either signifies a loss of welfare. The social welfare was described as the welfare measure for the entire economy and was obtained by the sum of all the EVs across the four household categories. The marginal utility of the households which was generated by the CGE model was used to estimate the welfare impacts of each rice trade policy measure on the household categories. The EV of each household was given by

$$EV^h = \left[\frac{U_n^h - U_o^h}{U_o^h}\right]Y_o^h \qquad (51)$$

Where:

Y_o^h -   Income of household h before the policy change

U_o^h -   Utility of household h before the policy change

U_n^h -   Utility of household h after the policy change

EV^h -   Equivalent variation of household h

3.4   **Limitations of the study**

The study was faced by a number of limitations which constrained the success of the work. The following were the limitations which were experienced:

i.   Data availability and accuracy. The data for the study were obtained from various sources which were either not consistent across years or were estimated data, not actual data. For instance, the data for the performance of the rice sector from FAO database spanning 1970 to 2004 were largely estimated data and were not comparable with NBS data. Again, the CGE model was constructed using 2004 input-output table. A more recent data may

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have made the outcome of the study different and also more representative of the current situation in the country.

ii.   This study assumed perfect competition in the CGE modeling despite evidence in the literature that imperfect competition actually exists in developing countries. Thus, the outcome of the study may have been different if the imperfect market characteristics of the economy had been incorporated.

iii.   The study used a static CGE and did not consider the dynamic nature of events in the economy. Hence, it was not possible to show the trend in changes associated with the different rice trade policy experiments.

CHAPTER FOUR
RESULTS AND DISCUSSION

This chapter presents the application of the methodology described in chapter three. The subsequent subsections thus present the results and discussions of the performance of the Nigeria's rice sub-sector under different rice trade policies, interrelation of the rice sector with the rest of the economy, effect of the rice trade policy on the Nigerian economy and the welfare implication of the rice trade policy on the Nigerian households.

4.1   Performance of Nigeria's rice sub-sector under different rice trade policy

This section attempts to provide a descriptive analysis of the performance, in term of growth, of the rice sector under four distinct periods of trade policy actions in Nigeria from 1970 to 2004. These four periods were:

  i.   the pre-ban period between 1970 and 1978,
  ii.   the period of quantitative restrictions or import quotas between 1979 and 1984,
  iii. the import ban period between 1985 and 1994 and
  iv.   the post ban period between 1995 and 2004

In the subsequent sections, the focus of discussion is on the comparative growth of yield, area cultivated to rice, domestic production/output and import volume in each period and the comparative growth of rice consumption and producer price in each period.

4.1.1   Performance of the ricesub-sector in the pre-ban period (1970-1978)

Figure 6shows the growth rates in rice yield, cultivated area, output, imports,consumption and producer price in the pre-ban period. The figure reveals that imports grew much

faster than yield, cultivated area and output during the pre-ban period. Imports only fell in 1971 and 1973 [see Figure 6 (III)] when tariff was 66% while the cultivated area and output recorded positive growth [see Figure 6 (II)]. The fall in importsmight have been in response to the increased tariff and growth of cultivated area and output in those years while the growth of rice yield was generally low with declinein this early part of the pre-ban period.
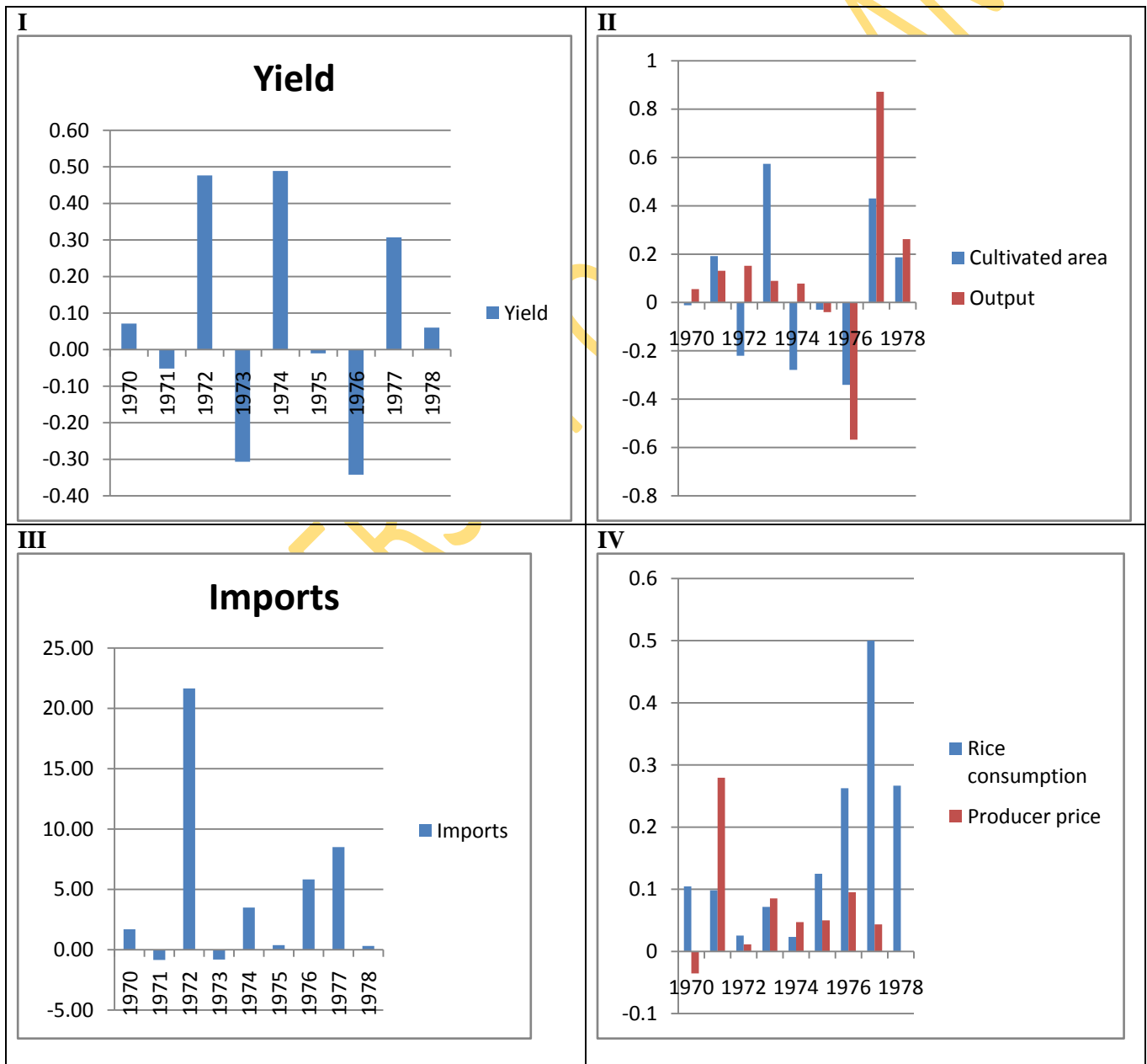
Fig 6: Growth (%) of rice yield, cultivated area, output, imports, consumption and producer price in the pre-ban period.

The low yield growth in the early part of the period indicates that yield development might not have been effectively supported by government alongside the tariff protection. The actual liberalisationperiod, which began with tariff reduction in 1974,initially recorded low growth in yield, cultivated area and in 1975 and 1976 while imports rose especially with a further reduction of rice import tariff by 10% 1976. However, the tide turned positively for the rice sector in 1977 as yield, cultivated area and output grew positively. Output recorded the highest growth attained throughout the four policy periods of study (1970-2004) by 87.2%; while yield and cultivated area grew by 30.7% and 43.0% respectively. The increase might have been occasioned by the increased efficiency of the farmers coupled with the increased consumption of the commodity and the substitution effect arising from lower market price rice which made rice relatively cheaper than other staples, hence increasing its demand.This indicates that domestic rice production may have the capacity to rise to the challenge of competition from the imported rice in a liberalized setting. The rice farmers may have been initially slow in responding to the challenge of the competition posed by imported rice but adjusted to the policy environment and began to produce more efficiently even in the face of competition from imports. This is indicated by the growth in yield of 30.7% [see Figure 6 (I)].

Moreover, cultivated area was increased as indicated by its 43% growth. Hence, lower tariffs might not be completely negative for domestic rice production. This impressive growth in output was however, not sustained in the following year (1978) when rice import tariff was increased by 9% as the government sought to increase the tariff protection. The policy change was as a result of the economic crisis that the country wasexperiencing at that time.Output grew by only 26% that year while yield and

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cultivated area grew by 6.0% and 18.7% respectively. This attests to the government's inconsistent use of different rice trade policies. In addition, the results suggest that inconsistent use of trade policies cannot deliver sustained performance in the rice sector.

Figure 6 (IV)   also shows that generally, in the early part of the pre-ban period (i.e. 1971-1974), producer pricegrew much faster thanrice consumption, although, both variables maintained positive growth through this period. This was the period of a 66% tariff protection. The highest growth in producer price of 28% in this period was experienced in 1971 when rice consumption grew by only 10%. During the same period, yield decreased by 5%, cultivated area increased by 19% and output increased by 13%.This suggests that producer price might not have been mainly influenced by yield, area cultivated or domestic output but also by thetariff protection which the domestic rice farmers enjoyed at the time. In addition, the effect of government price regulatory activities during this period might also have aided the price growth.

However, the lowest growth of producer price recorded across all policy periods occurred in the pre-ban. Rice consumptiongrew faster than producer price in the latter part of the pre-ban period. The highest growths of rice consumption (26% and 27%) were recorded in the years 1976 and 1978 respectively. This was because the massive importation of rice in this period stimulated increased preference for imported rice and hence, its demand also increased. The commodity was also cheaper due to the low tariff charged; hence rice was more easily affordable than at the earlier part of the pre-ban period. This meant that as the real income increased, the consumers were better off under trade liberalisation. However, producer price grew at a slower rate in this period until there was no record of growth in 1978. This indicates that producers' welfare only improved at a decreasing rate under trade liberalisation suggesting that consumers were better off under trade liberalisationthan the producers.

The mean growth of the performance variables shown on Figure 7 reveals that, on the average, the 9 years of the pre-ban period recorded positive growth for all the variables (yield, cultivated area, output, imports, consumption and producer price). As shown on

Figure 7 (I, IV &V),the best mean growths of rice yield, imports and consumption were recorded in the period with7.7 $\pm$30.2%, import 446.5$\pm$717.9%and 16.4 $\pm$15.4% respectively (also see Table 22 in Appendix I).The performance variable with theleast mean growth in the period was producer price;about 6.4 $\pm$9.0% (see Figure 7-VI).
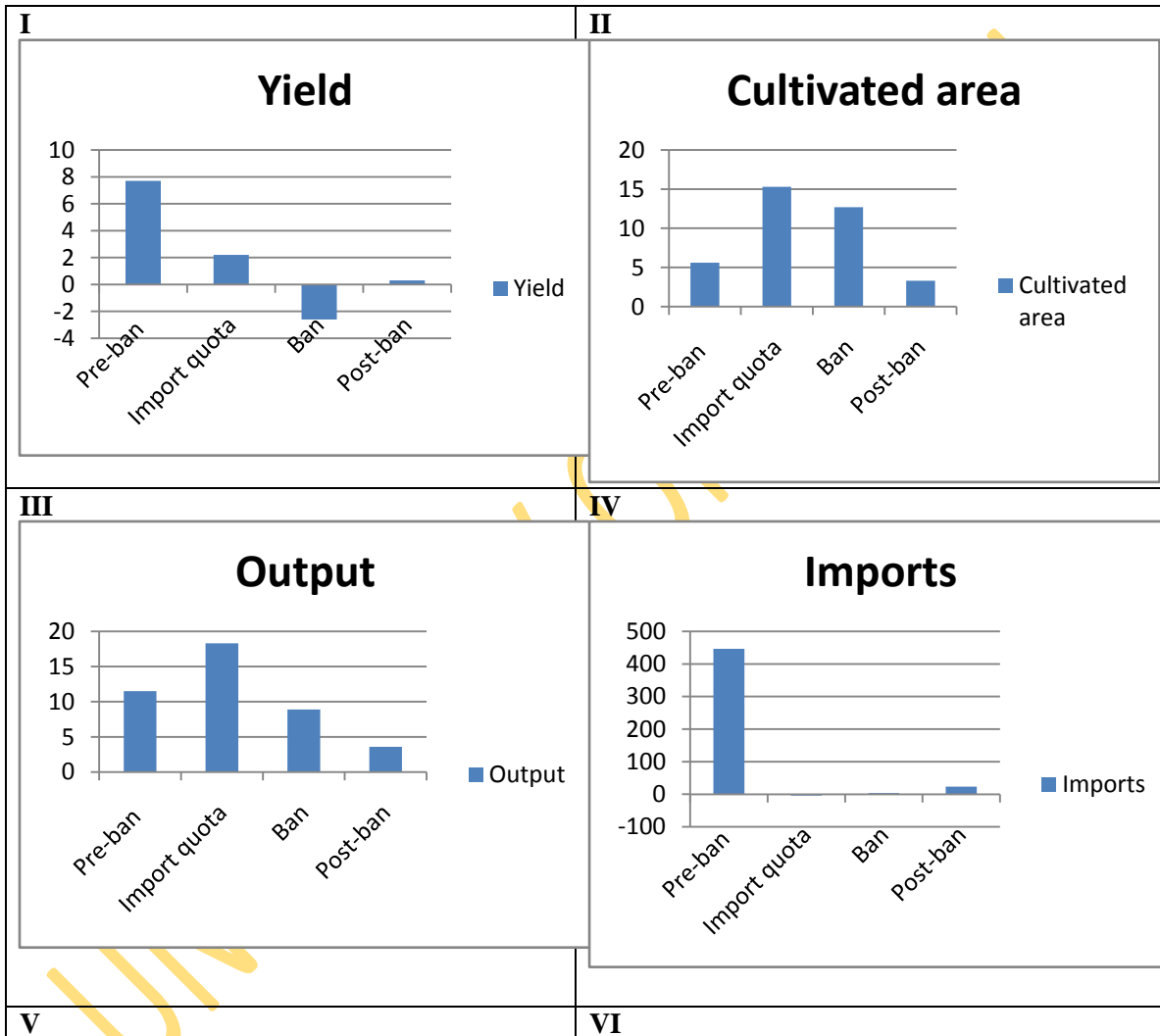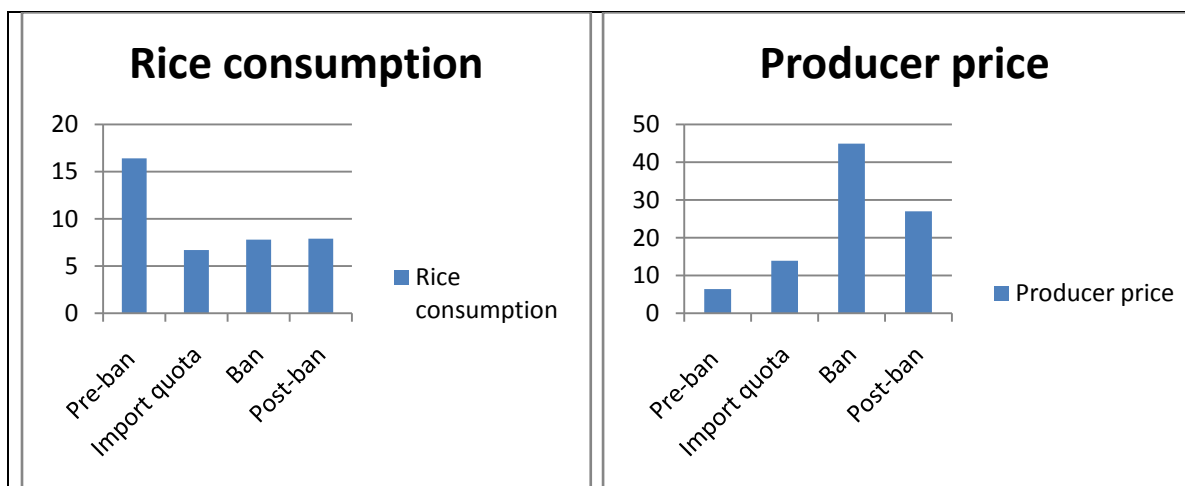
Fig. 7: Mean growth of rice sector performance variables in the different policy periods

4.1.2 **Performance of the ricesub-sector in theimport quota period (1979-1984)**

Figure 8 shows the growths of rice yield, cultivated area, output, import, consumption and producer price in the import quota period. Figure 8(I) revealsthat yield grew initially but later declined while imports fell for the most part of the period [see Figure 8(III)]. Cultivated area and output grew at a lesser rate than during the pre-ban [Figure 8(II)]. The highest growths of yield, cultivated area and outputoccurred in the first two years (i.e. 1979 and 1980) with yield recording growth rates of 6.8% and 5.3%, cultivated area recording 37% and 38% and output recording 45.6% and 45.3% respectively for the two years.

This growth might have been as a result of the trade protection policy of quota which shielded the domestic producers from import competition while; at the same time, providing an incentive to produce. After 1980, all three variables only attained minimal rates of growth until 1982 when there was no record of growth in cultivated area while yield and output grew at only 0.5% and 0.7% respectively. In addition, yield fell after 1982 while cultivated area and output only grew minimally for the rest of the import quota period. This unimpressive performance of the sector was largely due to the natural disaster of drought which occurred in the country between 1981 and 1982.

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Imports fell throughout this period or grew by less than 1.0%, except in 1981[see Figure 8(III)]. This suggests that the restrictive trade policy of quotas helped to reduce the volume of imports into the country. However, in 1981, imports grew fastest, at a rate of 50%. The import growth was due to the need to augment reduced domestic rice supply which arose from the drought experienced in the country that year. Quantitative restrictions were also removed in 1981 although import licensing was still in place. Thus government's stance on import quota was not completely rigid (especially for the period) and was changed as the need arose. Imports were tailored to complement domestic output in this period (Daramola, 2005).

I	II
III	IV
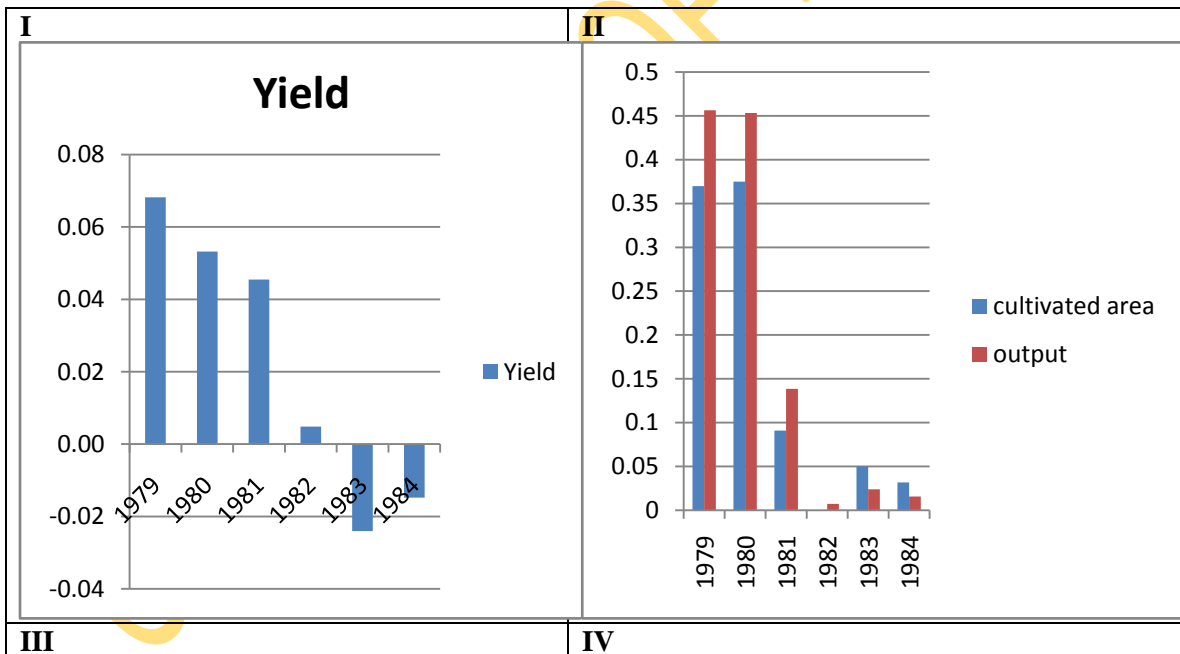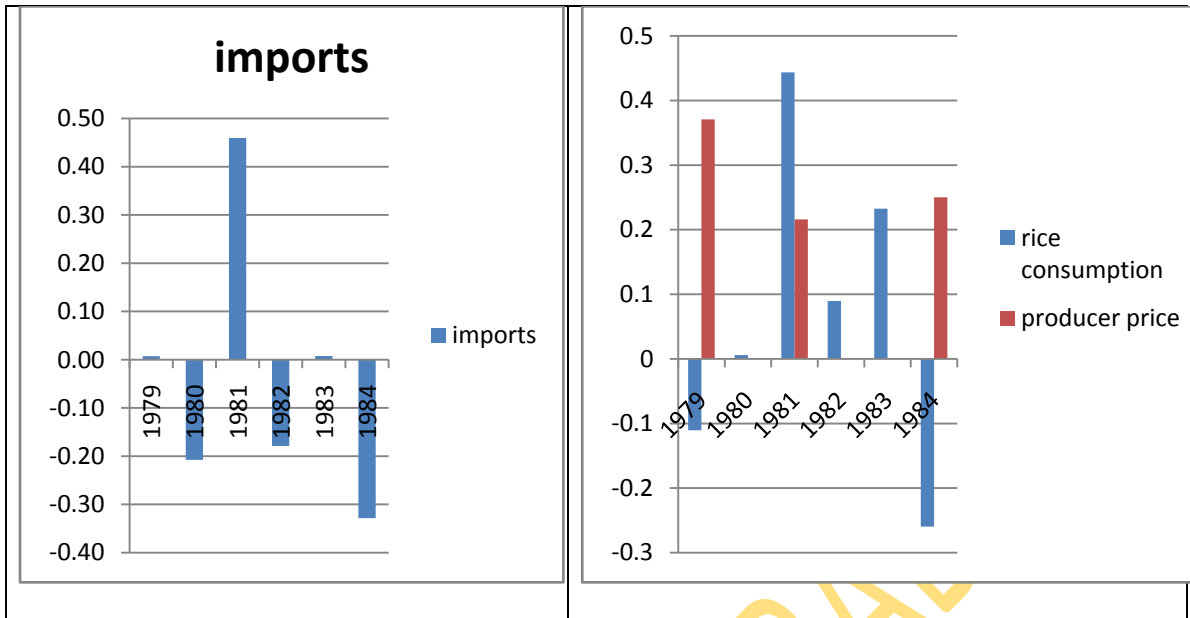
Fig 8: Growthofrice yield, cultivated area, output, imports, consumption and producer price in the quotaperiod

After 1982, when the drought problem began to ease off,the yield, cultivated area and outputdid not grow as much as before the drought.This indicated that farmers could not recover fast enough from the natural disaster despite the trade policy protection of quotas. Besides, appropriate complimentary policies were not put in place to enable the farmers gain maximally from the policy protection of quotas. In addition, the economic crisis which the country experienced during this period resultedin continued massive migration from the rural areas to the urban centers and leaving farmlands unattended. This may also explain the decline experienced in the sector during this period.

Figure 8(IV) also shows that rice consumption either grew minimally or declined for the greater part of the quota period.Riceconsumption fell in 1979 with a negative growth rate of-11%. This fall might have been due to the imposition of the import quota policy which resulted in a reduction in volume of imports and consequently, a reduction in composite

commodity.Producer price, on the other hand, recorded its highest growth rate of 37.1% in this period. This impressive growth may have been due to the incentive gained from the protection provided by the import quota policy. This growth in producer price may also have been partly due to the increases in output, cultivated area and yield which grew fastest in that year (1979). However, there was no additional growth in producer price the following year (1980).

Riceconsumption recorded its highest growth of 44.4% in 1981 during the period. This increase in riceconsumption was most likely occasioned by the increase in the volume of the volume of imports. This shows that consumers were better off with more trade in rice than with less. However, producer price also grew in 1981 despite competition from imported rice. The indications are that other factors such as the effect of government price policy may also have contributed to the growth in producer price. The fluctuating growth of producer priceduring this period may also have been because of the repeatedpolicy changes of government during this period. For instance, the government implemented several non-tariff barrier measures in the period which included: banning rice imports in containers below 50kg, restricting import license only to government agencies, a full 6 month ban on all rice imports, restricting imports to only 20,000 tons of rice per license holder and later removing this quantitative restriction (see Table 23 in Appendix). This againshows that if policies of government are inconsistent, the producers for whose benefit the policies are made may not reap the full benefits of such policies.

The mean growth of the variables shown on Figure 7 reveals that, on the average, the import quota period recorded positive growth for rice yield, cultivated area, output, consumption and producer pricewhile imports experienced a negative growth or decline. The best mean growths during this period occurred in cultivated area and outputwith 15.3$\pm$17.2% and 18.3$\pm$21.6%respectively (see Figure 7 II &III) while import declined with -4.0$\pm$27.7% (see Figure 7 -IV). This shows that on the average, cultivated area and output grew better during the import quota period than in the pre-ban period while yield grew better in the pre-ban period than in the import quota period. The result also indicates

that cultivated area mainly accounted for the growth in output. However, the growth in cultivated area resulted in almost the same proportionate growth of output coupled with the decline in yield development during this period. This suggests that farmers were not efficient in production during the import quota periodwhen compared to the pre-ban period. Also, from Figure 7 -V &VI respectively,the mean growth of riceconsumption was 6.7 $\pm$24.9%while producer price was 13.9 $\pm$16.1%, suggestingthat producers were better off during the import quota period than the consumers since producer price grew faster than riceconsumption.

4.1.3 **Performance of the rice sub-sector in the ban period (1985-1994)**

Figure 9 shows the growths of rice yield, cultivated area, domestic output, imports, consumption and producer price in the ban period. The figure reveals that cultivated area and output grew faster than yield and imports in the ban period. Cultivated area grew fastest among all four variables in this period. The highest growth of output (58.7%) in the ban period occurred in 1989whencultivated area also recorded the highest growth across all four policy periods of 58.7% [see Figure 9(II)]. This impressive growth in cultivated area may have been occasioned by the price incentive arising from the 'near monopoly' of rice supply which the ban provided for the domestic producers. This shows that a ban on rice importation may have the ability to increase area cultivated to rice fastest. Although, judging from the same proportionate growth of cultivated area and output, theoutput increase was largely due to increase in cultivated area rather than yield.

However, increase in cultivated area did not always give a proportional increase in output during the ban period. For instance, in 1985, an increase of 3.1% in land area produced a 10.0% increase in output however in 1986, a 4.5% increase in land area resulted in a decline of -1.0% in output. Also in 1994, land area increased by 9.6% butoutput declinedby-20.8%. Yield also recorded its greatest decline in growth (-27.5%) in 1994, despite the protection provided by the ban[see Figure 9(I)]. This suggests that there were no appropriate complimentary policies put in place to enable the farmers gain maximally from the policy protection of the ban.The fallin output was however, largely due to the

pest infestation which attacked rice growing areas such as Abakaliki, leading to huge losses for rice farmers (FAO, 2008). Ezedinnma (2005) also advanced other possible reasons for the decline which include: low investment in agriculture in key areas such as irrigation, shifts in populations away from rural areas, erosion of the rice ecological base, reduction in agricultural research funding and stagnating productivity.

Contrary to expectations that the ban would cause the level of imports to dwindle, Figure 9(III) shows that growth in import was recorded in four out of the ten years of the ban period. This suggests that, despite the ban, imported rice still found its way into the country through the nation's porous borders.The growth in the volume of imports fluctuated widely with that of domestic output unlike in the quota periods when they appeared to complement each other. For instance, in 1986 and 1990 both domestic output and import volume decreased while in 1987, 1989, 1991 and 1992 both domestic output and import volume increased during the ban.

I	II

III	IV
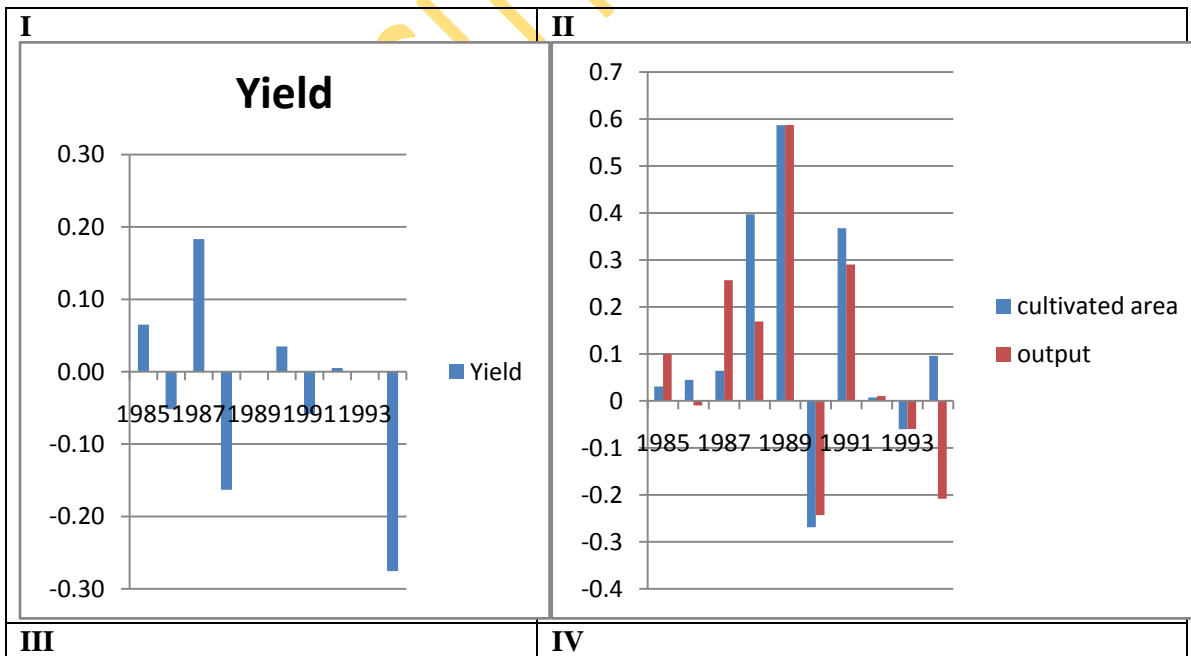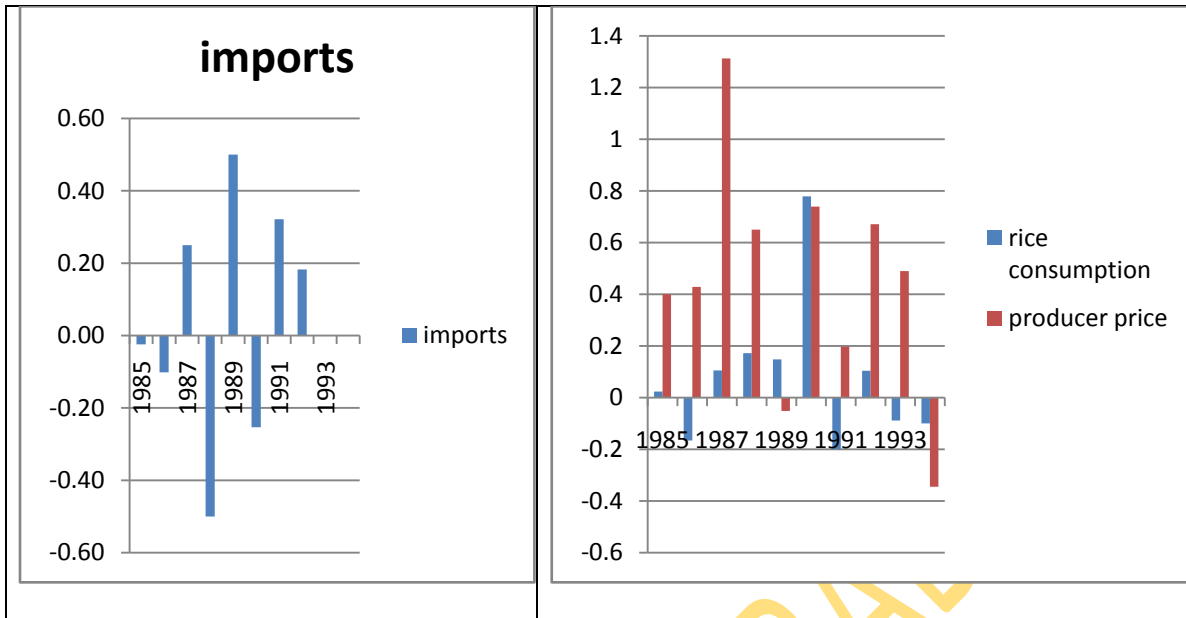
Fig 9: Growthofrice yield, cultivated area, output, imports, consumption and producer price in the ban period

The highest growth in imports and output in the ban period occurred in 1989 with an increase of 50.0% and 58.7% respectively. This might have beendue to smuggling rather than deliberate policy, as was the case in the earlier policy periods. This shows that a policy of atotal ban on importation of rice is difficult to enforce.

Figure 9(IV) also shows that producer price grew faster than rice consumption during the ban period. Producer price increased impressively throughout the ban period (except in 1989 and 1994) while rice consumption grew only minimally.The notable producer prices experienced in the ban period represent autarkic prices because the ban policy supposedly closed the rice economy to trade. Autarkic prices usually do not represent efficiency in production. A clear demonstration of this was in 1989 when producer price declined by -5% and rice imports recorded the highest growth in the same year. The decline in

producer price might have been due to the competition from imported rice on the market. Again, producer price increased by 74% in 1990 when both cultivated area and output declined and yield only increased by 3%. This further indicates that producer price was not driven by yield, increase in cultivated area or output but might have been driven by the policy protection provided by the ban. However, rice consumption also grew by 77.9% in 1990 thus, indicating understatements in the volume of imported rice that was on the market due to smuggling.

Rice consumption declined in the last two years of the ban period(1993 and 1994) by 8.8% and 10.0% respectively while producer price declined in 1994 by 34.0%. The decline recorded in producer price may have been due to the pest attack that occurred in 1994,in addition to the general instability of the economy and polity. The decline in rice consumption in the country was largely as a result of declining rice output which occurred in both 1993 and 1994 in addition to the Structural Adjustment Programme that had been biting hard on the economy. This suggests that rice consumption under the ban was driven by domestic output in addition to other factors such as smuggling. Hence, the consumers were worse off for some part of the ban period but were slightly better off during other parts of the ban.

On the average, as can be seen on Figure 7, the ten-year ban period recorded positive mean growths for rice cultivated area, output, import, consumption and producer price of 12.7 $\pm$25.1%, 8.9 $\pm$24.9%, 3.7 $\pm$29.0%, 7.8 $\pm$27.9% and 44.9 $\pm$45.5% respectively while yield experienced a negative growth or decline of -2.6$\pm$12.5% (see Table 9 in Appendix I). This indicates that on the average, the ban did not encourage growth of cultivated area and output as much as the import quota policy period. Also, growth in cultivated area resulted in less than proportionate growth in output. This suggests that production was inefficient in this period. The decline in yield development during the ban further indicates that despite the policy protection, farmers could not produce efficiently as in the pre-ban period. Further, the best mean growth of producer price occurred in the period, indicating that producers were better off during the ban period than any other policy period.

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4.1.4 **Performance of the rice sub-sector in the   post ban period (1995-2004)**

Figure 10 shows the growths of rice yield, cultivated area, output, imports, consumption and producer pricein the post-ban period. The figure reveals that imports grew best in the post-ban period, followed by the producer price [see Figure 10(III &IV) respectively]. Yield, cultivated area and output either grew only minimally or declined in growth in this period [see Figure 10(I &II) respectively].The highest growth in yield and outputrecorded during the post-ban(14.8% and 20.3% respectively)occurred in the first year of this period (1995) while cultivated area grew at only 4.8% while imports declined by -14.3%. The decline in import may have been due to the 100% tariff placed on rice import in the year after the ban. Afterwards, imports began to grow as the tariff was reduced by 50%. This indicates that tariff wasa major driver of imports in this period.

I	II

III	IV
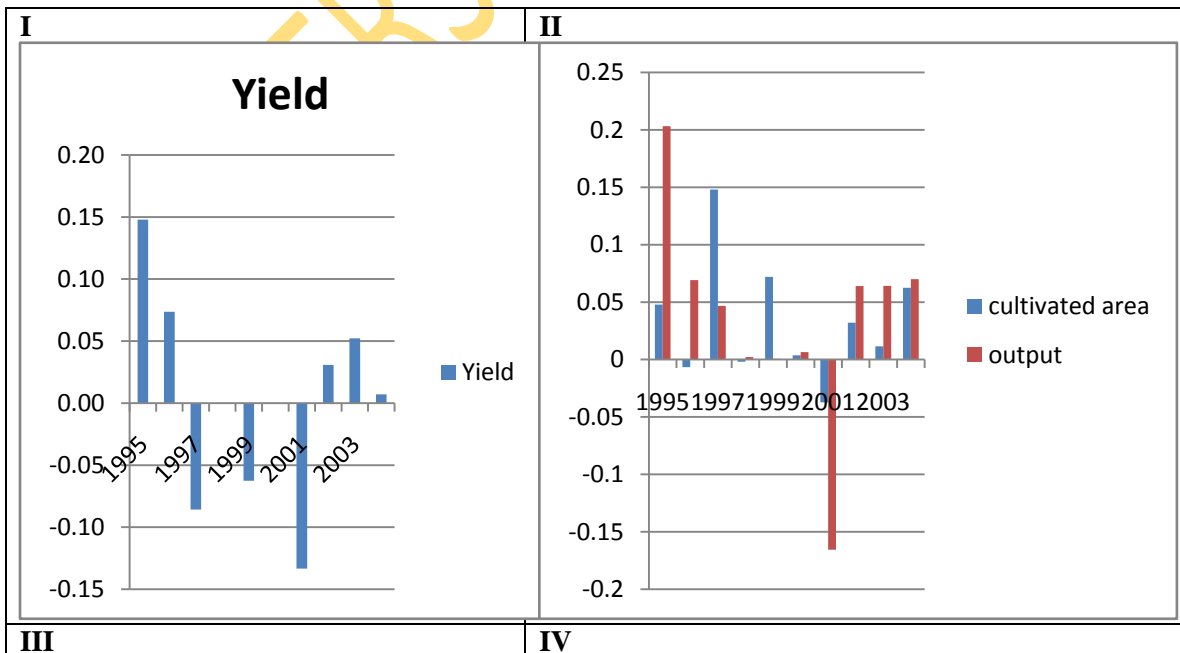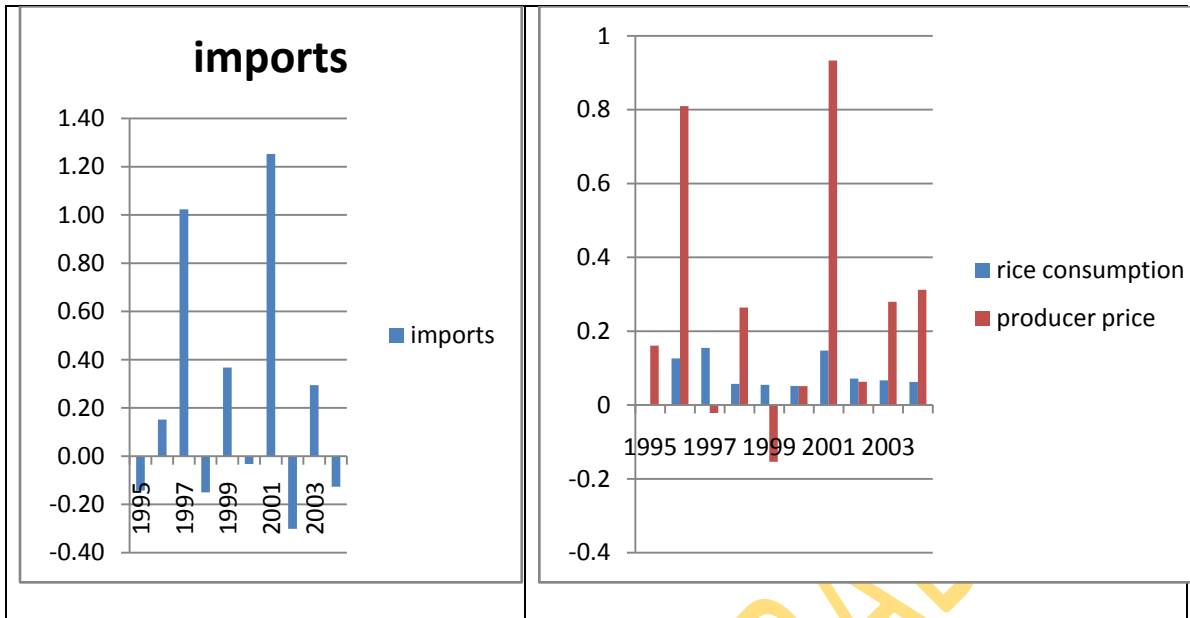
Fig 10: Growthofrice yield, cultivated area, output, imports, consumption and producer price post ban period.

Also, after 1995, yield and cultivated area only grew at a decreasing rate and later declined while output continued to grow only minimally. In 1997, yield declined by -8.57% but cultivated area, output and importsgrew by 14.8%, 4.7% and 102.3% respectively. The markedly high growth of imports might have been in response to declining yield and the unimpressive growth of output. This suggests that there was still a lack of complimentary policy to help domestic producers take advantage of the policy protection. The further decline of yield, cultivated area and output in 2001 despite the increase in tariff on rice import attests to this. On the other hand, imports recorded the highest growth of 125.3% in 2001. This again attests to the fact that the growing imports served to compliment declining output. The growth of imports also occurred when tariff were raised by 25%, thus indicating that the high tariff rates did not serve to discourage imports in the post ban period.

Thepoor performance of the sector continued until in 2002 when the sector took on a positive trend. Yield, cultivated area and output began to grow and maintained this positive trend throughout the post-ban period, although, only minimal growth was achieved. On the other hand, imports declined by -30.2% in the same year [see Figure 10(III)]. The decline in import might have been as a result of the positive growth in output. This further shows that imports played a complimentary role to output in this period. The sustained growth in yield, cultivated area and output was largely due to the Presidential Initiative on Rice which was launched in 2002 by the government. This suggests that a protective policy of trade is not enough to ensure good performance of the rice sector but that complimentary policies which ensure development in the sector must be put in place alongside trade policies. However, the minimal (though positive) growth recorded even after the government intervention of complementary policies is an indication that tariff protection may not translate into impressive growth in the ricesub-sector.

Figure 10(IV) also shows that producer price grew more impressively than consumption throughout the period except in 1997 and 1999 when it declined.The highest producer price of 93.0% occurred in 2001 when tariffs were raised from 50% to 75% (althoughyield, cultivated area and output all declined that year). This indicates that the producers might have only profited from high prices that were induced by the tariffs. The decreased growth in producer prices after the Presidential Initiative drive began furthersuggests thatthe high producer prices experienced prior Initiative was as a the result of an inefficient pricing system. Rice consumption, on the other hand, maintained a positivethough minimal growth, throughout the period. This growth in consumption might largely have been due to the growth in imports which occurred in those years. Also the lowest growth recorded for rice consumption was in 2000. This may also be associated with the decline in imports that yearwhile output grew by only 0.6%. This attests to the fact that consumers are better off when the volume of composite is increased by imports.

On the average, the ten-year period of the post-ban recorded positive mean growths for yield, cultivated area, output, import, consumption and producer pricewith 0.3±8.1%, 3.3±5.2%, 3.6±9.1%, 23.4±52.3%, 8.0±4.8% and 27.0±34.9% respectively (see Table 9 in Appendix I). The mean growths, as shown on Figure 7 (V&VI),reveal that, on the average, producers were better off during the post-ban period than the consumers since producer price grew faster than rice consumption in this period. Also, Figure 7 (II) shows that cultivated area and output grew least during the post ban period comparedto other periods.

In summary, the study observed that in the pre-ban period, rice yield, imports and consumption grew best compared to other policy periods while growth in cultivated area resulted in much more than proportionate growth in output. This indicates that yield might be enhanced and farmers produce more efficiently under a more liberalized trade policy than under highly protective trade policies.Consumers' welfare might also be enhanced. However, producer price grew least in the pre-ban period, indicating that producers may be worse off under a more liberalized trade policy.

Cultivated area and output grew best in the import quota period and growth in cultivated area resulted in a relatively proportionate growth in output. This indicates that a quantitative restriction on trade may encourage producers to increase land area cultivated to rice and consequently, increase output. The implications are that under highly protective trade policies, growth in cultivated area drives growth in output. Imports also fell fastest compared to other policy periods while rice consumption grew least during the import quota period, indicating that the quota system served to discourage growth of rice imports relative to other rice trade policies. However, consumers were worse off while producers were better off under the quota period, indicating that producers are winners under highly restrictive rice trade policies.

The fastest growth of producer price recorded in the ban period further attests to this. Producer price recorded its fastest growth during the ban period although,yield fell fastest in this period indicating that production under highly protective trade policies such as the

ban might not be efficient. Also, under the ban, growth in cultivated area resulted in a less than proportionate growth in output, further indicating that production under highly protective trade policies such as the ban might be inefficient. The growth in imports recorded during the ban period, although minimal, indicates that the ban was difficult to enforce and that it encouraged smuggling activities. Finally, the rice sector only began to show positive trends in the post-ban period when complimentary policies were put in place for the development of the rice sector by the government. This may be an indication that trade policies alone do not ensure the desired performance of the rice sub-sector.

4.2 Interrelation of the rice sector with the rest of the economy

This section presents the base solution of the CGE model which was replicated from the social accounting matrix (SAM) used for the study. Following procedures highlighted in chapter three, the SAM (a 17x17 matrix) was developed to show the interrelationship of rice with the rest of the economy. The social accounting matrix is a balanced table which illustrates the circular flow of income in an economy at a given period. The bench mark data of the social accounting matrix was used to calibrate the model and was replicated in the base solution of the model. Replication of the bench mark data in the base solution is a basic requirement for carrying out simulations with a CGE model. In the subsequent sections, base solution of the sectors, macroeconomic and household variables, as obtained from the SAM, are presented. These are the three major sets of variables bywhich the economy isdescribed in the model. The base solution values of the sector variables were first discussed, followed by the base solution values of the macroeconomic variables and lastly the base solution values of the household variables.

4.2.1 Description of base solution values of sector variables

This sub-section describes base solution values of the sector variables namely; domestic output, composite, exports, labour and capital which were included in the four sectors (rice sector, other agriculture sector, oil and mining sector and manufacturing and services sector) considered in the SAM. Other sector variables included are the following prices variables namely: composite price, price of capital, export price and import price. The Table 2 presents the base solution values of the different variables by sector. The

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subsequent sub-sections describe each of the sector variables used in relation to the sectors.

i.   **Domestic output**

The domestic output is the total quantity of goods produced by a sector for sale on the domestic market and also for export. From Table 2, it can be seen that the value of the domestic output of rice was ₦777.6 billion in the base year. This was 0.7% of the value of total composite in the economy. This means that rice production makes up a very small share of the total production in Nigeria. However, compared to the value of the domestic output for the other agriculture sector, which was ₦3032.7 billion, it suggests that rice forms a relatively important proportion of agricultural production in Nigeria. The proportion of the other agriculture sector in the total value of production in the base year was 27.5%. This shows that the share of the other agriculture sector in Nigeria's gross output is relatively large and it is thus a very important sector to national product. However, the sector that constituted the largest proportion of gross output in the base year was the manufacturing and services sector. The manufacturing and services sector had a total domestic output value of ₦4751.4 billion which was 42.9% of total gross output. This suggests that the sector may have the potential of becoming a more important contributor to the nation's economy than is currently the case.

Table 2: SAM base solution values of sector variables in ₦billion

S/No	Variables	Sectors				
		Rice	OA	OM	MS	Total
1	Domestic output	77.8 (0.7)	3032.7 (27.5)	3204.1 (28.9)	4751.4 (42.9)	11065.9 (100)
2	Composite	80.9 (0.8)	1716.9 (17.9)	352.2 (3.7)	7441.8 (77.6)	95918.9 (100)
3	Exports	-	1437.1 (32.1)	2981.1 (66.6)	563.6 (1.3)	44746.1 (100)
4	Labour	14.8 (0.8)	575.6 (31.6)	175.7 (9.7)	1052.8 (57.9)	181.9 (100)
5	Capital	629.9 (0.8)	2456.9 (30.4)	2825.3 (35.0)	2733.8 (33.8)	8078.9 (100)

Source: Computation from CGE model solution

Percentages in parentheses

Where

OA- Other agriculture sector

OM- Oil and mining sector

MS- Manufacturing and services sector

ii.   **Composite**

This is otherwise known as composite commodity. It is the sum total of a good(s) available for sale to consumers in an economy and is made up of goods imported for sale on the domestic market and those produced locally excluding exports. From Table 2 above, it can be seen that the value of the composite of rice was ₦808.7 billion in the base year. This was 0.8% of the value of total composite in the economy. This means that rice makes up a very small share of the market. The manufacturing and services sector had a total composite value of ₦7441.8 billion which was 77.6% of total composite. This was the sector with the largest proportion of composite in the economy. This suggests that the products of this sector from both home and abroad are the highest in demand on the Nigerian market

iii.   **Exports**

Exports constitute all domestically produced goods that are sold to foreign countries. Exports are an important determinant of the welfare status of an economy as it is a means of foreign exchange earnings for the country. Table 2shows that the Nigerian rice sector does not export its rice to other parts of the world. This means that all the all the rice produced in the country is also consumed locally. Although there have been reports of illegal exports of rice especially across the northern borders, these were not captured in the model. The manufacturing and services was the least foreign exchange earner for the economy in the base year. The sector had a total export value of ₦563.6 billion which was only 1.3% of total export value. This shows that despite having the largest proportion of gross domestic output and composite, the manufacturing and services sector accounts for only a small share of exports but a much larger share of imports. This suggests that the sector is relatively uncompetitive as most of its output is consumed domestically and only a small proportion is exported. The sector that constituted the largest proportion of Nigerian exports in the base year was the oil and mining sector. This sector had a total export value of ₦2981.1 billion which was 66.6% of total export value. This shows that the oil and mining sector was the largest foreign exchange earner to the Nigerian economy in the base year.

iv.   **Labour**

Labour is a factor of production which is the manual and mental contribution to productive activity made by the workforce. As can be seen from the Table 2 above, the value of labour employed in the rice sector was ₦14.8 billion in the base year. This was 0.8% of the value of total labour employed in the economy. This means that labour employed in rice production makes up a very small share of the total labour employed in Nigeria. The manufacturing and services sector employed the largest proportion of labour in the base year. This sector had a value of total labour employed of ₦1052.8billion which was 57.9% of total labour employed in Nigeria. This has important implications for welfare of Nigerian people.

v.   **Capital**

Capital is another factor of production which refers to the contribution to productive activity made by investment in physical assets or human development. From Table 2, it can be seen that the value of capital in the rice sector was ₦629.9billion in the base year. This was 0.8% of the value of total quantity of capital in the economy. This means that rice production makes up a very small share of the total quantity of capital employed in Nigeria although it is an important proportion of capital in Nigerian agriculture when compared to the value of the quantity of capital for the other agriculture sector, which was ₦2456.9 billion. The oil and mining sector constituted the largest proportion of total quantity of capital in the base year. The sector had a total quantity of capital of ₦2825.3 billion in the base year. This was 35.0% of total value of the quantity of capital in 2004. This shows that although the oil and mining sector is not a labour intensive sector since it only employs a small fraction of the total labour force, it is a capital intensive sector.

vi.   **Prices**

Price is simply defined as the money value of a unit of a good, service, asset or factor input. Prices are important welfare indicators since they drive the demand for goods and services in an economy. All the base solution prices were set at one in order to provide a basis with which the changes which may occur after the simulations can be compared. The prices used were: composite price, price of capital, export price and import priceThese prices were only included in the model but not in the SAM because a SAM does not provide information on prices but it does provide information which may be used to obtain these prices.

On the whole, the description of the sector variables has shown that the rice sector is a very small part of the entire Nigerian economy, less than 1.0%. Despite its small size in relation to the rest of the economy, the rice sector is an important part of Nigerian agriculture as it is 2.5% of the Nigerian agriculture.

4.2.2   **Description of base solution values of macroeconomic aggregates**

This sub-section describes base solution values of macroeconomic aggregates. The macroeconomic aggregates reported were: import tax, indirect tax, government revenue,

government savings, G.D.P, real G.D.P., foreign savings, investments, total quantity of labour, total quantity of capital, wage rate, exchange rate and consumer price index. Table 4 shows the base solution values of the macroeconomic aggregates which were obtained from the SAM and used in the model. Next, each aggregate is describedin turn in relation to the economy.

i. **Import tax**

Import tax is a levy imposed by the government on goods imported into the country. Inthe study, it is composed of taxes levied as a fixed percentage of the value of the imported good i.e. ad valorem. Table 3 shows that the total amount realized from import tax in the base year was ₦902.9 billion.

The import tax accounted for 77.5% of total government revenue generated in the economy in the base year. This shows that import tax was the most important source of government revenue in the base year.

Table 3: Base solution values of macroeconomicaggregates

Variable	Base Solution (₦billion)
Import tax	902.9
Indirect tax	263.7
Government revenue	1163.2
Government savings	670.6
G.D.P	9427.5
Real G.D.P.	10573.6

Foreign savings	-856.1
Investments	1382.5
Total quantity of labour	181.9
Total quantity of capital	8078.9

Source: Computation from CGE model solution

ii   **Indirect tax**

Indirect tax is a levy imposed by the government on spending on goods and services. The study however defines indirect tax as any tax, other than import tax, which is collected by government on goods and services. This includes sales tax levied on agricultural produce, value added tax (VAT), taxes on businesses and property taxes. Table 3 shows that indirect tax accounted for 22.5% of total government revenue generated in the economy in the base year. This amounted to ₦263.7 billion. This shows that indirect tax was also an important source of government revenue in the base year.

iii.   **Government revenue**

Government revenue is defined as money received by government from taxation. Government revenue is defined in the study as money received by government from

taxation after subsidies to the sectors have been deducted. The taxes that made up the government revenue were indirect tax and import tax. Table 3 shows that the total amount of government revenue realized in the base year was ₦1163.2 billion. From the SAM, it can be seen that the government expended its revenue on purchasing goods from the four productive activities and on investments. Investments are considered as savings to the government.

iv.   **Government savings**

Government savings is the proportion of government revenue that is not spent on current consumption. Government savings are important to national welfare because they are used to finance capital expenditure on physical assets. Table 3 shows that the total amount of government saving in the base year was ₦670.6 billion. This shows that government saved 57.6% of its revenue in the base year. From the SAM, it can be seen that the government invested this amount on the four sectors of the economy.

v.   **Investments**

Investments are defined in the study as the expenditure on the purchase of capital expenditure and financial securities in an economy. In the study, it is defined as the expenditure on the purchase of capital expenditure and financial securities by all the sectors, household, government and even foreign parties. Investments are financed by savings and under equilibrium conditions, investments equal savings. Thus since their values are the same, they are used synonymously in the study. Table 3 reveals that the total amount of investments in the Nigerian economy in the base year was ₦1382.5 billion. From the SAM, it can be seen that all the investments were expended on the four sectors of the economy.

vi.   **Foreign savings**

Foreign savings represent position of the country's trade transactions with the rest of the world. If the value of a country's exports of goods exceeds its imports, then it is in

surplus and foreign savings accrue while the reverse is the case when imports exceed exports. Table 3 reveals that the total amount of foreign savings which accrued to the Nigerian economy in the base year was -₦856.1 billion. The negative sign of the foreign savings shows that the economy was in a surplus in the base year and the amount accrued to foreign savings represents a withdrawal from the circular flow of income. The surplus was relatively large due to the country's oil exports. This result agrees with CBN, 2005 which indicated an increase in export earnings in 2004.

vii.   **Total quantity of labour and capital**

Labour is a factor of production which refers to the manual and mental contribution to productive activity made by the workforce. Hence,total quantity of labour is the value of the sum total of all the labour employed in the economy. Capital, on its part is defined as the factor of production which refers to the investment in physical assets or human development used in productive activity. Hence, the total quantity of capital is defined in the study as the value of all the capital employed in all sectors of the economy. Table 3 reveals that the value of the total quantity of labour in the base year was ₦181.9 billion while that of capital was ₦8078.9 billion. These represent the total amount paid for labour by each sector to the households and the total value of capital used by each sector respectively.

ix.   **Gross Domestic Product (G.D.P.) and Real G.D.P.**

G.D.P. is the total value of all final goods and services produced in the economy in a period of one year. Hence, in the study, G.D.P. is the value of the output produced by all the four sectors in the economy. Real G.D.P., on the other hand, refers to the total value of all final goods and services produced in the economy in constant prices in the base year. Real G.D.P. is G.D.P. that has been corrected for inflation by use of constant instead of current prices. Table 3 reveals that the G.D.P. in the base year was ₦9427.5 billion while that of real G.D.P. was ₦10573.6 billion. This shows that the value of real G.D.P. was higher than that of nominal G.D.P. by 89.2%. Hence the G.D.P. deflator, which is a ratio of nominal G.D.P. to real G.D.P., was close to unity. This indicates a decrease in the average price of output in the base year and this occurred due to an

increase in production of final goods. This result agrees with CBN, 2005 which indicated an increase in production in the Nigerian economy in 2004.

x.   **Other economic prices**

Other economic prices used in the model included: consumer priceindex (CPI), wage rate and exchange rate. The CPI is an index number which refers to the average price of consumption or the average price of goods consumed in the economy. This is also equivalent to the cost of living and is used as a measure of inflation in the economy. Wage rate is defined as the price of labour. It is determined by the forces of demand and supply in a in a competitive labour market. Exchange rate is the price of the domestic currency expressed in terms of a foreign currency or vice versa. From table 3 it can be seen that these prices are set at one in the model for the base year.

In summary, the description of the macroeconomic variables has shown that import taxes contributed more to government revenue than indirect taxes thus, indicating the importance of import taxes to government revenue in Nigeria. From the description of the macroeconomic variables, it was also revealed that production in the Nigerian economy tended to be more labour driven than capital driven in the base year. In addition, it was shown that the economy enjoyed a surplus balance of payment position due to increased aggregate output and exports in the base year.

4.2.3   Description of base solution shares of household variables

This sub-section shows base solution shares of the household variables. Shares and not values were reported since the values of total labour and capital incomes have been given in Table 3. The household variables reported in this sub-section were: labour income, capital income, total income, household expenditure, household savings and household utility. The Table 4 shows the base solution shares of the household variables used in the model while the sub sections following describe each one of the household variables used in relation to the economy.

i.   **Labour income**

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From Table 4, it can be seen that the rural north and the rural south households made up thehighest proportion of labour income (40.0% and 30.2% respectively) in the base year while the rural. This shows that labour income was concentrated in the rural areas in the base year. The urban north and urban south households made up the least proportion of labour income (18.6% and 11.2% respectively) in the base year.

ii.   **Capital income**

Table 5 also shows that the urban north and urban south households made up the highest proportion of capital income (33.1% and 43.9% respectively). This also indicates that they were the better capital endowed households and this has implication for investments.The rural north and rural south households made up the lower proportion (9.7% and 13.3% respectively) of capital income. This suggests that the rural households have less capital investments than the urban households.

Table 4: Base solution shares of household variables in (%)

Variables	Rural north	Rural south	Urban north	Urban south	Total
Labour income	40.0	30.2	18.6	11.2	100.0
Capital income	9.7	13.3	33.1	43.9	100.0
Total income	10.4	13.7	32.8	43.1	100.0

Expenditure	40.1	30.2	18.5	11.2	100.0
Savings	-76.9	-64.4	92.9	148.4	100.0
Household utility	47.6	36.9	8.8	6.7	100.0

Source: Computation from CGE model solution

iii.   **Total income**

The total income was the sum of total labour and capital income. Table 4 shows that the rural north and rural south households made up the least proportion of total income (10.4% and 13.7% respectively). This has implications for welfare. On the other, hand the urban north and urban south households made up the highest proportion of total income (32.8% and 43.1% respectively). This indicates that they were better off in terms of welfare than their rural counterparts.

iv.   **Total expenditure**

From Table 4, it can be seen that expenditure shares of the rural north and south households had the largest share of expenditure of 40.1% and 30.2% respectively while urban north and south households had the smallest shares of 18.5% and 11.2%

respectively. This shows that rural households consumed more of the goods and services produced in the economy in the base year.

v.   **Total household savings**

Household savings is the proportion of income that is not spent on current consumption. The shares of households' savings presented in Table 4 shows that the rural north and south households had dissaving (-76.9% and 64.4% respectively) while the urban north and south households had savings (92.9% and 148.4% respectively). This savings pattern was consequent on their income-expenditure pattern. This might be an indication that that rural households finance part of their consumption from transfers or remittances. This also indicates the presence of more wealth in the urban households than in the rural households (Leland, 1968).

vi.   **Total household utility**

Household utility was the money metric utility gained by a household from consuming a basket of goods at the given price level. From Table 4, it can be seen that the rural north and rural south householdsgained a higher proportion of utility 47.6% and 36.9% respectively.This was consequent on the higher proportion of expenditure of the rural households. The urban north and urban south household, on the other hand, gained 8.8% and6.7% utility. This result was consequent upon the expenditure pattern of the households and show that the urban households require less proportion of income to attain utility levels than the rural households.

4.2.4   **Description of base solution shares of householdsin relation to sectors**

This sub-section describes the shares household income earned from different sectors of the economy. Table 5 shows the shares of labour income earned by the households from the sectors.

i.   **Description of shares of household labour income from sectors**

The Table 5 showed that rural north households earned 1.6% of their labour income from the rice sector while 36.1% of their labour income was earned from the other agriculture

sector. Labour income from the manufacturing and services sector accounted for 62.3% of the total labour income earned by the rural north household. Moreover, the household earned no income from the oil and mining sector because employment in this industry is concentrated in the urban areas in Nigeria. This household thus received the higher proportion of labour income from the manufacturing and services sector. In sum, this result indicates that although the rural north households were farming households, they earned more from non-farm income. This follows Olugbire et al (2012). Also, these households will be more affected by rice trade policies since they earn the greater proportion of rice labour than other households.

The Table 5 also showed that rural south households earned 0.6% of their labour income from the rice sector while 34.2% of their labour income was earned from the other agriculture sector. Labour income from the manufacturing and services sector accounted for 65.2% of the total labour income earned by the rural south household. This household also earned no income from the oil and mining sector because employment in this industry is concentrated in the urban areas in Nigeria. This result indicates that the rural south earned a lesser proportion of its income from agriculture than the rural north household. However, since almost 0.6% of its labour income comes from the rice sector, it may also be affected by the government's rice trade policies.

Table 5: Shares of labour income to households earned from the sectors (%)

	Rural north	Rural south	Urban north	Urban south	Share of sectors in total labour income (%)
Rice	1.6	0.6	0.1	0.0	0.8
OA	36.1	34.2	23.4	22.9	31.6
OM	0.0	0.0	13.0	64.7	9.7

MS	62.3	65.2	63.5	12.4	57.9
Total (%)	100.0	100.0	100.0	100.0	100.0

Source: Computation from CGE model solution

Where

OA- Other agriculture sector

OM- Oil and mining sector

MS- Manufacturing and services sector

As indicated on Table 5, the urban north household earned only 0.1% of their labour income from the rice sector while 23.4% of its labour income was earned from the other agriculture sector. This household received 13.0% of its labour income from the oil and mining sector while the manufacturing and services sector accounted for 63.5% of the total labour income earned by the urban north household. This result indicates that this household diversified from agriculture in terms of labour income sources as it earned a greater proportion of its income from the oil and mining sector and the manufacturing and services sector compared to the rural households. The urban south household earned no income from the rice sector but earned 22.9%, 64.7% and 12.4% from other agriculture, oil and mining and manufacturing and services sectors respectively. This

indicates that the urban south households had more diversified sources of income than the urban north households.

In summary, the results show that the rural households earned the greater proportion of ricelabour income while the urban households had more diversified sources of income other than agriculture.

ii.   **Description of shares of capital income to households from sectors**

The shares of capital income earned by the households from the sectors are presented in Table 6. The table shows that rural north households earned 3.5% of their capital income from the rice sector while 87.5% of their capital income was earned from the other agriculture sector. Thus, the rural north household received the highest proportion of its capital income from agriculture. Capital income from the manufacturing and services sector accounted for 9.1% of the total capital income earned by the rural north household. The household did not earn any capital income from the oil and mining sector because employment in this industry is concentrated in the urban areas in Nigeria. In sum, the rural north household made up 9.7% of the total capital income earned by all households.

Table 6: Shares of Capital income to households earned from the sectors (%)

	Rural north	Rural south	Urban north	Urban south	Share of sectors in total capital income (%)
Rice	3.5	1.5	0.5	0.1	0.8

OA	87.5	81.8	25.2	6.2	30.5
OM	0.0	0.0	18.2	66.2	35.0
MS	9.1	16.7	56.1	27.5	33.7
Total (%)	100.0	100.0	100.0	100.0	100.0

Source: Computation from CGE model solution

Where

OA- Other agriculture sector

OM- Oil and mining sector

MS- Manufacturing and services sector

Since over 90% of the rural north household capital income came from agriculture in the base year, the result indicates that the rural north households were mainly farming households. Also, this household will be more affected by rice trade policies since they earn a greater proportion of capital income from the rice sector than other households.

Table 6 also showed that rural south households earned 1.5% of their capital income from the rice sector while 81.8% of the income was earned from the other agriculture sector. Capital income from the manufacturing and services sector accounted for 16.7% of the total capital income earned by the rural north household. This household also did not earn any income from the oil and mining sector because employment in this industry is concentrated in the urban areas in Nigeria.

On the whole, the rural south household made up 13.3% of the total capital income earned by all households. This result indicates that the rural south household earned a greater proportion of capital income from sources other than agriculture than the rural north household; hence, they are relatively more diversified in terms of capital income sources than the rural north household. However, since almost 1.0% of its labour income comes from the rice sector, it may also be affected by the government's rice trade policies.

The urban north households, as revealed on Table 6, earned only 0.5% of their capital income from the rice sector while 25.2% of their capital income was earned from the other agriculture sector. This household received 18.2% of its capital income from the oil and mining sector while the manufacturing and services sector accounted for 56.1% of the total capital income earned by the household. In sum, the urban north household made up 33.1% of the total capital income earned by all households. This result indicates that the urban north households are diversified in terms of labour income sources as it earned a greater proportion of its income from the manufacturing and services sector.

The urban south households earned only 0.1% of their capital income from the rice sector and 6.2% of their capital income was earned from the other agriculture sector. This household received 66.2% of its capital income from the oil and mining sector while the manufacturing and services sector accounted for 27.5% of the total capital income earned by the urban south household. In sum, the urban south household made up 43.9% of the total capital income earned by all households. This result indicates that the urban south households were also diversified from agriculture in terms of capital income sources as it earned a greater proportion of its capital income from the sources other than agriculture.

The results for household income have thus shown that the rural households earned a greater proportion of their capital income from agriculture while the urban households had more diversified sources of income other than agriculture. Moreover, the rural households earn more labour and capital income from rice than the urban households

while the rural north household earneda higher proportion of its income from rice than the rural south household.

iii.   **Description of shares of households' expenditure on sectors**

The Table 7reveals that the pattern of expenditure of the households on the different sectors. The rural north household spent 0.4%, 17.4%, 0.2% and 82.0% on the rice, other agriculture, oil and mining and manufacturing and services sectors respectively. Similarly, the rural south household also spent 0.4%, 17.7%, 0.3% and 81.3% on the four sectors respectively. This indicates that the pattern of expenditure of the rural households followed a similar trend. The urban north households, on the other hand, spent 0.5%, 11.7%, 1.6% and 86.2% % on the rice, other agriculture, oil and mining and manufacturing and services sectors respectively while the urban south household spent 0.6%, 15.9%, 2.7% and 80.7% % on the rice, other agriculture, oil and mining and manufacturing and services sectors respectively. This shows that the urban south household also spent the greater proportion of its income on goods from the manufacturing and services sector. The result also shows that all households spent the greater proportion of their income on the manufacturing and services sector while the urban households spentless on the other agriculture sector than the rural households.

Table 7: Expenditure shares of households on sectors (%)

Sectors	Rural north	Rural south	Urban north	Urban south	Share of sector in household expenditure
Rice	0.4	0.4	0.5	0.6	0.4
OA	17.4	17.7	11.7	15.9	16.1
OM	0.2	0.3	1.6	2.7	1.0
MS	82.0	81.6	86.2	80.7	82.5

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Total	100.0	100.0	100.0	100.0	100.0

Source: Computation from CGE model solution

Where

OA- Other agriculture sector

OM- Oil and mining sector

MS- Manufacturing and services sector

Also, the urban households spend more on the rice sector than the rural households. This suggests that rice trade policies that will encourage increase in supply of rice will benefit these households more. Therefore, the results show that expenditure on rice by households in the economy accounted for 0.4% of household income while other agriculture sector, oil and mining sector and manufacturing and services sector accounted for 16.1%, 1.0% and 82.5% of household income respectively.

In summary, the results of this section showed that the rice sector is 0.4% of the entire Nigerian economy. Although it is a very small part of the economy, the rice sector is an important part of Nigerian agriculture as it constitutes 2.5% of all agriculture in Nigeria. The description of the macroeconomic variables showed that import taxes contributed

more to government revenue than indirect taxes, thus underscoring the importance of import taxes to government revenue in Nigeria. Also, production in the economy was more labour driven than capital driven in the base year. In addition, it was shown that the economy enjoyed a surplus balance of payment position due to increased aggregate output and exports in the base year.

Furthermore, the results showed that the rural households earned a greater proportion of their labour and capital income from agriculture while the urban households had more diversified sources of income other than agriculture in the base year. Moreover, the rural households earn more labour and capital income from rice than the urban households while the rural north household earns more income from rice than the rural south household. The results show that expenditure on rice by households in the economy accounted for 0.4% of household income while other agriculture sector, oil and mining sector and manufacturing and services sector accounted for 16.1%, 1.0% and 82.5% of household income respectively. The urban households were found to spend a greater proportion of their income on goods from the rice sector, oil and mining sector and manufacturing and services sector than the rural households. The rural households spent a greater proportion of their income on goods from the other agriculture sector than the urban households. However, the rural households were found to have dis-savings while the urban households had savings. Finally, the study found that the urban households had less utility levels than the rural households.

4.3   **Effects of the rice trade policy on the Nigerian economy**

This section presents the results of the simulation experiments performed, using the empirical computable general equilibrium model for the study. The simulation experiments involved changing an exogenous variable of interest in the model and observing the changes in the endogenous variables. The percentage changes in the post-simulation values of the endogenous variables are then observed in how they differ from the base solution values. The magnitude and direction of the percentage changes indicate the response of the economy to the policy change. In the subsequent sections, the results

for the four policy scenarios simulated in the study are presented and are discussed under the ban, 80% tariff increase, 5% tariff reduction and 0% tariff charge.

4.3.1 Ban on rice imports on the Nigerian economy

This section presents the simulation results for a ban on rice imports in Nigeria. The results are presented in three sub-sections taking into account the changes in sectors, macroeconomic and household variables of interest.Under each section, the two ban scenarios simulated in the study are discussed comparatively. In the first ban scenario (Ban I), rice imports were equated to zero while in the second ban scenario (Ban II), an upper bound of 10% of the base year import quantity was set for rice imports.

i.   Effect of a ban on rice imports on the sectors of the Nigerian economy

Figure 11 presents the changes in the different sectors, macroeconomic aggregates and household variables of the economy in response to a ban on rice imports. The figure reveals that both ban scenarios produced similar effects on sector variables and prices but with different magnitudes such that a greater degree of change was observed with the first ban scenario (I) that with the second (II).Generally, the protectionist policy of a ban on rice imports affected the rice sector and OA positively while OM and MS were negatively affected by the ban.
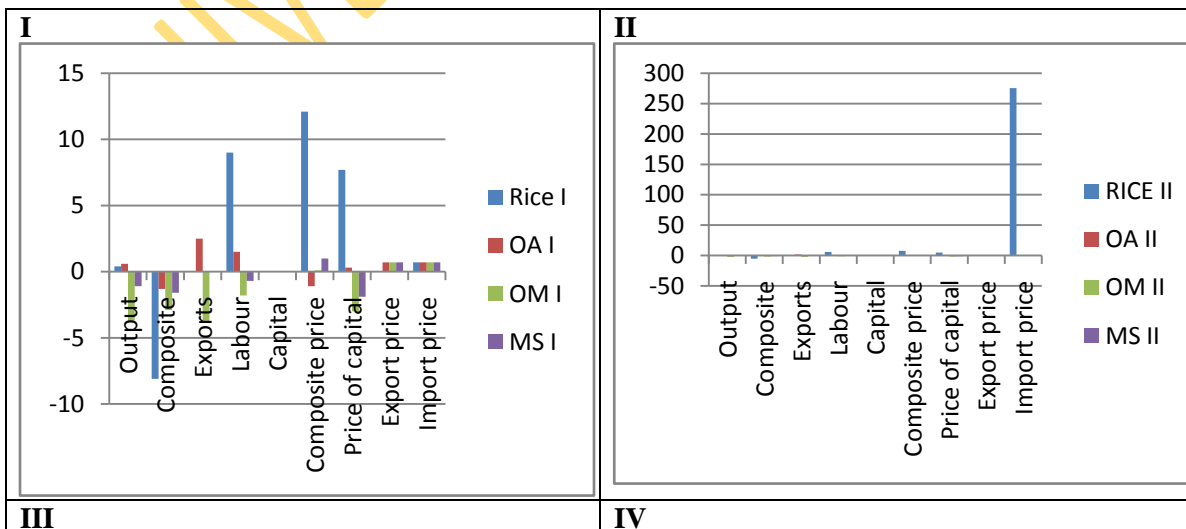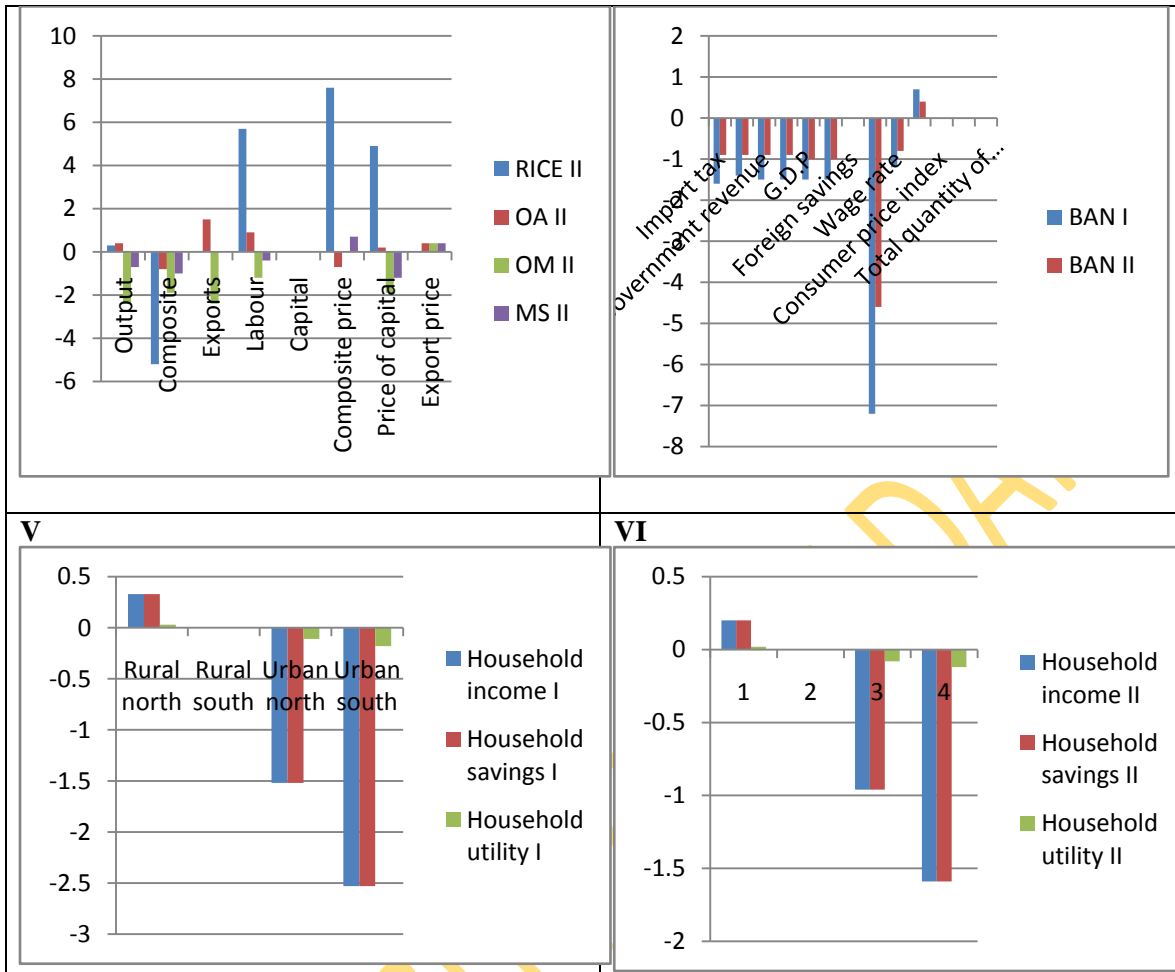
Fig 11: Change in sectors variables and prices, macroeconomic aggregates and household variables due to a rice import ban

With respect to the first ban scenario, Figure 11(I) the domestic output and labour employed in the rice sector increased by 0.4% and 9.0% respectively but with 03% and 5.7% respectively with Ban II while capital employed did not change with either ban scenario (also see Table 10 in the Appendix I). Output,labour and exports in OA increased by 0.6%, 1.5% and 2.5% respectively with Ban I and by 0.4%, 0.9% and 1.5% with Ban II (see Figure 11-III). However, composite commodity decreased in all sectors but most especially in the rice sector by 8.1% with Ban I and 5.2% with Ban II. Domestic output, labour and exports in OM and MS all fell with both ban scenarios while composite price increased in all sectors except in OA where it fell by 1.1% with Ban I and 0.7% with Ban II.

The price of capital increased only in rice and OA by 7.7% and 0.3% respectively with Ban I and 4.9% and 0.2% respectively with Ban II. This agrees with Obih et al (2008) who found that a ban raises the relative prices above the level that can be raised by other trade policies. Export and import price also increased in all sectorshowever, the import price of rice under the second ban scenario increasedby 275.4% compared to 0.7% for the first ban scenario (see Figure 11-II&III). This astronomical increase was occasioned by the high tariff placed to discourage imports while the increase in labour, exports and price of capital in rice and OA was occasioned by the increased output in both sectors.

Although, there was an increase in domestic output by 0.4% (or 0.3 with Ban II), this does not proportionally compare to the composite price increase of 12.1% (7.9% with Ban II). Thus, it is an indicationof lack of competition and efficiency in the market system.The decrease in composite commodity is expected since the ban will create a shortfall in the quantity of rice available for sale in the domestic market. This causes the composite price and price of capital in the sector to increase thus, representingnear-autarkic prices.The increase in composite price also creates a higher incentive for farmers to produce. This explains the increase in domestic output. The increase inlabouroccurred due to the increased output and prices in the sector; hence, labouris attracted to the sector from other sectors.

ii.   **Effect of a ban on rice imports on the macroeconomy of Nigeria**

The response of macroeconomic aggregates to a ban on rice imports are also shown on Figure 11(VI). The figure reveals that a ban on importation of rice led to a fall in allthe macroeconomic aggregates. Import tax, indirect tax, government revenue, government savings fell by 1.6%. 1.4%, 1.5% and 1.5% respectively with Ban I and 0.9% for each respective aggregate with Ban II (also see Table 11 in the Appendix I). This is expected since tariffs were not collected and there was a fall in the output of some sectors. Also, the fall in overall indirect tax is expected since decreases in domestic output, composite, exports and labour employed were recorded severally in different sectors. The fall in both import and indirect tax led to the fall in government revenue. Also since government savings is a function of its revenue, the fall in government revenue also explains the fall

in government savings. Nominal and real GDP, wage rate and investment all fell by 1.5%, 1.5%, 7.2% and 1.2% respectively with Ban I and 1.0%, 1.0%, 0.8% and 4.6% respectively with Ban II. The reduction in both nominal GDP and real GDP shows that, the value of the output produced by all the four sectors in the economy actually fell when valued at both current and constant prices as a result of the ban on rice imports. This explains the reduction in overall investment since the four sectors' investments will be reduced. This fall in investments had the largest magnitude among all the macroeconomic variables since overall investment is determined by savings of the four sectors, the government and the households. All of these had their savings negatively affected as a result of the rice import ban. The fall in all of the above macroeconomic aggregates explain the fall in wage rate as an increase in wages requires more favourable economic conditions before they can rise.

Other macroeconomic aggregates such as foreign savings, consumer price index and the total quantities of labour and capital were not affected by the rice import ban under either ban scenarios. This indicates that the policy effect was not large enough to cause a change in these aggregates due to the small share of rice in the economy.

iii.   **Effect of a ban on rice imports on the households in Nigeria**

The changes in household variables of interest which occur in response to a ban on rice imports for the different households in the economy are also shown on Figure 11(V&VI). The figure shows that generally, the rural households were positively affected under the ban while the urban households were negatively affected. With respect to Ban I, therural north households' income and savings each increased by 0.3% while marginal utility increased 0.03% (see Figure 11-V). Similarly, with the Ban II scenario, therural north households' income and savings each increased by 0.2% while marginal utility increased 0.02% (see Figure 11-VI).This may be due to the fact that the majority of rice farmers in Nigeria are located in the rural north since this region produces about 83% of domestic rice(NBS, 2007) hence as net producers they reaped the greatest benefit of the price effect of a rice import ban.The income and savings of rural south households, however,

did not change as a result of the import ban with either ban scenariohowever the marginal utility increased by 0.01% with Ban I but did not change with Ban II. The non-change in income may be because the rural south of the country produces much less rice than the north and that rice production is a very small part of the economy of the entire rural south.Moreover, the sources of income in the rural south were more diversified than in the rural north such that a rice import ban does not bring about an appreciable change in the income of the households in this region.

However, the increase in the household's utility indicates an increase in consumption of goods from which they derive satisfaction.This attests to the fact that this household was positively affected by the rice import ban. Conversely, the urban north household's income and savings each fell by 1.52% while utility decreased by 0.11% with Ban I while household's income and savings each fell by 0.96% while utility decreased by 0.08% with Ban II. The fall in income may have been due to the fact that the urban north households are net consumers of rice hence, their income decreased with increase in the price of rice coupled with increase in the price of goods from other sectors especially manufacturing and services sector. In addition, labour and capital employed in OM and MS fell with the ban. Urban income is earned largely from these two sectors hence, the fall in their income. The fall in savings and utility was also consequent upon the fall in income, as explained above. In the same vein, the urban south household income and savings each fell by 2.53% while utility fell by 0.18% with Ban I. Under Ban II, household's income and savings each fell by 0.96% while utility decreased by 0.08%. This may have been due to the fact that the urban south households are net consumers of rice. Thus, the fall in the income of this household can be explained as that of the urban north households. Moreover, the urban south suffered a greater fall in income becausethey consume a greater proportion of imported rice than the urbannorth household hence; an import ban will affect the urban south household more.

In summary, the results have shown that a rice import ban produces a greater magnitude of change in the rice sector than in other sectors of the economy. Generally, the ban positively affects the rice sector and the other agriculture sector but negatively affects the

oil and mining sector and the manufacturing and services sector. Domestic output, labour and price of capital increased in both the rice sector and the other agriculture sector and also exports in the latter sector. Composite also fell in all the sectors with the rice import ban while composite price increased in all sectors except in the other agriculture sector, where it fell. Moreover, the rice import ban led to a fall in all major macroeconomic aggregates including: Import tax, indirect tax, government revenue, government savings, nominal and real GDP, wage rate and investment while foreign savings, consumer price index and the total quantities of labour and capital were not affected by the rice import ban. Finally, the rice import ban positively affected the rural households while the urban households were negatively affected. The rural north household had the largest increase in income, savings and utility under the ban while the urban south household suffered the largest fall in income, savings and utility due to the ban.

4.3.2 **Effect of 80% increase in rice import tariff on the Nigerian economy**

This section presents the simulation results for an 80% increase in rice import tariff on the Nigerian economy. As done in the previous section, the results are presented in three parts - the sectors, macroeconomic and household variables of interest.

i. **Effect of 80% increase in rice import tariff on the sectors of the Nigerian Economy**

Figure 12 shows the effect of 80% tariff increase on rice imports on the sectors, macroeconomic aggregates and households of the economy. Generally,the effect of the tariff increase on the sectors is similar to that of the ban, although, the magnitude of change in the sector variables was greater with the ban scenarios than with the 80% tariff increase. Figure 12(I) shows that therice sector and OA were positively affected by the tariff increase as domestic output increased in each sector by 0.1%. Labour employed also increased by 2.1% and 0.3% respectively in both sectors while exports increased in OA by 0.6%. However, OM and MS were negatively affected by the tariff increase as domestic output,labour employed and exports in these sectors fell. All sectors also experienced a fall in composite. Figure 12(II)also shows that composite price increased in

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the rice sector and in OM by 2.7% and 0.3% respectively. Price of capital increased only in rice and OA by 1.8% and 0.1%. Export and import prices also increased in all sectors by 0.2%.

The decrease in composite commodity is expected since the tariff increase will cause the importation of the rice to become expensive. This will relatively discourage importation and thus, create a shortfall in the quantity of rice available for sale in the domestic market.This result agrees with Griswold (2005) who found thattariffs increase the price of the commodity as much as four times the world price thus serving to discourage trade.The increase in composite price also created an incentive for farmers to produce. This explains the increase in domestic output. Likewise, the increase inlabour occurred due to the increased output and prices in the sector; hence, labour was attracted to the sector from other sectors. However, theminimal increase in domestic output of only 0.1% is not relatively proportionate to the composite price increase. This is an indication of inefficiency which may be due to the tariff protection under which the farmers are producing. The fall in the price of capital in OM and MS was occasioned by the fall in domestic output which led to the fall in exports and labour employed in these sectors.
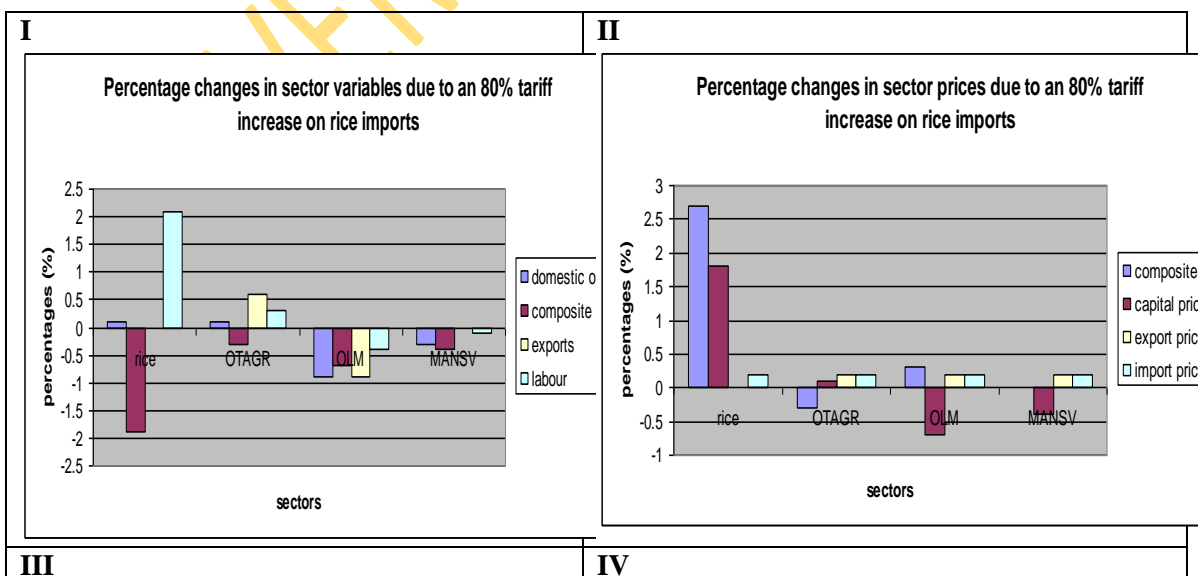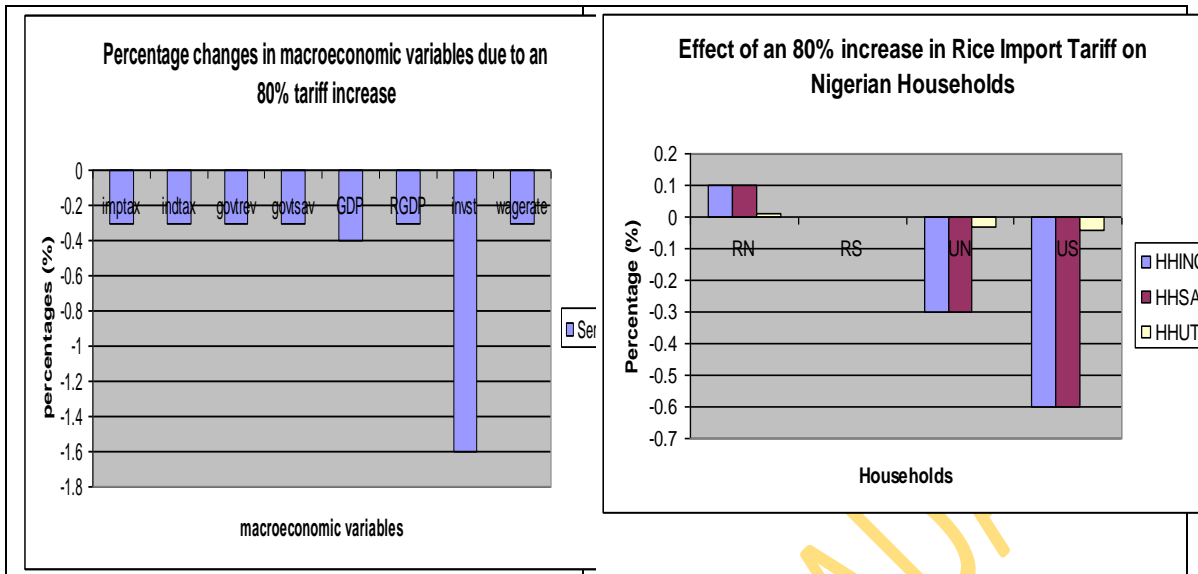
Fig 12: Change in sectors variables and prices, macroeconomic aggregates and household variables due to 80% increase in rice import tariff

In addition, while revenue from tariffs was being obtained, the fall in price of capital may have been due to the fact that the government investment of its increased revenue from rice tariffs was not large enough to achieve a positive effect on the sectors. The manufacturing and services sector's domestic output may also have declined due to reduced availability of rice as a raw material for production in the sector due to the high cost of procurement.

ii. **Effect of 80% increase in rice import tariff on the macroeconomy of Nigeria**

Figure 12(III) alsoreveals that the 80% increase in tariffs led to a fall in allthe macroeconomic aggregates while exchange rate increased by 0.2%. Import tax, indirect tax, government revenue and government savings each fell by about 0.3% while nominal

and real GDP, wage rate and investment all fell by 0.4%, 0.3%, 1.6% and 0.3% respectively. Other macroeconomic variables such as foreign savings, consumer price index and the total quantities of labour and capital were not affected by the tariff increase. This was because the policy effects were not large enough to change the value of all the labour and capital employed in the economy. Contrary to expectation that the tariff increase will increase import tax and government revenue, these rather fell. The fall in import tax may have occurred due to the inefficiency that obtains in tariff collection in Nigeria. This agrees with Olopoenia and Aminu (2007) who found that even when tariffs were charged, only a proportion of the revenue was actually collected due to the problems of inefficiency and corruption in the system.

The fall in overall indirect tax is expected since decreases in domestic output, composite, exports and labour employed were recorded severally in different sectors. The fall in both import and indirect tax led to the fall in government revenue as explained in the previous sub-section. Also since government savings is a function of its revenue, the fall in government savings was consequent upon the fall in government revenue. The reduction in both nominal GDP and real GDP shows that, the value of the output produced by all the four sectors in the economy actually fell when valued at both current and constant prices as a result of the ban on rice imports. This explains the reduction in overall investment since government investment into the four sectors will be reduced.

iii.   Effect of 80% increase in rice import tariffs on the households in Nigeria

The changes in household variables of income, savings and utility in response to 80% increase in rice imports tariffs for the different households in the economy are also depicted on Figure 12(IV). The figure reveals that the 80% tariff increase generally positively affected the rural households while the urban households were negatively affected. The policy led to increases in rural north household income and savings by 0.1% and utility by 0.01%. The rural south households were not affected by the policy change. This may be because rice production made up a very small part of the economy of the entire rural south. As explained in section 4.3.1, this household is a net producer of rice and the largest production of rice obtains in the rural north of the country. The tariff

increase raised the price of the import-competing commodity which is the local rice hence, the resulting increase in their incomes. Consequently, savings increased and since the household can consume more goods from which they derive satisfaction, utility also increased. The rural south household income, savings and utility did not change as a result of the tariff increase. This may be because they produce less rice than the north and that rice production is a very small part of the economy of the entire rural south.

Moreover, the sources of income in the rural south are highly diversified such that a rice import ban does not bring about an appreciable change in the income, savings and utility of the household.On the other hand, the urban north households' income and savings fell by 0.3% and utility by 0.03%. The urban south household income, savings and utility fell by twice as much. This fall in income may be due to the fact that the urban north household were netconsumers of rice hence, their income decreased with increase in the price of rice coupled with increase in the price of goods from other sectors especially MS.

In summary, the results have shown that generally, both protectionist policies of ban and increase in tariffs have similar effects on the economy, however, the policy effects for 80% tariff increase are more minimal compared with those of a rice import ban. Also, the trade policy of increase in rice import tariff produces a greater magnitude of change in the rice sector than in other sectors of the economy. Generally, the tariff increase positively affects the rice sector and the other agriculture sector but negatively affects the oil and mining sector and the manufacturing and services sector. Domestic output, labour and price of capital increased in both the rice sector and the other agriculture sector and also exports in the latter sector. Composite also fell in all the sectors with the tariff increase while composite price increased in all sectors except in the other agriculture sector, where it fell. Moreover, the tariff increase led to a fall in all major macroeconomic aggregates including: Import tax, indirect tax, government revenue, government savings, nominal and real GDP, wage rate and investment while foreign savings, consumer price index and the total quantities of labour and capital were not affected and exchange rate increased. Finally, the rice import ban positively affected the rural households while the urban households were negatively affected. The rural north household had the largest

increase in income, savings and utility under the ban while the urban south household suffered the largest fall in income, savings and utility due to the tariff increase.

4.3.3 Effect of 5% reduction in rice import tariff on the Nigerian economy

This sub-section presents the simulation results for 5% reduction in rice import tariff on the Nigerian economy.

i. **Effect of 5% reduction in rice import tariff on the sectors of the Nigerian economy**

Figure 13 presents the changes in the different sectors of the economy in response to the mild liberalisation policy of 5% reduction in rice imports tariff.This is otherwise known as the mild liberalisation policy in the study. As shown on Figure 13(I), the tariff reduction positively affected the rice sector and OA as output increased in each sector by 1.1% and 0.5%, composite by 1.0% and 0.3% and exports in OA by 0.6% respectively. However, labour employed in both sectors declined by 2.55 and 0.1% respectively. Conversely, labour employed in MS increased by 0.2% while all other variables declined in the sector. All variables also declined in OM.
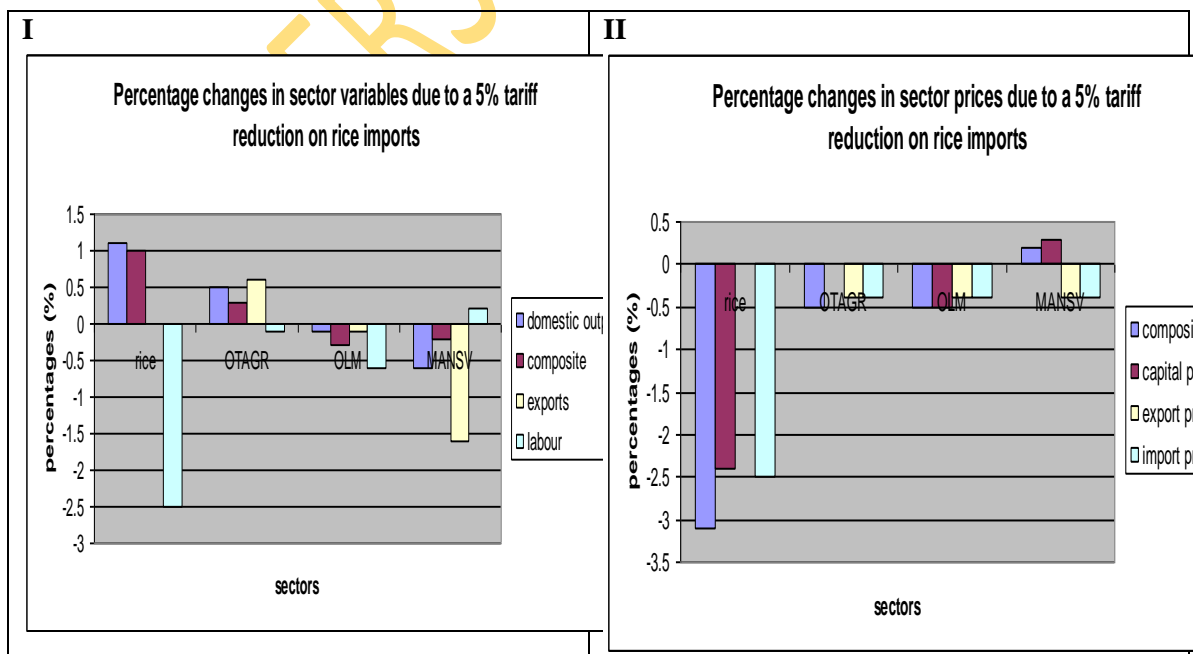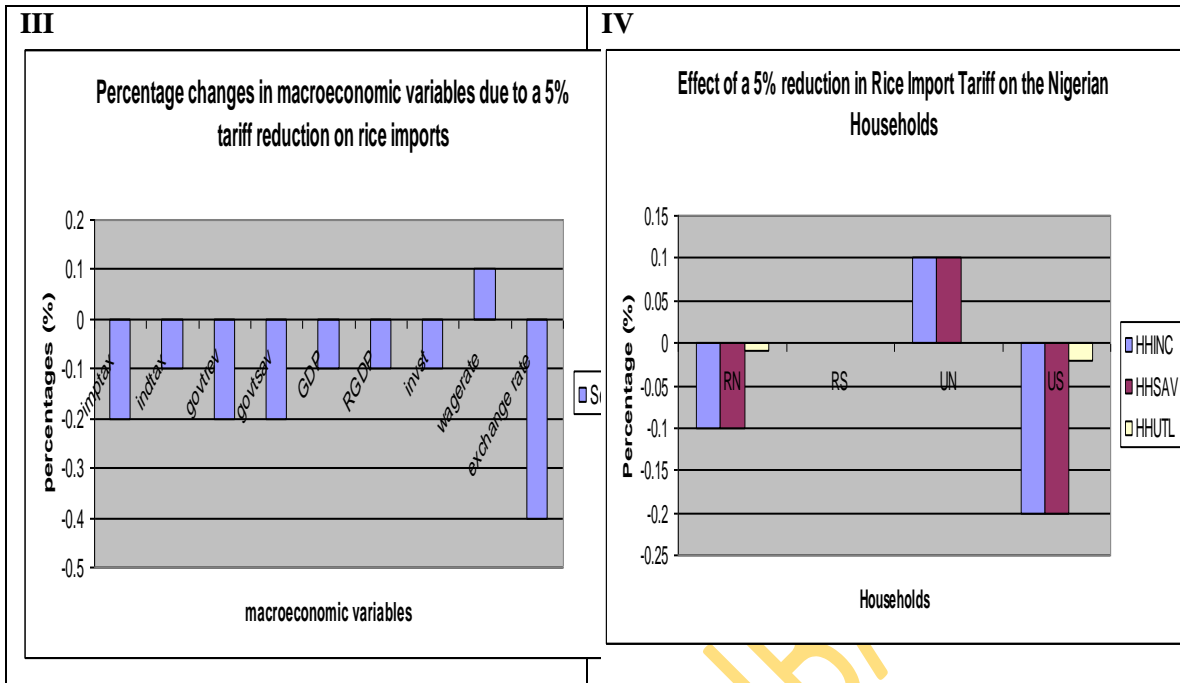
Fig 13: Change in sectors variables and prices, macroeconomic aggregates and household variables due to 5% reduction in rice import tariff

Figure 13(II) also reveals that the mild tariff reduction resulted in the fall of all sector prices apart from composite price and price of capital in MS. This may be due to the small change in tariff reduction which was not large enough to affect the price of capital.Labour also moved away from other sectors of the economy to MS. This may be because the output in the sector increased. This in turn resulted in the rise in the price of capital. The results also show that the trade liberalization policy led to a more appreciable increase in output of rice than the protectionist policies. This result is consistent with Warr (2005) and Panagariya (2005).The increase in domestic output may be as a result of increased efficiency in production and processing which arose from competition coupled with increased demand for the commodity due to the lower composite price. The increase in composite commodity alsooccurred as a result of the tariff reduction and this result is

consistent with Griswold (2005) and Nwafor et al (2007). In addition, labour employed in the sector fell due to the fall in prices in the sectors. This result also agrees with Nwafor et al (2007) who found that trade liberalization leads to reduction in employment in the agriculture sector. Also, the increase in labour employed in MS indicates that the sector will readily absorb labour from rice sector and OA.

ii. **Effect of a 5% reduction in rice import tariff on the macroeconomy of Nigeria**

Theeffectof a 5% reduction in rice import tariffs on macroeconomic aggregates are also depicted on Figure 13(III). Generally, the tariffreduction led to afall in macroeconomic aggregates. Import tax, indirect tax, government revenue, government savings all fell by 0.2%. 0.1%, 0.2% and 0.2% respectively. Also, nominal and real GDP and investment all fell by 0.1% each while exchange rate fell by 0.4%. However, wage rate increased by 0.1% while foreign savings, consumer price index and the total quantities of labour and capital were not affected by the tariff reduction. The fall in government revenue was consequent upon the fall in both tax revenues which also led to a fall in savings. Since investment is driven by savings, it also fell. Also, the increase in wage rate occurred because employment increased in MS; the sector that employs the largest proportion of the labour force. The non-change in foreign savings, consumer price index and the total quantities of labour and capital, as in the previous scenarios, further goes to confirm that rice trade policies do not affect these aggregates in Nigeria. The reduction in both nominal GDP and real GDP shows that, the value of the output produced by all the four sectors in the economy fell when valued at both current and constant prices as a result of the ban on rice imports. This was because of the fall in prices which occurred as a result of the liberalization policy. This also explains the reduction in overall investment since government investment into the four sectors will be reduced due to the fall in revenue. Again investments fell fastest among all the macroeconomic variables since overall investment is determined by the savings of the four sectors, the government and the households. Savings were negatively affected at all three levels as a result of the tariff reduction.

iii. **Effect of 5% reduction in rice import tariffs on the households in Nigeria**

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The changes in households in response to 5% reduction in rice imports tariffs are presented on Figure 13(IV).The chart shows that the mild liberalization policy resulted in a fall in income, savings and utility of the rural north and the urban south households by 0.1%, 0.1% and 0.001% for the former and twice this magnitude for the latter.This shows that the net producers in the rural north were negatively affected by only a small decrease in rice tariff. This may be an indication of the inefficiency in production. The magnitude of fall in income of the urban south was less than that recorded under both protectionist policy scenarios. This could be attributed to the fall in prices of rice and other agricultural products. However, these prices fall were not large enough to increase the income of this household group especially as most sector and macroeconomic variables also fell. The income, savings and utility of the rural south households did not change. As explained in the previous sub-sections, rice production made up a very small part of the economy of the entire rural south hence, the policy change did not affect the household. The urban north household's income, savings and utility increased by 0.1%, 0.1% and 0.0% respectively indicating that this household benefitted most from the reduction in prices in the economy, especially the reduction in prices of rice and also other agricultural goods.

In summary, the results have shown that the mild liberalization policy produced a greater magnitude of change in the rice sector than in other sectors of the economy. Generally, the effects of the policy were mixed across the sectors. The tariff reduction positively affected the rice sector and the other agriculture sector with respect to domestic output, composite commodity and exports for the latter sector. However, all other sector variables and prices in the two sectors were negatively affected. The oil and mining sector and the manufacturing and services sector were also negatively affected although; the manufacturing and services sector recorded. Moreover, the tariff reduction led to a fall in all major macroeconomic aggregates except wage rate which increased minimally. Import tax, indirect tax, government revenue, government savings, nominal and real GDP and investment all fell while foreign savings, consumer price index and the total quantities of labour and capital were not affected by the tariff reduction. Finally, the tariff reduction negatively affected the rural north and urban south households. Only the urban north households were positively affected as a result of the liberalization policy while the

rural south did not change. The rural north household had the largest decrease in income, savings and utility with the tariff reduction while the urban south household the least fall in income, savings and utility due to the policy.

4.3.4   Effect of 0% rice import tariff on the Nigerian economy

This sub-section presents the simulation results for a 0% charge on rice import tariff on the Nigerian economy.

i.   Effect of 0% rice import tariff on the sectors of the Nigerian economy

Figure 14 presents the changes in the different sectors of the economy in response to the liberalization policy of 0% on rice imports tariff. Figure 14(I) reveals that generally, a 0%rice import tariff positively affected the rice sector as the largest magnitude of growth for both domestic output and composite of rice across all scenarios of 3.1% and 3.5% respectively was recorded in this scenario. Again, as explained in 4.3.3, this relatively higher magnitude of increase in output may be due to more efficient production on the part of the rice farmers in addition to competition and increased demand of rice. This result is consistent with Warr (2005) and Panagariya (2005) which agree that trade liberalization enhances production.The increase in domestic output may be as a result of increased efficiency in production and processing coupled with increased demand for the commodity due to the lower composite price. The increase in composite commoditywas expected since the tariff removal will result in cheaper imported rice. This result agrees with Griswold (2005) and Nwafor et al (2007) who found thattariffs reductions increase composite commodity in the economy. OM and MS were also positively affected with respect to labour employed in the sectors as they grew by 13.4% and 0.8% respectively.

However, the complete liberalization policy had negative effects on all other variables in all sectors of the economy. Figure 14(II) also showed that all prices in all the sectors fell in this scenario except composite price in OA where it rose by 6.6%. This may be as a result of decreased supply of the sector's commodity to the domestic market arising from a decrease in the volume of OA's output. Labour employed in the sector also fell due to

the fall in prices in the sector. This result also agrees with Nwafor et al (2007) who found that trade liberalization leads to reduction in employment in the agriculture sector.

ii.   **Effect of 0% rice import tariff on the macroeconomy of Nigeria**

The changes in the macroeconomic aggregates of the economy in response to the liberalization policy of 0% on rice imports tariff are also shown on Figure 14(III). The tariffremoval led to afall in all macroeconomic aggregates with the greatest magnitude recorded across all previous scenarios. Import tax, indirect tax, government revenue, government savings all fell by 12.1%. 12.5%, 12.2% and 12.2% respectively while nominal, real GDP, investment, exchange rate and wage rate all fell by 11.1%, 11.0%, 0.5%, 1.1% and 13.7% respectively. Foreign savings, consumer price index and the total quantities of labour and capital were not affected by the tariff removal.

Expectedly, import tax fell because of the tariff removal. Indirect tax also fell since domestic output, composite, exports and labour employed in different sectors decreased. The fall in both import and indirect tax led to the fall in government revenue as explained in previous sub-sections while the fall in government savings was consequent upon the fall in government revenue.

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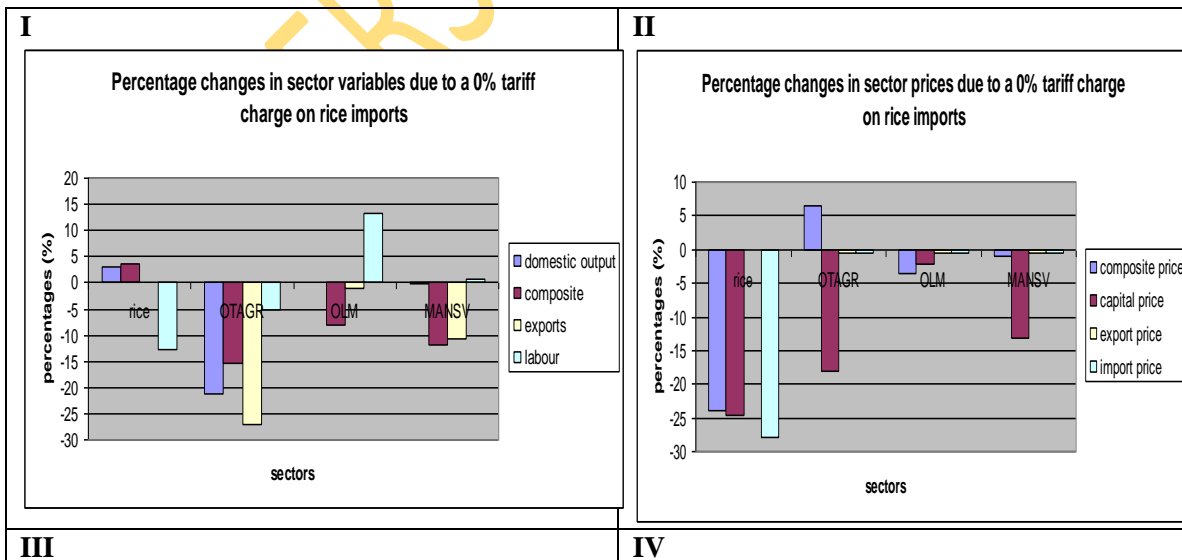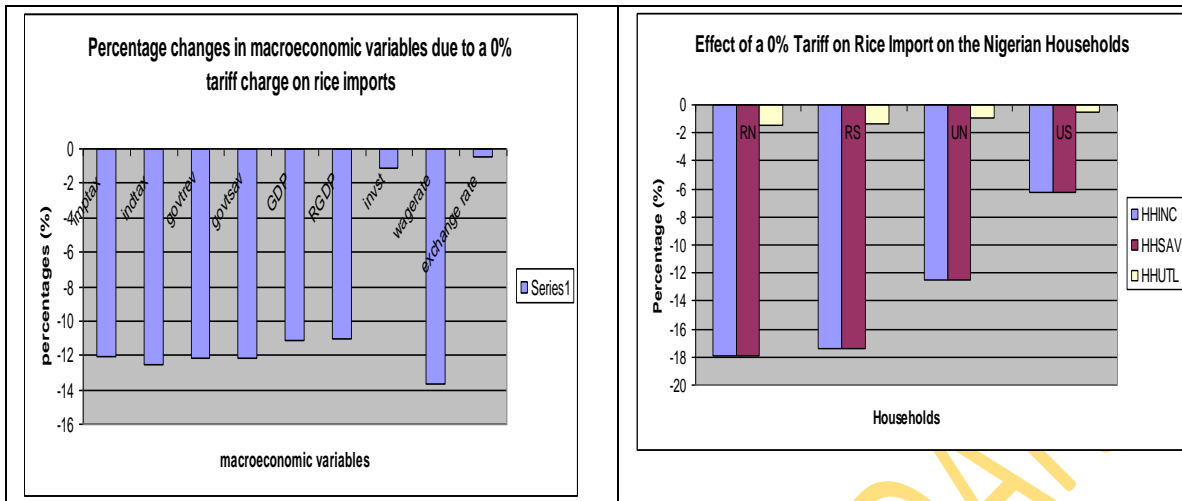
Fig 14: Change in sectors variables and prices, macroeconomic aggregates and household variables due to 0% rice import tariff

Investments fell least among all the macroeconomic variables because prices in the economy fell with great magnitude under the non-tariff charge policy than other rice trade policies, hence, savings from current expenditure may have contributed to financing investment such that the negative effect was minimized. The larger magnitude of sector prices' fall occasioned by the extreme liberalization policy led to the rapid fall in wage rate by 13.7%. The non-change in foreign savings, consumer price index and the total quantities of labour and capital, as in the previous scenarios, further indicates that rice trade policies did not affect these aggregates.

iii.   **Effect of 0% rice import tariff on the households in Nigeria**

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Figure 14(IV) further presents the changes in household variables in response to a 0% rice imports tariff for the different households in the economy. The figure shows that the incomes, savings and utility of all the households fell under the complete liberalization scenario, although the rural households' fell faster than the urban households'. Income, savings and utility of the rural north household fell by 17.9%, 17.9% and 1.42% respectively while that of the rural south household fell by 17.4%, 17.4% and 1.36%. This results shows that, despite the fact that the rural south produces much less rice than the north and that rice production is a very small part of the economy of the entire rural south, a complete rice trade liberalization policy hurt the rural south almost as much as the rural north. This may be because of the decline in all aspects of the economy occasioned by the rice trade policy. In addition, the rural south is located closest to the ports (the entry point of imported rice into the country) and is also closest to the urban south where the majority of imported rice consumers are located. Hence, this may also have contributed to the large magnitude of effect. This shows that complete rice trade liberalization hurts net rice producing households.

The urban south household suffered the least as their income, savings and utility decreased by 6.3%, 6.3% and 0.47% respectively while that of the urban north household decreased by about twice as much. This lesser fall relative to the other households could be attributed to the general fall in prices especially of rice because this household consumes more imported rice than any other household. However, the fall in these prices were not large enough to increase the income of this household group. In addition, the rise in composite price of the other agricultural sector may have contributed to the fall in income since rice makes up only about 10% of calorie supply in Nigeria (FAO, 2008) the other agriculture sector is responsible for the greater percentage of calorie supply.

In summary, the results for the effect of a zero percentage rice import tariff have shown that the complete liberalization policy produces a greater magnitude of change in the other agriculture sector than in other sectors of the economy. Generally, the effects of the policy were negative across all the sectors. Domestic output and composite commodity increased in the rice sector but decreased in all other sectors of the economy. Also

exports fell across all sectors while labour employed only increased in the oil and mining sector and the manufacturing and services sector. Also, all prices fell in this scenario except for composite price in the other agriculture sector. Moreover, the tariff reduction led to a fall in all major macroeconomic aggregates in the economy. Import tax, indirect tax, government revenue, government savings, nominal and real GDP, investmentandwage rate all fell while foreign savings, consumer price index and the total quantities of labour and capital were not affected by the tariff removal. Finally, the 0% rice import tariff negatively affected all the households in the economy. The urban north households were less affected than their rural counterparts as a result of the liberalization policy. The rural north household had the largest decrease in income, savings and utility with the tariff removal while the urban south household had the least fall in income, savings and utility due to the policy.

4.4 Welfareimplication of the rice trade policy on the Nigerian households

This section presents the results of the estimation of welfare gains/losses arising from the rice trade policies simulated in this study. The Hicksian Equivalent variation (EV) was used to make equilibrium comparison of before and after each policy change,following Deverajan (2001),Annabi et al (2006) and Olopoenia and Aminu (2007). The sum of the EVs of all households is the total transfer that is equivalent to the policy change and is used as the social (or national) welfare gain/loss. The marginal utility of the households which was used to estimate the welfare implications of each rice trade policy was generated by the CGE model. In the subsequent sections, the results for the four policy scenarios simulated in the study are presented.

4.4.1 Welfare implication of a rice import ban on Nigerian households

The results of the effect of therice trade policies on the welfare of Nigerian households are presented in Table 8. The table reveals that under the first ban scenario (Ban I), the welfare gain in terms of nominal income for the rural north household was ₦2.3billion while that of the rural south was ₦0.8 billion. Similarly, with the second ban scenario (Ban I), rural north and south households gained welfare of ₦1.4 billion and ₦0.4 billion respectively.Thus, these net producing households recorded gains in their income as a

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result of the price increases which occurred with the ban. This indicates that the protectionist policy of a ban on rice imports favoured the rural households.On the other hand, welfare of the urban north household, in terms of nominal income, decreased by ₦30.0 billionwhile that of the urban south deceased by ₦65.9 billion withBan I while urban north and south households lost welfare in terms of nominal income of ₦21.4 billion and ₦50.0 billion respectively with Ban II. This was as a result of the price increases and the decrease in composite commodity recorded in this scenario. Hence, the rural households are the winners under the ban while the urban households are the losers. However, the rural north households were the bigger winners than rural south households while the urban south households were bigger losers than the urban north households. Social welfare decreased by ₦92.8 billionas a result of imposing a ban on rice importation. This indicates that the protectionist policy of a rice import ban resulted in a loss of welfare to the entire country.

4.4.2 Welfare implication of 80% increase in rice import tariff on households

The results in Table 8 show thatan 80% increase in rice import tariff on households' welfare in Nigeria also resulted in welfare gains for the rural households, in terms of nominal income.The rural north household gained welfare of ₦0.5 billion while the rural south householdgained welfare of ₦0.4 billion. Conversely, the welfare of the urban north household, in terms of nominal income, decreased by ₦8.6 billion while that of the urban south decreased by ₦14.7 billion. The urban south household suffered a greater loss because it consumes more of imported rice than the urban north households although both urban households were net consumers of rice. Social welfare decreased by ₦22.4 billion as a result of the increase in tariff on rice imports. This result indicates that, the rural households are the winners of the tariff increase policy while the urban households were the losers. Again, the rural north households were bigger winners while the urban south households are the bigger losers under the tariff increase although, the magnitude of gains/losses to each households were less than under the ban.

Hence, the more extreme the policy protection, the greater the welfare gains to the rural households and also the loss to the urban households. Also, the since the country losses

welfare under the tariff increase than under the ban, the more extreme the policy protection, the greater the social welfare to the country.

4.4.3 Welfare implication of 5% reduction in rice import tariff on Nigerian households

Table 8 reveals that the effect of a 5% reduction in rice import tariff on households'caused a welfare loss, in terms of nominal income, for the rural north household of ₦0.7 billion whilethere was no change in the welfare of the rural south household. Thus, even a minimal reduction in tariff hurt welfare of the rural north household.The urban north household welfare was also unaffected by the policy change. However, the urban south household lost welfare, in terms of nominal income,of ₦7.3 billion. Social welfare also decreased by ₦8.0 billion. This result shows that the rural north and urban south households were the losers under the mild liberalization policy. However, the urban south households were the bigger losers under the tariff reduction although, the magnitude of losses to the households are less than was recorded under the protectionist policies of ban and tariff increase. Hence, the less extreme the policy protection, the less the welfare loss to the urban south and the more extreme the policy protection, the greater the welfare loss to the urban south.

Table 8: Welfare implications of the rice trade policies on Nigerian households (₦billion)

Households	EV for Ban I	EV for Ban II	EV for 80% tariff increase	EV for 5% tariff reduction	EV for 0% tariff charge
Rural north	2.3	1.4	0.5	-0.7	-115.0
Rural south	0.8	0.4	0.4	0	-149.1
Urban north	-30.0	-21.4	-8.6	0	-261.5

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Urban south	-65.9	-50.0	-14.7	-7.3	-168.5
Social welfare	-92.8	-69.6	-22.4	-8.0	-694.1

Source: Estimates from Hicksian measures of CGE analysis

Where EV – Equivalent variation

Also, loss to social welfare as a result of the mild liberalization policy was less than under the protectionist policies of ban and tariff increase. Hence, a mild liberalization hurt social welfare less than protectionist policies. This result of least welfare loss with minimal tariff reduction is consistent with Olopoenia and Aminu (2007). This shows that a small reduction in tariff will hurt national welfare least.

4.4.4 Welfare implication of 0% rice import tariff on Nigerian households

The results in Table 8 reveal that the effect of a 0% rice import tariff on households' welfare in Nigeria caused a welfare loss in terms of nominal income, for the rural north

household of ₦115.0 billionand ₦149.1 billion for the rural south households. This was the greatest welfare loss for the rural households. The welfare loss for the urban north household was ₦261.2 billion while that of the urban south was ₦168.5 billion. This shows that full liberalization of rice imports will hurt all household the most. Although a minimal reduction in tariff did not affect the rural south,a complete removal in tariff hurt them more than the rural north. Also, the results show that the urban households suffered a greater loss of welfare under the 0% tariff policy than other policy scenarios. However, the urban south households suffered less loss of welfare than the urban north because they consume more imported rice than the urban north household. Social welfare suffered the largest loss recorded across all scenarios of ₦694.1 billion as a result of the extreme liberalization policy. This result is consistent with Wailes (2003) who found that a full liberalization of rice imports will hurt national welfare in Nigeria.

In summary it was observed that, under the protectionist policy scenarios of ban and high tariff, the results showed that the rural households' were the winners while the urban households were the losers. Overall, all households groups in the economy suffered a loss of welfare under both protectionist policies although the welfare loss was higher under the ban than under the high tariff scenario for all households.Hence, the higher the policy protection, the greater the welfare gains to the rural households and the less the policy protection, the lesser the welfare gain to the rural households and vice versa for the urban households. On the other hand, the liberalization scenarios of a small reduction in tariff and a 0%/ tariff elimination on rice import showed thatthere were no winners of these policy changes.All households were either unaffected bythe policy changes or were losers of the same. However, the least welfare loss occurred with the small reduction in tariff whilst the largest welfare loss occurred with the 0% (tariff elimination)scenario. Thus, the greater the liberalization of rice trade the greater the welfare loss to the nation and the more subtle the liberalization of rice trade, the lesser the welfare loss to the nation. On the whole, none of the rice trade policies resulted in a gain in national welfare. Therefore, rice trade policies do not improve welfare for the entire nation but do so only, for specific households.

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CHAPTER FIVE

SUMMARY OF MAJOR FINDINGS, CONCLUSION AND POLICY RECOMMENDATIONS

5.1   Summary of major findings

Despite being the largest producer of rice in West Africa, Nigeria's rice demand still surpasses its supply and imports help to fill the demand gap. Inconsistent use of trade policies has characterized Nigeria's rice imports over the years and little is known about the welfare implications on these policieson households and their effect on the economy.

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Only few empirical works exist in the literature which investigate the welfare implications and these used partial equilibrium models that neither reveal the effects on the other sectors of the economy nor on the households in the economy. Thus the study aimed to investigate the effect of rice trade policies on households' welfare in Nigeria using a general equilibrium framework.Specifically, the study compared the performance of the rice sector under Nigeria's different trade policy periods, examined the interrelationship of the rice sector with other sectors in the economy in 2004 accounting period, determined the effect of the rice trade policies on the Nigerian economy and identified the welfare implicationsof the policies on household groups in Nigeria.

Secondary data on rice yield, cultivated area, output, imports, national consumption and producer price were collected and bar charts and means were used to describe the trend in their growth. The interrelationship of the rice sector with other sectors of the economy in 2004 accounting period was described using a social accounting matrix for 2004 constructed from the input-output table for 2004, the Nigerian living standards survey for 2004 and other library resources. A static computable general equilibrium model was used to determine the effect of the rice trade policies on the Nigerian economy while the Hicksian measure of equivalent variation was used to identify the welfare implicationsof these policies on household groups in Nigeria.

The performance of the rice sector during the largely liberalized 9 year pre-ban period (1970-1978) showed that on the average, the best mean growth for rice yield of 7.7%, import of 446.5% and national consumption of 16.4% were acheived. Output also recorded its highest growth of 87% during this period when tariffs were reduced from 20% to 10% respectively. This indicates that despite the liberalization policy, the output grew because due to yield development. The 6 year period of import quota (1979-1984) recorded the highest mean growth in cultivated area and output of 15.3% and 18.3% respectively, indicating that cultivated area accounted for the increase in output. Mean imports growth declined in this period by -4.0% only. The maximum growth in producer price of 73.9% was also recorded in this period. The 10 year period of the ban (1985-1994) also recorded declined in yield of -2.6%. The best mean growth rate for producer

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price of 44.9% was achieved in this period. The 10 year post-ban period (1995-2004) recorded the lowest positive growth for yield, cultivated area and output.

The description of the interrelationship of the rice sector with the rest of the economy showed that the rice sector output was about 0.7% of the total output of the Nigerian economy and 2.5% of total agriculture in Nigeria inn the base year. The manufacturing services sectors made up the largest sector being 42.9% of the economy. This indicates that the rice sector was an important part of Nigerian agriculture although it was a very small part of the economy in the base year. The oil and mining sector was the largest exporting sector with 66.6% and thus, the most important foreign exchange earner in the base year. Import taxes contributed more to government revenue than indirect taxes indicating the importance of import taxes to government revenue in Nigeria in the base year. Foreign savings account showed that the economy enjoyed a surplus balance of payment position due to increased aggregate output and exports. Furthermore, the rural households earned a greater proportion of labour and capital income from rice and in total labour income earned in the base year.The urban households, on the other hand, earned more from the oil and mining and the manufacturing and services sectors than rural households and also capital income indicating more diversified sources of income other than agriculture. Rice accounted for 0.4% of household expenditure while other agriculture sector, oil and mining sector and manufacturing and services sector accounted for 16.1%, 1.0% and 82.5% respectively.

The computable general equilibrium model was used to simulate the effect of different rice trade policies on the economy. The protectionist policies of a rice import ban and 80% tariff increase followed a similar trend howbeit; the magnitude of change was less severe with the tariff increase. Under these protectionist policies, domestic output, labour employed in the sectors, price of capital and exports increased in both the rice sector and the other agriculture sector but decreased in the oil and mining and the manufacturing and services sectors. All major macroeconomic aggregates fell while foreign savings, consumer price index and the total quantities of labour and capital were not affected by the rice import ban, indicating that the protectionist policies did not result in

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macroeconomic benefits for the country. The rural north household had the largest increase in income under the total ban on imported rice and the ban with an effective tariff rate of 420% which allowed only 10% of the quantity of imported rice in the base year. Hence, for the first and second ban policies simulated, rural north household income increased by ₦2.3 billion and ₦1.4 billion respectively while the urban south household suffered the largest fall in income of ₦65.9 billion and ₦50.0 billion respectively. Thus, indicating that the rural households were more favoured under the ban than the urban households.

The liberalization policies did not follow similar changes in the economy except that the 5% reduction in tariff caused an increase in domestic output of rice by 1.1% while 0% tariff led to a rice output increase of 3.1%; these were higher than was obtained under the protectionist policies. Although the oil and mining sector generally declined and major macroeconomic aggregates fell with 5% tariff reduction, labour employed, composite price and price of capital in the manufacturing and services sector and wage rate all increased. Also, the two households that lost income (rural north and urban south) experienced the least income loss across all scenarios. Thus, indicating that mild rice trade liberalisation resulted in the least loss to households. However, the zero tariff policy generally led to negative effects for all the sectors especially the other agriculture sector. Thus, indicating that complete rice trade liberalisation increased domestic output of rice best but hurt the other agriculture sector most. Labour employed increased in the oil and mining sector and the manufacturing and services sector. All major macroeconomic aggregates in the economy fell. All households' incomes declined with complete liberalization, especially the rural north household with a decline in income of about 17.9%.

The Hicksian measure of equivalent variation was used to estimate the welfare implications of the rice trade policies simulated in the study. The results indicated that the protectionist policies improved the welfare of the rural households especially rural north household but hurt the urban households especially the urban south household. Social welfare also declined. The 5% reduction in tariff did not affect the welfare of the urban

north and rural south households but hurt the rural north and urban south households minimally with a welfare loss of ₦0.7 billion and ₦7.3 billion respectively. The least loss in social welfare of ₦8.0 billion was also experienced in this scenario. Thus, indicating that a mild liberalisation of rice trade hurt the economy least among other rice trade policies. The 0% rice import tariff led to the largest loss in welfare for all households especially the urban north household with ₦261.5 and least with the rural north household with ₦115.0. Social welfare also experienced the largest decline, relative to other rice trade policies, indicating that complete removal of tariff hurt the economy most among other rice trade policies.

5.2   Conclusion

The study evaluated the effects of rice trade policies on the welfare of households in Nigeria. The performance of the rice sector in the four policy periods from 1970 to 2004 revealed that, on the average, the sector recorded positive growth in output and cultivated area throughout the four policy periods but the maximum growth of output was recorded during the pre-ban period. The simulations with the computable general equilibrium model also revealed that rice output increased under each of the four policy scenarios but increased best under the liberalization scenarios. Thus, the study established that domestic rice output increases under any existing rice trade policy, however, the magnitude of increase differs under different rice trade policies and that domestic rice output increases best under a liberalised rice trade policy.

The study further established that the rice trade policies do not improve social welfare although; certain households are favoured under specific rice trade policies. The study found that rural households were winners under protectionist policy scenarios and more so under a ban than an 80% increase in tariff while the urban households were the losers. Thus, the study established that the more extreme the policy protection the higher the welfare gains of the rural households especially, the rural north households. Also, the urban households lost less welfare under the tariff increase than under the ban. Thus, the study established that with regards to protectionist policy, the less extreme the policy protection on rice imports, the better for the welfare of urban households. Also, the less

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extreme the policy protection on rice imports, the better for national welfare. However, with regards to liberalisation, the study established that the milder the rice trade liberalisation, the better for national welfare and the more extreme the rice trade liberalisation, the worse for national welfare. The study also established that the milder the rice trade liberalization, the less the welfare loss to any household and the more extreme the rice trade liberalisation, the greater the welfare loss to any household.

The general conclusion of the study is that rice trade policies do not improve overall national welfare. All households experience the least loss to welfare with a small tariff reduction or a mild rice trade liberalisation policy while even urban households could not gain the benefits of trade liberalisation because of the negative effects on sector prices, macroeconomic aggregates and other parts of the economy. This makes it imperative to introduce complimentary policies in order that all households can gain the expected benefits of liberalisation. This is because improvement in welfare is expected to contribute to poverty reduction which is the current drive of the government. This is more so if the country is to follow the current global trend of liberalisation which all countries of the world accede to. To this end, the following recommendations are made:

5.3 Policy recommendations

i.   <u>Mild liberalisation of rice trade</u>: This is necessary since the social welfare was least hurt with a small reduction of 5% in tariff. This policy option also gave rise to a minimal rise in wage rate and increased employment in the manufacturing and services sector. In addition, the least fall in macroeconomic aggregates occurred with this policy while welfare of two households was also unaffected; hence, the economy will experience the least welfare reduction under this policy option. This is will ensure that the poverty reduction drive of government is not hampered while, at the same time, maintaining households' welfare despite the policy change.

ii. <u>Initiating complimentary policies to mitigate welfare loss to households</u>: This recommendation follows from the observation of welfare losses for the rural

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north and urban south households with a subtle liberalisation of 5% tariff reduction. Since labour employed fell in the sectors from which rural households mainly earn their income (rice and other agriculture sectors), appropriate policies which will attract labour back to these sectors should be put in place while welfare improving programmes should be targeted at both rural north and urban south households.

iii. <u>Targeting the disadvantaged sectors arising from the policy change</u>: The results of the computable general equilibrium analysis revealed that the oil and mining sector and the manufacturing and services sector declined in exports and output with liberalisation. These are two important sectors which contribute the highest proportion of exports and composite commodity respectively. Therefore the government must focus on policies that will encourage increased production and exports in these sectors.

iv. <u>Adopting a policy of tariff increase rather than ban if the government's policy thrust is targeted mainly at producers' welfare</u>: This recommendation follows from the observation that the protectionist policy of tariff increase would hurt Social welfare less than an import ban while, at the same time, increase welfare of rural households.

v. <u>Diversification of government revenue sources</u>: This recommendation follows the observation that import tax does not effectively improve government revenue and national welfare. Thus, government should explore other forms of taxes which will more effectively improve revenue and overall national welfare.

5.4 **Suggestions for further studies**

This study analysed the effect of rice trade policies on the welfare of households in Nigeria using a general equilibrium framework however, certain additional factors could be incorporated into the study which could alter and/or enhance the findings and policy recommendations. Thus, the following suggestions are made for further studies:

i. The incorporation of imperfect competition into CGE analyses for Nigeria and other developing countries should be carried out. This will give rise to more true-to-life assumptions and more realistic outcomes.

ii. The dynamic specifications should be incorporated into the models to allow for the observation of trend in changes due to policies simulated. This will, in turn, aid the formulation of sustainable/long term policies for development.

iii. The poverty impact of the rice trade policy should be assessed to allow for proper targeting of poverty reduction programmes and projects.

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Appendix I (TABLES)

Table 9: Mean growth of rice sector performance variables in the different policy periods

Policy period	Yield	Cultivated area	Output	Imports	Rice consumption	Producer price
Pre-ban 1970-1978	7.7 (30.19)	5.6 (31.66)	11.5 (36.93)	446.5 (717.96)	16.4 (15.41)	6.4 (9.05)
Quota 1979-1984	2.2 (3.85)	15.3 (17.26)	18.3 (21.63)	-4.0 (27.73)	6.7 (24.97)	13.9 (16.12)
Ban 1985-1994	-2.6 (12.51)	12.7 (25.15)	8.9 (24.95)	3.7 (29.06)	7.8 (27.98)	44.9 (45.57)
Post-ban 1995-2004	0.3 (8.16)	3.3 (5.26)	3.6 (9.18)	23.4 (52.35)	7.9 (4.86)	27.0 (34.97)

Source: Extrapolations from FAO (2008) data
Standard deviations in parenthesis.

Table 10: Effect of a ban on rice imports on the sectors of the Nigerian economy

Variables	RICE I	RICE II	OA I	OA II	OM I	OM II	MS I	MS II
Domestic output	0.4	0.3	0.6	0.4	-3.7	-2.4	-1.1	-0.7
Composite	-8.1	-5.2	-1.3	-0.8	-2.9	-1.9	-1.6	-1.0
Exports	NIL	NIL	2.5	1.5	-3.8	-2.4	0	0.0
Labour	9.0	5.7	1.5	0.9	-1.8	-1.2	-0.7	-0.4
Capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Composite price	12.1	7.6	-1.1	-0.7	0.1	0.0	1	0.7
Price of capital	7.7	4.9	0.3	0.2	-3.0	-1.9	-1.9	-1.2
Export price	NIL	NIL	0.7	0.4	0.7	0.4	0.7	0.4

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Import price	0.7	275.4	0.7	0.4	0.7	0.4	0.7	0.4

Source: CGE model simulations results.

Table 11: Macroeconomic effects of a rice import ban (%)

Variable	BAN I SCENARIO	BAN II SCENARIO
Import tax	-1.6	-0.9
Indirect tax	-1.4	-0.9
Government revenue	-1.5	-0.9
Government savings	-1.5	-0.9
G.D.P	-1.5	-1.0
Real G.D.P.	-1.5	-1.0
Foreign savings	0.0	0.0
Investments	-7.2	-4.6
Wage rate	-1.2	-0.8
Exchange rate	0.7	0.4
Consumer price index	0.0	0.0
Total quantity of labour	0.0	0.0
Total quantity of capital	0.0	0.0

Source: CGE model simulations results.

Table 12: Effect of a rice import ban on households

| Households | Percentage changes in household variables | | | | | |
	Income I	Income II	Savings I	Savings II	Utility I	Utility II
Rural north	0.33	0.20	0.33	0.20	0.03	0.02
Rural south	0.00	0.00	0.00	0.00	0.00	0.00
Urban north	-1.52	-0.96	-1.52	-0.96	-0.11	-0.08
Urban south	-2.53	-1.59	-2.53	-1.59	-0.18	-0.12

Source: CGE model simulations results.

Table 13: Effect of an 80% increase in rice import tariff on the sectors of the Nigerianeconomy

Variables	Rice (%)	OTAGR (%)	OLM (%)	MANSV (%)
Domestic output	0.1	0.1	-0.9	-0.3
Composite	-1.9	-0.3	-0.7	-0.4
Exports	-	0.6	-0.9	0
Labour	2.1	0.3	-0.4	-0.1
Capital	0	0	0	0
Composite price	2.7	-0.3	0.3	0
Price of capital	1.8	0.1	-0.7	-0.4
Export price	-	0.2	0.2	0.2

Import price	0.2	0.2	0.2	0.2

Source: CGE simulations

Table 14: Macroeconomic effects of an 80% increase in rice import tariff

Variable	Percentage change
Import tax	-0.3
Indirect tax	-0.3
Government revenue	-0.3
Government savings	-0.3
G.D.P	-0.4
Real G.D.P.	-0.3
Foreign savings	0.0
Investments	-1.6
Wage rate	-0.3
Exchange rate	0.2
Consumer price index	0.0

Total quantity of labour	0.0
Total quantity of capital	0.0

Source: CGE simulations

Table 15: Effect of an 80% Increase in Rice Import Tariff on the Households in Nigeria

Households	Percentage changes in household variables		
	Household income	Household savings	Household utility
Rural north	0.11	0.11	0.01
Rural south	0.00	0.00	0.00
Urban north	-0.31	-0.31	-0.03
Urban south	-0.62	-0.62	-0.04

Source: CGE simulations

Table 16: Effect of a 5% Reduction in Rice Import Tariff on the Sectors of the Nigerian Economy

S/No	Variables	Rice	Other agriculture	Oil & mining	Manufacturing & services
1	Domestic output	1.1	0.5	-0.1	-0.6
2	Composite	1.0	0.3	-0.3	-0.2
3	Exports	-	0.6	-0.1	-1.6
4	Labour	-2.5	-0.1	-0.6	0.2
5	Capital	0	0	0	0

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6	Composite price	-3.1	-0.5	-0.5	0.2
7	Price of capital	-2.4	0	-0.5	0.3
8	Export price	-	-0.4	-0.4	-0.4
9	Import price	-2.5	-0.4	-0.4	-0.4

Source: CGE simulations

Table 17: Macroeconomic Effects of a 5% Reduction in Rice Import Tariff

Variable	Percentage change
Import tax	-0.2
Indirect tax	-0.1
Government revenue	-0.2
Government savings	-0.2
G.D.P	-0.1
Real G.D.P.	-0.1
Foreign savings	0.0
Investments	-0.1
Wage rate	0.1
Exchange rate	-0.4

Consumer price index	0.0
Total quantity of labour	0.0
Total quantity of capital	0.0

Source: CGE simulations

Table 18: Effect of a 5% Reduction in Rice Import Tariff on Households in Nigeria

Households	Percentage changes in household variables		
	Household income	Household savings	Household utility
Rural north	-0.1	-0.1	-0.01
Rural south	0	0	0.00
Urban north	0.1	0.1	0.00
Urban south	-0.2	-0.2	-0.02

Source: CGE simulations

Table 19: Effect of 0% Rice Import Tariff on the Sectors of the Nigerian Economy

Variables	Rice	Other agriculture	Oil & mining	Manufacturing & services
Domestic output	3.1	-21.3	-0.01	-0.1
Composite	3.5	-15.5	-8.0	-11.8
Exports	-	-27.1	-1.0	-10.6
Labour	-12.8	-5.1	13.4	0.8
Capital	0.0	0.0	0.0	0.0

Composite price	-24.0	6.6	-3.6	-1.1
Price of capital	-24.7	-18.1	-2.2	-13.1
Export price	-	-0.5	-0.5	-0.5
Import price	-27.9	-0.5	-0.5	-0.5

Source: CGE simulations

Table 20: Macroeconomic Effects of a zero tariff charge (0%) in Rice Imports

Variable	Percentage change
Import tax	-12.1
Indirect tax	-12.5
Government revenue	-12.2
Government savings	-12.2
G.D.P	-11.1
Real G.D.P.	-11.0
Foreign savings	0.0
Investments	-1.1

Wage rate	-13.7
Exchange rate	-0.5
Consumer price index	0.0
Total quantity of labour	0.0
Total quantity of capital	0.0

Source: CGE simulations

Table 21: Household Effect of a zero percentage tariff charge (0%) in Rice Imports

Households	Percentage changes in household variables		
	Household income	Household savings	Household utility
Rural north	-17.9	-17.9	-1.42
Rural south	-17.4	-17.4	-1.36
Urban north	-12.5	-12.5	-0.96
Urban south	-6.3	-6.3	-0.47

Source: CGE simulations

Table 22: 2004 Social Accounting Matrix for Nigeria

	rice	OA	OM	MS	rice	OA	OM	MS	lab	capt	hholds	govt	indtax	imtax	invsmt	ROW	total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
rice					77760.643												77760.64
OA						1595522.44										1437142.62	3032665.07
OM							223023.44									2981110.94	3204134.38
MS								4695077.79								56355.36	4751433.15
rice	4301.553	87.7867907		1629.77							27670.09	177.09			47007.36	0.00	80873.65
OA	87.78679	171096.45		63561.11							1079133.36	6906.67			396144.43	0.00	1716929.80
OM	18.03	703.17	4996.95	178209.71							67610.05	16016.21			84695.43		352249.56
MS	1774.04	69187.56	60905.76	467455.89							5518488.38	469420.86			854610.39		7441842.88
lab	1475.874	57559.10	17570.91	105281.14													181887.02
capt	62767.25	2447922.79	2813954.74	2706923.07													8031567.85
hholds									181887.02	8031567.85							8213454.87
govt	-70.21475	-2738.38		-712.20									263718.97	902962.00			1163160.18
indtax	201.6153	7862.99	11264.24	244390.12													263718.97
imtax	2039.391	79536.246	73313.68	296591.7	856.3775	17256.007	17774.818	415593.8									902962.00
invstmt	230.98	9008.22	11318.28	26839.28							1520552.99	670639.35				-856131.52	1382457.58
ROW	4934.337	192439.128	210809.8	661263.6	2256.6316	104151.35	1114511.3	2331171.3									3618477.39
total	77760.64	3032665.07	3204134.38	4751433.15	80873.65	1716929.80	3522249.56	7441842.85	181887.02	8031567.85	8213454.87	1163160.18	263718.97	902962.00	1382457.61	3618477.39	

Source: Author's computations from NISER 2004 I-O Table

Table 23: Taxonomy of Nigeria's rice trade policy

PERIOD	POLICY MEASURES
Prior to April 1974	66% tariff
April 1974 – April 1975	20% tariff
April 1975 – April 1978	10% tariff
April 1978 – June 1978	20% tariff
June 1978 – Oct 1978	19% tariff
Oct 1978 – April 1979	Ban on imports in containers below 50kg
April 1979	Imports under restricted license only to Government Agencies
September 1979	6 month ban on all imports
January 1980	Import license issued for 20,000 tonnes of rice
October 1980	General import license with no quantitative restrictions
December 1980	Presidential Task Force (PTF) on rice was created and it used the Nigerian National Supply Company (NNSC) to issue allocations to customers and traders
May 1982	PTF commenced issuing of allocations to customers and traders in addition to those issued by NNSC
January 1984	PTF disbanded. Rice importation placed under general licence restrictions
October 1985 - 1994	Importation of rice (and maize) banned
July 1986	Introduction of the Structural Adjustment Programme (SAP) and the abolition of Commodity Boards to provide production incentives to farmers through increased producer prices
1995	Ban on importation of rice lifted and tariff set at 100%
1996 – 2000	50% tariff
2001	75% tariff
2002 - 2003	100% tariff
2004	110% tariff
2005	120% tariff
2006	110% tariff
2007	100% tariff
2008	109% tariff
2009	30% tariff
2010	30% tariff

Source: Federal Government Budgets, 1984 – 1986; 1995 – 2005 modified fromAkande et al (2002),Daramola (2005) and Obih et al (2008); 2008-2010 modified from USDA (2010) Grains report.

Appendix II

Calibration of the model

$$Q_i = D_i + M_i \quad \text{..52}$$

$$depr_i = DPRE_i / CAP_i \quad \text{..53}$$

$$IO_{ij} = \frac{IOVAL_{ij}}{X_j} \quad \text{......................................54}$$

Calibration of household variables and parameters in the model

$$HFYLS_{hi} = \frac{HFYL_{hi}}{LAB_i.W} \quad \text{...............................55}$$

$$HFYKS_{hi} = \frac{HFYK_{hi}}{CAP.PK_i.(1-depr_i)} \quad \text{..............56}$$

$$HHY_h = \sum_{i=1}^{4} \frac{HFYL_{hi}}{LAB_i.W} + \sum_{i=1}^{4} \frac{HFYK_{hi}}{CAP.PK_i.(1-depr_i)} \quad \text{..........57}$$

$$h\exp s_{hi} = \frac{HEXP_{hi}}{HHY_h} \quad \text{...............................58}$$

$$SAV_h = HHY_h - \sum_{i=1}^{4} h\exp s_{hi}.HHY_h \quad \text{...............59}$$

$$HEXPQ_{hi} = h\exp s_{hi}.HHY_h / P_i \quad \text{......................60}$$

$$tm_{im} = \frac{TMR_{im}}{M_{im} - TMR_{im}} \quad \text{............................61}$$

$$tn_{im} = \frac{TNR_{im}}{N_{im} - TNR_{im}} \quad \text{............................62}$$

$$td_i = \frac{TDR_i}{X_i} \quad \text{......................................63}$$

$$sub_i = \frac{SUBR_i}{X_i} \quad \text{..................................64}$$

$$ta_i = td_i - sub_i \quad \text{......................................65}$$

$$nx_i = \frac{N_i}{X_i}$$ 67

$$DEPT = \sum depr_i.CAP_i.PK_i$$ 68

$$CAPY = \sum CAP_i.PK_i$$ 69

$$NCAPY = \sum CAP_i.PK_i - (1 - depr_i)$$ 70

$$PV_i = PX_i(1 - td_i - sub_i) - \sum IO_{ji}P_j - PN_i.nx_i$$ 71

$$\alpha_i = \frac{LAB_i.W}{PV_i.X_i}$$ 72

$$LABY = \sum LAB_i.W$$ 73

$$L = \sum LAB_i$$ 74

$$K = \sum CAP_i$$ 75

Calibration of prices

$$QSUM = \sum Q_i$$ 76

$$pwts_i = Q_i / QSUM$$ 77

$$PINDEX = \sum pwts_i.P_i$$ 78

$$PWE_{ie} = PE_{ie} / ER.(1 + te_{ie})$$ 79

$$PWM_{im} = PM_{im} / ER.(1 + tm_{im})$$ 80

$$PWN_{in} = PN_{in} / ER.(1 + tn_{in})$$ 81

$$PWEG = PEG / ER$$ 82

$$INTD_i = \sum IO_{ij}.X_j$$ 83

$$Q_i = PD_i.D_i + PM_i.M_i$$ 84

$$AV_i = PV_i.X_i / \left((LAB_i)^2\alpha_i.(CAP_i)^2.(1 - \alpha_i)\right)$$ 85

$$at_{ie} = \frac{X_{ie}}{\left(\beta_{ie}.E_{ie}.rhot_{ie} + \left(1-\beta_{ie}\right)D_{ie}^{\;2}rhot_{ie}^{\;2}\left(1-rhot_{ie}\right)\right)} \quad \dots\dots\dots\dots86$$

$$IMTAX = \sum tm_{im}.PWM_{im}.M_{im}.ER + \sum tn_{in}.PWN_{in}.N_{in} \quad \dots\dots\dots\dots87$$

$$INDTAX = \sum td_i.PX_i.X_i \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots88$$

Computation of transfer rates by households

$$GOVSUB = \sum sub_i.PX_i.X_i \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots89$$

$$GRT = IMTAX + INDTAX - GOVSUB \quad \dots\dots\dots\dots\dots\dots\dots90$$

$$GRT = GET \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots91$$

$$govsavr = \frac{GOVSAV}{GET} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots92$$

$$GSEC = \frac{GEXP_i}{\left(GET(1-govsavr)\right)} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots93$$

$$SECGOV_i = g\sec_i\left(GET(1-govsavr)\right) \quad \dots\dots\dots\dots\dots\dots94$$

$$FSAV = \sum PWM_{im}.M_{im} + \sum PWN_{in}.N_n - \sum PWE_{ie}.E_{ie} \quad \dots\dots\dots95$$

$$INT_j = \sum IO_{ij}.X_i \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots96$$

$$SAVINGS = FSAV.ER + HSAV + GOVSAV + DEPT \quad \dots\dots\dots97$$

$$INVEST = SAVINGS \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots98$$

$$ID_i = ksh_i.INVEST \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots99$$

$$CD = \sum HEXPQ_{hi} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots100$$

$$Q_i = INTD_i + CD_i + SECGOV_i + ID_i \quad \dots\dots\dots\dots\dots\dots101$$

$$GDP = \sum(PV_i.X_i) + IMTAX + INDTAX \quad \dots\dots\dots\dots\dots\dots102$$

$$RGDP = \sum CD_i + \sum ID_i + \sum SECGOV_i + \sum E_{ie} - \sum(1-tm_{im}.M_{im}) \quad \dots103$$