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A Computable General Equilibrium Analysis of Nigeria's Trade Competitiveness.

By

Sam Olofin, Adeola Adenikinju and Akin Iwayemi

Centre for Econometric and Allied Research, University of Ibadan, Nigeria

1. Introduction

The Nigerian economy like most sub-Saharan economies experienced rapid growth in the decade of the late 70s to early 80s. With specific reference to Nigeria, the discovery of oil, coupled with favourable developments in the global oil market made massive capital accumulation possible. This in turn, rather than increase in productivity or competitiveness, largely accounted for the rapid growth experienced over this period. The Nigerian economy has over the years become heavily dependent on petroleum export, which has provided the finance for an import substitution (ISI) but import dependent industrialization strategy. This dependence on petroleum exports on the one hand and an ISI industrialization strategy have both made the economy to become highly vulnerable to changes in the parameters of external trade. With the secular decline in the oil market, the Nigerian economy has continued to experience both economic and political difficulties. These have resulted in negative growth in overall GDP, persistent current account and fiscal deficits, rising inflation and significant increase in the magnitude of external debt burden.

While the economic regress may have been triggered off by external factors, poor domestic economic policies and anti-export bias of government policies have exacerbated the problems. The Nigerian economy by the mid-80s had become characterized by structural rigidities, overwhelming dominance of government in resource allocation and management, and low level of competitiveness. The lack of competitiveness was evidenced in overvalued exchange rate, high protectionist stance, high tariff rates, high tariff variance and high unit labour costs. The initial approach of government to finding solutions was to introduce austerity measures in 1982. These were aimed at downsizing government and government participation in directly productive economic activities. This was soon to be followed by strict controls on imports and foreign exchange. However, the demand management measures adopted by the government were ineffective in combating the economic malaise.

The drying up, or increasing difficulty in attracting foreign direct investment (FDI) imposed the necessity for a change in development strategy. The adoption of structural adjustment programme (SAP) in 1986 was aimed at putting in place a process of progressive liberalization of the economy. This was designed to increase the

productive capacity of the economy, increase its ability to adapt to shocks, and enhance its overall competitiveness. Among the major policy trusts of SAP were the liberalization of trade; achieving a realistic exchange rate for the naira; reducing the level of distortions in the economy by allowing greater role for the market in resource allocation; and deregulating the economy. The advocates of structural reforms viewed lack of competitiveness in international trade as one of the major constraints accounting for the overall poor performance of the economy, despite the country's oil wealth.

Reforms in trade policy are viewed as one of the avenues for enhancing the competitiveness of an economy. Thus, the SAP adopted in 1986 sought to open up the economy for increased trade with the rest of the world by removing the existing barriers to trade. The was in line with a new emerging trend illustrated in Dornbusch's (1992), argument that "since the days of plentiful external credit are gone, attention must shift to productivity gains as the source of growth ..."

Since Nigeria is reckoned to be both the largest exporter and importer in sub-Saharan Africa excluding South Africa (GATT, 1991), it becomes imperative to consider the extent to which trade policy measures may enhance competitiveness and growth. This is the primary focus of this study meant to serve as a pilot study, which could then be extended to cover the entire sub-Saharan region in a representative manner.

For the analysis reported in this paper we developed a Computable General Equilibrium (CGE) model that is suitably adapted to the Nigerian economy. The adoption of a CGE modeling approach enabled us to capture both the direct and indirect effects of alternative trade reform programmes, and take into account the structural features that characterize a typical developing sub-Saharan economy.

2. *Trade, Competitiveness and Growth*

The concept of international competitiveness has many dimensions. It encompasses a number of considerations that are both economic and non-economic. By way of illustration, we know that such factors as changes in relative productivity, relative wage inflation, and the exchange rate affect competitiveness. Equally

important however are non-price factors such as quality, timeliness and delivery of goods produced, marketing and distribution skills, reliability, after sales services, technological and the institutional and structural environment (Agenor, 1995). More than anything else, technology has changed the pace and face of industrial competitiveness. However, in practical terms, the near impossibility of quantifying many of these factors, have led many researchers to focus more on quantifiable indicators such as those based on prices.

Thus, the most pervasive concept of competitiveness is price competitiveness, although this again has many dimensions. "A useful summary gauge of competitiveness is labour cost per unit of output, the ratio of wages to productivity" (Golub, 1996). Lipshiz and McDonald (1992) argue that unit labour cost provides a good indicator of competitiveness. Unit labour cost (ULC) index has also been widely used in many studies (see for example, Nordås, 1996; Pilat, 1995; Golub, 1994, 1996; Agenor, 1995).

Several variables come into play in using unit labour cost as a measure of competitiveness. These variables include, labour productivity, average wage and the exchange rate. Changes in each of these factors would affect a country's relative competitiveness. Thus, to the extent that low wages reflect low productivity, competitiveness is not improved (Adenikinju, Olofin and Iwayemi, 2000).

In addition to the ULC, the role of tariffs is also very important in price competitiveness. Tariffs create a wedge between domestic and foreign price of a commodity. Tariff on intermediate imports, for example, has been shown to imply a complementary tax on exports of goods that use such inputs. This raises the price of final exports and thus reduces the competitiveness of the country's products on the global market. Thus, trade policy has an important impact on price competitiveness.

Sachs and Warner (1997) identify an open economy as one that satisfies the following conditions:

i. An average tariff rate below 40 per cent
ii. Average quota and licensing coverage of imports below 40 per cent
iii. Black market exchange rate premium of less than 20 per cent

iv. No control on exports and

v. Not considered a socialist economy

A body of theoretical and empirical literature exists on the link between trade openness and economic growth. While the bulk of the literature posits a positive and often significant relationship between the two, in recent times the attenuated relationship has been challenged. For instance, Rodrik and Rodriquez (2000) identified certain methodological limitation of most of the existing literature in this area. These include the endogeniety of trade openness measures and the collinearity between trade protection and other measures of policy, such as the quality of macroeconomic policy.

Trade theory identifies a number of possible costs and benefits of trade openness. These include, first, that trade openness may create incentives for policy makers to pursue virtuous macroeconomic policies. A good macroeconomic policy is needed to provide a competitive environment for domestic firms engaged in foreign transactions. It also creates an environment for stable planning and reduces inflation.

In addition, open economies also allow countries to specialize in the areas of their comparative advantage. An open economy is likely to have a domestic price vector that is very close to the international prices, as free trade facilitates price convergence of traded goods across countries. Theory suggests that countries with open economy are likely to have less price distortions than closed economies. Easterly (1993) argues that price distortions have adverse effects on factor accumulation and growth.

Literature on endogenous growth theory also provides insights on the additional channels through which trade may affect growth. First is the channel of technology transmission, as trade makes it easier for countries to access worldwide stock of productivity-enhancing knowledge. This allows the country to increase the variety of goods and raises productivity by providing less expensive or higher quality intermediate goods. Thus, access to a variety of foreign inputs at a lower cost shifts the economy-wide production possibility frontier outwards. The second channel is through attracting foreign direct investment (FDI), although the impact of FDI on trade is not unambiguous. Harrison and Revenga (1995) show that open economies attract more FDI than closed economies.

Wacziarg (2001) finds that trade policy openness affects growth through six channels. These are investment, FDI and macroeconomic policy quality. Other channels are government size, reduction in price distortions and black market premia. Investment effect constitutes about 63 per cent of the total effect, technology transmission constitutes about 22.5 per cent, and macroeconomic policy quality accounts for 18 per cent of the effect. He also reports that trade openness was positively associated with the share of manufactured exports in total exports.

Trade liberalization also carries the potential of dynamic benefits. Chenery, et al., (1986) focus on the sources of growth in total factor productivity. Their findings suggest that periods of trade liberalization are associated with periods when total factor productivity growth is unusually high. Using CGE models that incorporate imperfect competition, Norman (1990) shows that in specific market structure or with specific scale economies, the gains from liberalized trade can be substantial.

In the context of Schumpeter's analysis, trade reforms is capable of shaking an economy out of a slow-growth trap into the path of fast growth, as entrepreneurs in the economy take advantage of the favourable economic environment to implement major productivity improvements that have been on the shelve.

In the African context, Wang and Winters (1998) argue that the current marginalization of the African continent in global trade stemmed solely " from a generalized loss of competitiveness rather than the emergence of a particular change in circumstances". The loss of competitiveness has also been responsible for the low share of Africa both in global trade and in the global flow of foreign investment. Wang and Winters (1998) argue that African trade policies in particular must be changed in order to promote growth in the continent. Thus, the authors provide a definitive link between African trade and its low competitiveness on the one hand, and its trade policies and growth on the other hand.

Dornbusch (1992) observes that the protectionism stance of most developing countries in the pre-1980s did help to keep imports out. However, the resulting decline in the demand for foreign exchange led to an appreciation of the currency, caused a severe tax on exports of both traditional commodities and even emerging industrial goods. In addition, the tax on imported intermediate inputs apart from generating a tax

on exports helped cause a currency overvaluation, which hurt the competitiveness of their exports.

One of the most contentious issues in trade policy is the appropriate measure for trade openness. Existing measures of trade openness can be categorized into three (Wacziarg, 2001). These are first, outcome measures, such as using the volume of trade or its components, for example the ratio of imports or exports to trade. Second, are policy indicators, such as tariff rates, non-tariff barriers and tariff revenues. Third, indicators measure the deviation of actual trade volume from model predicted free trade volume such as the gravity model. In spite of their limitations, these measures have been variously used to conduct trade policy analysis.

Another area of controversy relates to the appropriate trade policy measure to adopt in real world situations. In the presence of other distortions in the economy, tariff reduction may not necessarily be welfare improving. According to Dornbursch (1992), a partial tariff reduction as against total elimination may not necessarily improve welfare. He however, argued that an "equiproportionate cut in tariff rates will raise welfare".

3.0 Nigeria's Trade Policy Regimes

Nigeria is by most account considered the biggest exporter and importer in sub-Saharan Africa excluding South Africa (GATT, 1991). Her trade policies have witnessed extreme swings from high protectionism in the first few decades after independence to its current more liberal stance. Tariffs have at various times been used to raise fiscal revenues or to protect domestic industries from foreign competition or both. Various forms of non-tariff barriers (NTBs) such as quotas, prohibitions, licensing schemes, among others were also extensively used in the past to limit the quantity of imports of a particular good.

Following the economic difficulties of the early 80s, the government through the Economic Stabilization Act of 1982 and the import restrictive policies of 1984, imposed high tariff and NTB measures in order to curb imports. However, the resulting decline in demand for foreign exchange also led to an appreciation of the naira leading to a tax on exports of both traditional and emerging industrial goods.

Since 1986, the Nigerian government has undertaken series of trade and foreign exchange reforms under the SAP. They include trade liberalization measures such as elimination of imports and exports licenses, reduction in the number of prohibited imports, removal of price controls, export promotion initiatives and market-oriented changes in the foreign exchange system (GATT, 1991). A tariff reform was also introduced in 1988 to provide a more stable and predictable tariff regime, through the establishment of a tariff structure meant to be in place for at least 7 years. However, over the years, especially between 1986 and 1988, some of the trade liberalization measures introduced have been reversed.

Oyejide, Ndulu and Gunning (1997) document reforms for various SSA countries, including the simplification of tariff regimes, the removal of NTBs and the pursuit of more satisfactory real exchange rate regimes. However, in spite of the rapid progress made in the direction of dismantling trade restrictions, Wang and Winters (1998) still contend that SSA countries are mostly substantially less open than those of East Asia countries and countries in the Western hemisphere. In addition, the reforms also suffer from credibility problems in terms of their sustainability as in some cases they have been subjected to reversals.

Table 1 compares tariff structure is three African countries Nigeria, South Africa and Zimbabwe. Although, on the average the tariff rates in Nigeria are much higher than in South Africa, it is clear that they are substantially lower than what obtains in Zimbabwe. Secondly, the rates in Nigeria have declined over the period. Similarly, the standard deviation of tariffs declines in Nigeria and in South Africa but increases in Zimbabwe. Highly dispersed rates increase the level of protection substantially.

Table 1: Tariff Structure across Selected African Countries

Year	Nigeria		South Africa		Zimbabwe	
	1988	1995	1988	1995	1996	1998
1.All products						
Simple mean tariff (%)	26.0	21.8	12.7	8.5	40.8	22.2
SD of tariff rates	16.7	15.7	11.8	10.2	15.0	17.9
Weighted mean tariff	23.8	20.0	12.0	4.4	38.1	17.5

2.Primary Products						
Simple mean tariff	33.3	29.5	6.3	8.0	34.2	27.0
Weighted mean tariff	32.3	20.8	4.3	1.6	32.1	23.8
3. Manufactured Products						
Simple mean tariff	25.2	20.2	12.9	8.6	41.4	21.7
Weighted mean tariff	21.4	19.9	12.4	5.7	38.9	16.7

Source: World Bank (2001)

Table 1 also shows that tariff structure is lower for manufactured products compared to primary products in the case of Nigeria and Zimbabwe. The reverse is the case for South Africa.

Table 2 compares trade openness indicators for Nigeria with the average for SSA and East Asia. It is clear form the table that Nigeria compares favourably with the regional averages.

Table 2: Measures of Trade Openness Nigeria and Selected Regions

Year	Nigeria		SSA		East Asia	
	1989	1999	1989	1999	1989	1999
1. Trade in goods						
a. % of PPP GDP	21.3	20.5	15.9	16.3	14.5	15.3
b. % of Goods GDP	79.6	83.2	78.1	95.6	82.7	91.1
2. Growth in real trade less growth (89-99)	2.2	N/A	N/A	N/A	N/A	N/A
3. Gross private capital flows (% of PPP GDP)	3.5	4.3	2.1	4.9	1.3	3.8
4. Gross foreign direct investment (% of GDP)	2.8	1.0	0.6	0.7	0.4	1.1

Source: World Bank (2001)

Table 3 below shows the unweighted tariff structure for Nigeria in year 1999. One of the features of this study is that we make a distinction between competitive and non-

competitive imports. The tariff structure is different for both types of imports. This can be seen from Table 3.

Table 3: Unweighted Tariff rates for Nigerian Imports, 1999

Sector	Non-competitive Imports	Competitive Imports
Agriculture	10	10
Consumer goods	26	41
Intermediate goods	15	20.2
Capital goods	10	16.8
Petroleum	24	27
Infrastructure	11	17
Services	10	15

Source: computed from Central Bank of Nigeria (CBN) and Federal Office of statistics (FOS) data

Table 4 further provides a trend analysis of the import tariff structure for Nigeria, between 1990 and 2001.

Table 4: Import Tariff Indicators (%) 1990 - 2001

	1990	1995	2001
a. Import duties			
• Average	35.7	24.4	27.5
• Range	0 - 200	0-150	0 - 100
b. Consumer goods			
* average	55.2	38.6	38.1
c. Intermediate goods			
* average	31.1	21.1	25.2
d. capital goods			
* average	17.1	11.3	16.1

Source: Oyejide T.A. (2001)

Going by Sachs and Warner's classification, it is obvious that the average tariff rate in Nigeria is less than 40 per cent. This is the outcome of the liberalization of the economy under the SAP. Moreover, there has been a significant decline in tariff escalation and also on scale of non-tariff barriers. Since the introduction of SAP in

1986, the number of items in the prohibition list has been substantially reduced from about seventy-five to about sixteen broadly defined product categories, excluding those banned for such reasons as national security, public health, safety, among others. In general, there are no export taxes in Nigeria.

What is also obvious about the Nigerian tariff structure as presented in Tables 3 and 4 above is that in general the tariff rates on imported intermediate inputs are much lower than on final imports. This has implications for effective tariff rates. Another direct observation from the tariff structure is that consumer goods sector enjoys the highest rate of protection.

4.0 Computable General Equilibrium [CGE] Analyses:

4.1 The Main Characteristics and Uses of Computable General Equilibrium Models.

The CGE modelling approach represents an attempt at facilitating empirical applications of the Walrasian general equilibrium theory, which provides a framework for explaining the interdependence of economic activities. A CGE model is styled computable because the model allows for explicit computation of numerical solutions. The CGE models belong to the class of simulation models, which are suitable for counterfactual analysis. In other words they allow us to find answers to if ... type of questions. The CGE group of models as a class of computable multi-sectoral models share some common characteristics. One of such features is the endogenous determination of quantities and relative prices within the models. In this respect, CGE models differ sharply from input-output and programming models used for development planning purposes. Another common feature of CGE models is their ability to numerically solve for market clearing prices in all product and factor markets. Finally, CGE models in general focus more on the real side of the economy than on the monetary side even though some models do include financial instruments and financial markets in their specifications.

Formalized analyses of general equilibrium systems have provided insights into the factors determining the allocation of resources and the distribution of income in market economies. With the development of CGE models, general equilibrium theory has become

an operational tool in empirically oriented economic analysis. Thus, a CGE model often can serve as a useful and versatile empirical simulation laboratory for analyzing quantitatively, the likely impacts of trade policy measures on a set of micro and macro variables in the economy.

CGE models allow the analyst to make allowance for the direct incorporation of the peculiar structural characteristics of any particular economy in his specifications. It represents a vast improvement over highly simplified models that are not able to capture both direct and indirect effects of specific policy measures. Using CGE models not only allow for general equilibrium effects to be taken into account but also makes room for the study of the interaction of different policy measures (Iqbal and Siddiqui 2001). The technical innovation of CGEs is that they escape the constraints of linearity. A CGE model is a much better representation of real economies than its linear predecessors (Iqbal and Siddiqui, 2001). According to Shovey and Whalley (1992), "...the virtue of using applied general equilibrium models is that, once constructed, they yield a facile tool for analyzing a wide range of policy changes. Such analysis generates results that either confirm existing null hypotheses, or challenge the prevailing view. Sometimes the conclusions deriving from the model are rejected as inappropriate. This may result for example from the assumptions being considered unrealistic, errors may be unearthed, or other factors may undermine confidence in the results. Whatever the nature of the results might be, the modeler and those involved in the policy decision-making process invariably gain some new insights that may influence existing perspectives, as a result if using the model.

In the last two decades, there has been a proliferation of general equilibrium models developed for developing as well as developed countries. Since, Johansen, doctoral thesis in 1960, several CGE models have been developed and applied. Several factors aided the rapid development of CGE models in policy analysis. First, is the development in computing facilities and solution algorithm to solve large-scale non linear equations. Second, is the publication of two major books at the World Bank – Dervis, De Melo and Robinson (1982) and Taylor, et al (1980).

4.2 Structure and Equations of the CEAR-CGE Model of the Nigerian Economy

The model structure follows earlier work of Dervis, de Melo and Robinson (1982) and its application to Cameroon by Devarajan, et al (1994) and to Nigeria by Dorosh (1996) and Iwayemi and Adenikinju (2001). The model pays particular attention to detailed modeling of the trade sector of the economy.

4.2.1 *Equations of the CEAR-CGE Model*

The specification of a CGE model is based on two fundamental principles of economic analysis in a market economy. These are optimization and equilibrium considerations. Thus the system of equations forming the model describes the behaviour of various economic agents, the constraints they face, and the equilibrium conditions in factor and product markets in which they operate. The equations for the CGE model follow closely the structure of the corresponding social accounting matrix (SAM). The system of equations of the model is typically divided into the following blocks:

THE PRICE BLOCK

The price block essentially describes the structure of incentives facing the private sector. The government uses a combination of domestic and foreign taxes to form a wedge between domestic prices and international prices and between production costs and market prices.

The equations in the price block define the domestic prices of the various categories of goods distinguished in the model. Our model follows the tradition of most trade-focused CGE models. There is a fundamental distinction between tradeable and non-tradeable goods. The former is further subdivided into exportables and importables. This characterization leads to the definition of composite producer and consumer goods. The definition of prices takes into consideration the above classification of goods and the tax policies in place. Thus the domestic prices of importables (PM_I) and exportables (PE_I) are given by the following two equations:

$$PM_I = PWM_I * (1 + tm_I) * ER \qquad (1)$$

$$PE_i = \frac{PWE_i * ER}{1 + te_e} \qquad (2)$$

where ER is the naira/US dollar exchange rate, PWM_i and PWE_i are the world market prices (in US dollars) of imports and exports respectively, tm_i is the ad valorem import tariff and te_i is the export tax rate. For non-competitive imports, the domestic price PIM_i is also defined as:

$$PIM_i = PWI_i * (1 + tim_i) * ER \qquad (3)$$

As far as producer prices are concerned, the price of the composite producer good XS_i, is defined from the equation giving the value of domestic output, D_i:

$$P_i * XS_i = PD_i * D_i + PE * E_i' \qquad (4)$$

where PD_i is the domestic sale price at factory gate, D_i domestic sales (valued at factory gate), and E_i the level of exports.

The equation giving the net price or unit value-added of an activity is:

$$PVA_j = P_j (1 - tprod_j) - \sum_i PC_i a_{ij} \qquad (5)$$

Where $tprod_j$ is the indirect tax rate in the sector, PC_i is the price of the consumer composite good to be defined later and a_{ij} the relevant input-output coefficients.

The user price (PC_i) of the consumer composite good is derived in a manner analogous to the derivation of the price of the producer composite good. Use is made here of the equation giving the value of domestic sales. We thus have:

$$PC_i * Q_i = PD_i * D_i + PM_i * M_i \qquad (6)$$

Two additional prices are defined in the model, namely the price of capital goods and the aggregate price index. These are described by equations 7 and 8.

$$PK_j = \sum PC_i * IMAT_{ij} \qquad (7)$$

Where PK_j is the price of a unit of capital in sector j, and $IMAT_{ij}$ is the (i,j) element of the capital composition (or investment) matrix, i.e. the demand for investment good I per unit of investment for sector j.

Finally, the aggregate price index is computed as a weighted average of user prices for composite goods. Thus:

$$PINDEX = \sum_I \theta_i * PC_I \qquad (8)$$

Where θ_i is the share of consumption goods i in total private consumption.

THE SUPPLY BLOCK

In the supply block, sectoral production is guided by profit maximization subject to economic and technological constraints. We assume a simple Cobb-Douglas production function to represent value added in each sector. The choice of Cobb-Douglas production function is dictated by the ease of estimation and also because previous studies have shown it is appropriate for describing the Nigerian economy (Adenikinju, 1994).

$$XS_j = AD_j L_{1J}^{\alpha 1} K_j^{(1-\alpha)} \qquad (9)$$

Where AD_j is a constant.

Assuming that capital is fixed in each sector, perfect competition prevails and producers seek to maximize profits. This implies that labour input will be

demanded up to the point where its wage equals its marginal value product. This condition is translated as follows:

$$W * L_j = \alpha_{lc,j} * PVA_j * XS \qquad (10)$$

When the model is solved, it is this average wage that will change to equate labour demand and supply according to the following equations:

$$\sum_j L_{lc,j} = L^s_{lc} \qquad (11)$$

The domestic supply is allocated between domestic sales, D_i, and exports, E_i. As it is conventional with most CGE Trade models, we make a distinction between imported final goods and those that are domestically produced. The Armington principle is therefore employed to aggregate imported goods and domestic goods into a composite good that is demanded by the consumer. Similar approach was also adopted in handling exports and domestic goods. This implies that the allocation of goods between domestic market and foreign market would then depend crucially on relative prices between domestic and foreign markets and on the elasticity parameters. In terms of export demand we also follow the example of most CGE trade models that assume some market power to the country, implying that the country faces a downward sloping demand curve for its exports. This is given by the following equation:

$$E_i / EO_i = \left(\frac{PWEO_i}{PWE_i} \right)^{\eta i} \qquad (12)$$

Where $PWEO_i$ is the initial world price of exports and ηi is the elasticity of demand for exports of sector i.

Furthermore, if we assume that the allocation is made such as to maximize the value of domestic output given by equation 3 subject to constant elasticity of transformation between domestic sales and exports:

$$XS_i = AT_i \left(\gamma_i E_i^{\rho t} + (1-\gamma_i) D_i^{\rho t} \right)^{1/\rho t} \qquad (13)$$

then the relative export supply is given by:

$$\frac{E_i}{D_i} = \left[\frac{PE_i^*}{PD_i} * \frac{(1-\gamma_i)}{\gamma_i} \right]^{\phi} \qquad (14)$$

For imports the country is assumed to face a perfectly elastic supply of imports at given world prices. The relative share of imports in total absorption depends on relative prices and the elasticity of substitution between imported and domestic goods. It is assumed that consumers purchase a composite good which is a CES (constant elasticity of substitution) aggregation of imports and domestic goods according to the following equation:

$$Q_i = AC_i \left(\delta_i M_i^{-\rho i} + (1-\delta_i) D_i^{-\rho i} \right)^{-\frac{1}{\rho i}} \qquad (15)$$

Where AC_i is a constant and δ_1 is the share parameter.

Minimizing the cost of acquiring a unit of the composite commodity yields the following relative demand for imports:

$$\frac{M_i}{D_i} = \left(\frac{PD_i^*}{PM_i^*} * \frac{\delta_i}{1-\delta_i} \right)^{\sigma_i} \qquad (16)$$

Where $\sigma_i = \frac{1}{1+\rho_i}$, is the elasticity of substitution.

The equations for non-traded goods are simpler than those for traded goods. For non-exportable goods, equation 13 reduces to:

$$XS_i = D_i \qquad (17)$$

For non-importable goods, the aggregation equation 15 becomes:

$$Q_i = D_i \qquad (18)$$

THE DEMAND BLOCK

The following components of domestic demand for the composite commodity are identified in the model: intermediate demand, private consumption, government demand for final goods, the demand for capital goods and demand for non-competitive imports. The levels of these variables are determined in general by the income-expenditure patterns of the various sectors in the economy.

Intermediate Demand

Given the assumption that the amount of intermediate input i required in the production process j is in direct and fixed proportion to the level of output in sector j, the total demand for good i for intermediate use is given by:

$$INT_i = \sum_j a_{ij} XPTACT_j \qquad (19)$$

Private Consumption

We identify only one aggregate household in the model. The consumption of commodity i by the household is assumed to be a fixed share of total expenditure:

$$PC_i * CD_i = Cles_i * (Y\text{-}S\text{-}TDIR*Y) \qquad (20)$$

Where CD_i stands for real consumption of commodity i.

Savings is made up of autonomous and induced components

$$S = SAVHHh + s* Y \qquad (21)$$

Total income of households has two basic components: wages and returns to capital. A household is assumed to receive all the labour income flowing from the production process and also a share of the profit going to the firms in the economy. The total income received by households is given by:

$$Y = \sum W L_i + \lambda^* \sum_i R_i K_i \quad (22)$$

GOVERNMENT CURRENT ACCOUNTS

Let β_i^G and GDOT stand respectively for government expenditure shares and real government consumption, then government consumption of good i is given by the equation:

$$GD_i = \beta_i^G .GDTOT \quad (23)$$

Government revenues are equal to import tariffs (TARIFF), export duties (DUTY), indirect taxes on production (PRODTX), direct taxes on households (DIRTX), direct taxes on firms (DFIRM) and tariffs on non-competitive imports (COMPETE)

$$GR = DFIRM + TARIFF + DUTY + PRODTX + DIRTX + COMPETE \quad (24)$$

$$TARIFF = \sum_i TM_i * PWM_i * ER \quad (25)$$

$$DUTY = \sum_i TE_i * PE_i * E_i \quad (26)$$

$$PRODTX = \sum_j TPROD_j * P_j * XS_j \quad (27)$$

$$DIRTX = \sum_h TDIR_h * Y_h \quad (28)$$

$$DFIRM = TK * (1- \lambda)^* \sum_i R_i K_i \quad (29)$$

$$COMPETE = \sum_i Tim_i * IMT_i * XS_i * PWI_i \quad (30)$$

Government savings is defined as:

$$GOVSAV = GR - \sum_i PC_i * GD_i \quad (31)$$

OTHER INSTITUTIONS

Firms receive all the incomes (YF) accruing to capital and allocate this amount as dividend payments to households, tax payments to firms while the balance is regarded as the savings of the firms (SF).

$$YF = \sum_i R_i K_i \quad (32)$$

$$SF = YF - ((TK + \lambda) * \sum_i R_i K_i) \quad (33)$$

INVESTMENT DEMAND

Since this is a static model, it is worth mentioning that, even though investment is a source of demand it does not affect current capital stock. Investment by sector of origin is determined by the composition of investment in each sector.

$$ID_i = \sum_j IMAT_{ij} * DK_j \quad (34)$$

Where Dk_j is investment by sector of destination and $IMAT_{ij}$ are the fixed shares of investment good I in total private investment in sector j.

$$PK_j * DK_j = KIO_j * SAVINGS \quad (35)$$

Where SAVINGS is total savings and is equal to the sum of total household savings (S), government savings (SG), savings of firms (SF), foreign savings (FSAV) multiplied by the exchange rate (ER) and depreciation (DEPRECIA):

$$SAVINGS = S + SG + SF + FSAV * ER + DEPRECIA \quad (36)$$

Depreciation is assumed to be a fixed percentage ($DEPR_j$) of the value of the capital stock in each activity j:

$$DEPRECIA = \sum DEPR_j * PK_j * K_j \quad (37)$$

THE CURRENT ACCOUNT AND FOREIGN SAVINGS

The Current account equation defines foreign savings (expressed in terms of foreign currency) as the total value of imports less the total value of exports:

$$\sum_i PWM_i * M_i + \sum PMI * IMT * XS = \sum_i PWE_i * E + FSAV * ER \quad (38)$$

SUPPLY - DEMAND BALANCE AND CLOSURE

For the model to be complete we must specify system constraints that it must satisfy. These are embedded in the supply-demand equilibrium conditions and the chosen closure rule. In a neo-classical model describing a competitive market economy, prices adjust to clear factor and product market. While capital is assumed to be fixed for each sector, labour is perfectly mobile, implying that wages adjust to clear labour markets.

With respect to goods market, for each composite good i, supply must equal demand.

$$Q_i = INT_i + CD_i + GD_i + ID_i \quad (39)$$

Where CD_i is total household consumption of commodity i:
Total GDP (YGDP) is equal to value added plus indirect taxes:

$$YGDP = \sum_j PVA_j * XS_j - DEPRECIA \quad (40)$$

4.3. DATA ISSUES

At the heart of a CGE model is the Social Accounting Matrix (SAM). The SAM provides a snapshot representation of an economy usually over a period of one year. It captures the feedback relationships between production and income. A SAM is a square matrix consisting of sub-matrices or accounts. Although most SAMs have the

same basic structure, the treatment of individual accounts, particularly in terms of level of aggregation, varies between studies. The structure of any particular SAM is often dictated by the nature of the study for which it is intended. The SAM is a data intensive table, even though it is constructed for a single period. A balanced SAM is a necessity for a CGE model. The key accounts in a SAM include: Production account, Income account, Factor account, Institutions account, and Savings - investment account.

The 1999 input-output table, produced by the Federal Office of Statistics (FOS) and the Nigeria Institute of Social and Economic Research (NISER) provide the main inputs for the construction of our SAM. This was supplemented by data from the Central Bank of Nigeria [CBN] Annual Reports and other data sources.

The FOS table contains 30 production sectors. However for the purpose of the study, this was re-aggregated into 7 production sectors: Agriculture, Consumer goods, Intermediate goods, Capital goods, Petroleum, Infrastructure and Services. Each of the production sectors produces its own commodity. Two primary factors of production consisting of capital and labour are identified in the SAM. Four institutions are distinguished: These are, household, firms, government and the foreign sector.

An aggregated SAM for the economy in 1999 is presented in ***Table 5***.

5.0 *POLICY SIMULATIONS*

This section examines the effects of various major trade policies on the economy. The following simulations were considered in this study.

Case 1: 50 per cent reduction in tariff on competitive imports.

Case 2: 50 per cent reduction in tariff on non-competitive imports.

Case 3: A combination of cases 1 and 2.

Case 4: 10 percent depreciation in exchange rate to bridge the gap between official and parallel market.

Case 5: a 10 per cent increase in foreign savings inflow

Cases 1 to 3 are direct trade policy measures. These measures are consistent with World Trade Organization (WTO) goal of promoting freer global trade by removing existing constraints to free trade. Case 4 is not strictly speaking a direct trade policy

measure, but a trade policy enhancing measure. Sachs and Warner (1997) had shown that a country could be adjudged as open or not, depending on the disparity between the official and black market exchange rates. It is obvious that over the last few years in Nigeria, there has been a widening of the gap between the two exchange rates. Hence, this particular scenario is expected to assist in evaluating the impact of the closing of the gap. Scenario 5 is a measure whose outcome is similar to measures of trade openness (e.g. imports/GDP). In this particular case, we expect exogenous inflow of foreign investment into the economy. This is also equivalent to a cut in debt service or debt payment commitments.

6.0 ANALYSIS OF RESULTS

The impacts of the various alternative scenarios considered above are discussed in this section.

Case 1: 50 per cent reduction in tariff on competitive imports

The first scenario involves an equiproportional 50 percent reduction in tariff rates for all competitive imports. This implies a significant reduction in current levels of tariffs on competitive imports in Nigeria. With the implementation of such a tariff policy, tariffs for most imports would fall within the scope of what prevails for most developed countries.

The impacts of the policy on major macroeconomic variables are presented in table 6. The table shows that the impact is marginal. Real GDP remains unchanged. Average price level declines by 0.01 per cent. Real income rises by 0.04 per cent. Imports, exports and consumption record marginal positive changes. Investment and government revenue however declined. The latter is primarily because imports tariffs constitute an important source of non-oil government revenue in Nigeria. The fall in government revenue also affects domestic investment given the fact that government is the major source of domestic investment in Nigeria.

		I	II	III	IV	V	VI	VII
		ACTIVITIES	COMMODITITES	FACTORS	INSTITUTIONS	CAPITAL ACCOUNT	ROW	TOTAL
I	ACTIVITIES	495982.41	1170453.75			300544.68	1018967.4	2985948.2
II	COMMODITIES	0			2067558.98			2067559
III	FACTORS	2381489.12						2381489.1
IV	INSTITUTIONS	17053.82	37364	2381489	1556909.499			3992816.3
V	CAPITAL ACCOUNTS	0			285963.8694		14580.808	300544.68
VI	ROW	91422.89	859741.23		82384.0895			1033548.2
VII	TOTAL	2985948.24	2067558.98	2381489	3992816.438	300544.68	1033548.2	12761906

Table 5: An Aggregated Social Accounting Matrix for Nigeria - 1999

Table 6: Impact of a 50% Reduction on Tariffs on Competitive Imports on key Macro variables (percentage change over the Base Year)

Variable	Percentage change
Real GDP	0.00007
Average Price Level	-0.01
Real Income	0.04
Government Revenue	-0.36
Import	0.19
Export	0.06
Consumption	0.11
Investment	-0.78

The sectoral impacts of the policy measure are further explored in table 7. Again the effects are quite moderate. The output of Agriculture and Infrastructure sectors experience marginal decline while other sectors record positive marginal changes. Imports and exports rise for most of the sectors. The fall in tariffs also lead to a fall in consumer prices, with the intermediate goods sector recording the highest reduction in price. As would ordinarily be expected, the fall in price stimulates private consumption, which increases in all the sectors.

Table 7: Changes in Sectoral variables as a result of 50 per cent decrease in tariffs on competitive imports (percentage change over the base year)

	Prod	Import	Export	Consumption	Prices	Labour
Agriculture	-0.00	0.28	0.05	0.05	-0.04	-0.04
Consumer goods	0.06	0.83	0.59	0 89	-0.88	1.44
Intermediate goods	0.00	0.90	1.48	1.06	-1.05	0.10
Capital goods	0.00	-0.09	0.17	0.12	-0.12	-0.41
Oil	0.01	2.53	0.05	0.29	-0.29	1.10
Infrastructure	-0.05	0.20	-0.06	0.04	-0.04	-1.24
Services	0.01	0.07	0.08	0.07	-0.06	0.12

Case 2: 50 per cent reduction in tariff on non-competitive imports

Rather than pursuing a reduction in tariffs on competitive imports, government trade policy may be targeted at protecting domestic producers by retaining the existing

tariff structure on competitive imports, but reducing the tariffs paid on non-competitive imports. This is the objective the second scenario attempts to evaluate. The impacts of such a policy on the economy are presented in Tables 8 and 9.

Table 8 provides an overview of the macroeconomic impact of a 50 percent reduction in tariffs on non-competitive imports. Just as in the case of the first scenario, the impact of this policy is very marginal. Real GDP increases slightly by about 0.02 per cent. Average price level remains unchanged. Government revenue and investment expectedly decline. Exports and consumption increase slightly as real exchange rate depreciates.

Table 8: Table 5: Impact of a 50% Reduction on Tariffs on Non-Competitive Imports on Macrovariables (percentage change over the Base Year)

Variable	Percentage change
Real GDP	0.02
Average Price Level	-0.00
Real Income	-0.02
Government Revenue	-0.25
Import	-0.12
Export	0.01
Consumption	0.03
Investment	-0.55

Table 9: Changes in Sectoral variables as a result of 50 per cent decrease in tariffs on non-competitive imports (percentage change over the base year)

	Prod	Import	Export	Consumpt	Prices	Labour
Agriculture	-0.01	-0.03	0.02	0.02	-0.02	-0.25
Consumer goods	-0.03	-0.03	0.07	0.12	-0.12	-0.76
Intermediate goods	-0.02	-0.38	0.35	0.22	-0.22	-0.48
Capital goods	0.04	-0.15	0.21	0.04	-0.04	0.52
Oil	0.00	0.01	0.00	-0.00	0.00	0.29
Infrastructure	0.02	-0.13	0.09	0.06	-0.06	0.48
Services	0.01	-0.05	0.06	0.03	-0.03	0.10

In terms of the sectoral impacts, Table 9 shows that the sectoral effects are weak. Some sectors however expand marginally while others contract. Labour demand rises

in expanding sectors and falls in declining sectors. Again, consumer prices fall in all the sectors due to a fall in production costs. Exports also increase, however, for most sectors imports decrease.

Case 3: Combined Tariff Reduction

Case 3 examines the impact of simultaneous 50 per cent reduction on all categories of imports. The impact of such a policy on the Nigerian economy is presented in Tables 10 and 11. Real GDP rises by 0.11 per cent. Average price level falls due to the reduction in production costs. Government revenue falls by -0.004 per cent. Imports, exports and consumption increase, albeit marginally.

Table 10: Impact of 50% Combined Reduction on Tariffs on Imports on Macro-variables (percentage change over the Base Year)

Variable	Percentage change
Real GDP	0.11
Average Price Level	-0.02
Real Income	-0.08
Government Revenue	0.00
Import	0.13
Export	0.07
Consumption	0.15
Investment	-0.01

The sectoral effects are similar to those of the previous cases. Each sector's response to the changes depends critically on elasticities of substitution and production parameters. The qualitative resp of prices and consumption to the policy change is uniform across the sectors.

Cases 1 to 3 show that the impact of the tariff reduction on economic performance is low. This is due to a number of reasons. First, is the existing low tariff rate, which already implies that tariffs constitute a very small proportion of producer costs. Thus, the fall in tariff rates has marginal impact on producers' behaviour. The second reason has to do with the moderate substitution possibilities between imports and domestic goods. This implies that the welfare costs of distortions are small (Dornbusrch, 1992). Third, is the array of other non-tariff factors that militate against

the competitiveness of Nigerian producers such as infrastructure failures, supply bottlenecks, technical barriers to trade, and leakages in the system among others. All of these factors combine to limit the impact of tariff reductions on the economy.

Table 11: Changes in Sectoral variables as a result of 50 per cent combined decrease in tariffs on imports (percentage change over the base year)

	Prod	Import	Export	Consum	Prices	Labour
Agriculture	0.01	0.14	0.18	0.13	-0.13	0.24
Consumer goods	-0.22	-0.57	0.79	1.42	-1.40	-4.86
Intermediate goods	-0.18	1.14	0.88	0.81	-0.81	-5.45
Capital goods	-0.13	0.00	-0.10	0.07	-0.08	-1.71
Oil	0.01	2.70	-0.04	0.23	-0.23	1.73
Infrastructure	-0.00	0.10	0.05	0.09	-0.10	-0.08
Services	0.02	0.10	0.07	0.25	-0.05	0.35

It is however obvious that the reduction in tariffs leads to a fall in government revenue as tariff revenue constitutes an important component of government non-oil revenue in Nigeria. The decline in government revenue also affects government savings and thus overall investment. This is because government savings is a major component of the volume of savings available for investment in the economy.

One other important result from cases 1 to 3 is that the trade policy changes result in some positive impact on GDP. This implies that a reduction in tariffs on imports may enhance the competitiveness of domestic goods, as exports rise in most of the sectors of the economy.

Case 4: 10 percent depreciation in exchange rate to bridge the gap between official and parallel market.

The results of this simulation are presented in Tables 12 and 13. The results show that the depreciation of the real exchange rate has significant impact on the economy. As expected there is improvement in balance of trade as exports grow and imports decline. Domestic prices increase on the average by about 3.2 per cent as a result of

the depreciation. The rising domestic price level also leads to a fall in domestic consumption. Overall, Real GDP increases by less than 1 percentage point. Aggregate consumption and investment decline by -4.4 per cent and -3.9 per cent respectively.

Table 12: Impact of a 10% Depreciation in Real Exchange Rate on key Macro-variables (percentage change over the Base Year)

Variable	Percentage change
Real GDP	0.45
Average Price Level	3.18
Real Income	-0.78
Government Revenue	-1.32
Import	-4.18
Export	12.80
Consumption	-4.39
Investment	-3.92

Table 13 shows the sectoral impacts of the depreciation. The depreciation causes significant adjustments in most of the sectors. Imports decline in most of the sectors while exports increase. However, the higher consumer prices result in sharp fall in consumption in all the sectors. The fall in real wages also lead to increase in demand for labour in most of the sectors, except the declining sectors like capital goods and services.

Table 13: Changes in Sectoral variables as a result of 10 per cent Depreciation of Real Exchange rate (percentage change over the base year)

	Prod	Import	Export	Consum	Prices	Labour
Agriculture	0.38	-14.03	14.54	-1.08	0.48	13.70
Consumer goods	1.01	-7.95	5.16	-5.53	5.21	25.2
Intermediate goods	0.07	10.78	-9.48	-14.85	16.74	2.12
Capital goods	-0.49	-0.30	-0.66	-9.67	10.04	-6.47
Oil	0.06	-6.63	0.95	-7.48	7.43	8.71
Infrastructure	0.219	-4.47	2.45	-7.82	7.83	6.15
Services	-1.25	-9.07	7.01	-3.83	5.54	-21.48

Case 5: a 10 per cent increase in FDI

The final scenario relates to increase of 10 per cent in net inflow of foreign investment.

Table 14: Impact of a 10% Increase in Foreign Inflows on key Macro variables (percentage change over the Base Year)

Variable	Percentage change
Real GDP	2.17
Average Price Level	2.25
Real Income	-3.68
Government Revenue	1.41
Import	2.60
Export	-1.45
Consumption	-0.71
Investment	41.15

From Table 14, it is obvious that Real GDP increases by about 2.2 per cent, imports also increase by 2.6 per cent, however, the appreciation of the real exchange rate arising from the exogenous inflow of foreign investment leads to a fall in exports. Investment increases by about 41 per cent since the foreign sector constitutes an important component of total savings available for investment. Domestic price level rises by about 2.25 per cent. However, consumption declines marginally under this scenario. The sectoral impacts are presented in Table 14.

Table 15: Changes in Sectoral variables as a result of 10 per cent Rise in foreign Inflows (percentage change over the base year)

	Prod	Import	Export	Consum	Prices	Labour
Agriculture	0.23	0.58	-0.08	-0.13	0.21	7.91
Consumer goods	0.15	31.35	-11.32	-12.07	13.83	3.48
Intermediate goods	-2.02	2.59	-6.35	-2.58	2.73	-4.93
Capital goods	-0.31	0.56	-1.10	-0.10	0.18	-4.10
Oil	-0.56	5.54	-1.36	-1.95	2.07	-5.20
Infrastructure	-0.38	0.37	-0.73	-0.23	0.31	-9.92
Services	0.49	1.10	-0.10	-0.22	0.30	9.75

7.0 CONCLUDING REMARKS

It is very obvious from the simulation results that the economic impact of tariff reduction is very low. This is because of a number of reasons. First, the level of importance attached to tariffs prior to the adoption of SAP in 1986 has reduced considerably. Second, the welfare costs of tariffs and other impediments to trade depend on general equilibrium effects and market structure. Given the limited substitution between domestic goods and imports, the welfare improvement for tariff reduction is minimal. Thirdly, there are a plethora of factors beside tariffs that constrain the supply response of Nigerian manufacturers. These include infrastructural constraints, weak institutions, and policy inconsistency, among several others. Besides, there are other non-tariff barriers both from within and outside the country. While, the WTO arrangements may reduce the scale of the barriers from the country's trading partners, it is also on record that transportation costs within Africa are among the highest in the world. Another set of constraints that Africa must have to contend with relate to the serious disadvantages in the area of technology. It is a fact that technological development is capable of altering the nature and structure of comparative advantage and resulting pattern of trade.

Also there are constraints imposed by size of markets, which can be eased through economic integration. As discussed elaborately in an earlier study by Olofin (1991) improving trade competitiveness of sub-Saharan African countries would require working on easing these various constraints.

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Definition of Variables in the CGE Model

Endogenous Variables

CD	Total consumer demand of good i
DIRTX	Direct Tax
DK	Real investment by activity
DKTOT	Total real investment
DUTY	Export duties
E	Exports
SF	Firms savings
GD	Government consumption of good i
GOVSAV	Government savings
GR	Government revenue
ID	Private investment demand for good i
INT	Intermediate use of good i
L	Labour use (demand) in activity j
LS	Labour supply
M	Imports
PE	Domestic price of exported goods
PINDEX	National consumer price index
PK	Price of capital goods in activity j
PM	Domestic price of imported goods
PD	Price of domestically produced goods
P	Price of output of goods i
PRODTX	Revenue from producer taxes
PVA	Price of value added of activity j
R	Return on capital by activity
SAVHH	Savings by household
SAVINGS	Total value of savings
TARIFF	Tariff revenue
S	Total household savings
WA	Average wage rate

D	Domestic sales of production of commodity i
XS	Output of activity j
Q	Supply of commodity i
Y	Household income
YF	Firms income
YGDP	Definition of GDP

EXOGENOUS VARIABLES

ER	Exchange rate (Naira/dollar)
DEPRECIA	Depreciation
DEPR	Depreciation rate
FSAV	Foreign savings
GDTOT	Total government consumption
K	Capital stock in activity j
PWM	World import price in dollars
PWE	World exports price in dollars
PWI	World Import price of non-competitive imports in dollars
TE	Export tariff rate
TMR	Import tariff rate
TIM	Import tariff rate on non-competitive imports