

**IMPACT OF MACROECONOMIC SHOCKS ON HOUSEHOLD POVERTY
AND INCOME INEQUALITY IN NIGERIA**

BY

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ABSTRACT

Poverty and income inequality are huge development challenges in Nigeria. Over half of the population are living below the poverty line, which is further accentuated by highly skewed incomes. While it is widely held that the poor are more vulnerable to economic shocks, empirical information regarding the degree to which these shocks affect them is desired to ameliorate the problem. Hence, the impact of some macroeconomic shocks on poverty and income inequality in Nigeria was investigated.

The National Living Standards Survey (NLSS) data of 2004 by the National Bureau of Statistics and Nigeria's 2006 Social Accounting Matrix (SAM) by the International Food Policy Research Institute (IFPRI) were used. The NLSS employed a two-stage cluster sampling technique. The 19,158 housing units reported at the end of the survey were used in the analysis. The NLSS provided data on households' income and expenditure whereas the SAM provided data on production, income, consumption and capital accumulation. The modified IFPRI SAM used comprised 21 matrix accounts; made up of four activity sectors (food, other agriculture, crude oil and manufacturing/services) and four different household groupings (rural-south, rural-north, urban-south and urban-north). Data were analysed using Foster-Greer-Thorbecke poverty measures and Gini-index, computable general equilibrium technique, and sensitivity of poverty and inequality to macroeconomic shocks (fluctuations in food and crude oil prices, exchange rate, and a combination of these).

Average incomes in rural-south and rural-north households were ₦234.0 (± 206.8) and ₦211.5 (± 198.2) per person per day respectively. Food and other agricultural imports constituted 30.0% of total imports consumed by households. Poverty incidence was 55.0%, 47.3%, 75.1%, 40.4% and 47.2% respectively for Nigeria, rural-south, rural-north, urban-south and urban-north, while national inequality was 0.42. A 50.0% rise in food price increased poverty by 4.9%, 2.0%, 3.9% and 4.2% respectively for rural-south, rural-north, urban-south and urban-north. Conversely, a fall in oil price by 50.0% increased poverty by 3.0% in rural-north but reduced same by 8.7%, 0.8% and 1.8% in urban-north, rural-south and urban-south respectively. A 25.0% depreciation in the exchange rate increased poverty by 2.5%, 0.3%, 2.2% and 3.3% respectively in rural-south, rural-north, urban-south and urban-north. The combined impact of the shocks increased poverty by 8.6%, 7.1%, and 7.0% respectively in rural-south, rural-north and urban-south, although shocks did not impact on poverty among urban-north households. National inequality level dropped by 0.05% and 0.26%,

respectively, following the increase in food price and exchange rate, while it rose by 1.41% due to the fall in oil price.

Overall, shocks impacted all household groups mostly negatively but rural-north households were most affected, as they now accounted for about 47% of the poor in Nigeria after the shocks. This indicates that the challenge of poverty reduction is greatest in the rural-north, and hence interventions need be targeted at this region before others.

Keywords: Macroeconomic shocks, Poverty incidence, Income inequality, Nigerian households, Simulations

Word count: 457

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DEDICATION

To the two most important women in my life

My mother, Beatrice

For her selflessness

And

My love, Ann

For her inspiration

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To Him, our Almighty God, who sits on the throne and unto the Lamb, our Lord Jesus Christ, be all praise and honour, glory and power, forever; for most mercifully, steadfastly and excellently seeing me through to the end of this pursuit of deepening human knowledge for the benefit of mankind and the greater magnification of His holy name!

I am indebted to my thesis committee for their effort to ensure that this research work was well carried out. In particular, I am full of thanks for my major supervisor, Dr. B. T. Omonona for his invaluable contributions toward my completion of this programme: I am yet to meet any of his kind. I pray God Almighty, the provider of all good things, to bountifully reward him for being an exemplification of godly virtues of meekness, humility, sincerity and selflessness. My earnest appreciations go to Dr. S. A. Yusuf for introducing me to general equilibrium modelling, and subsequently becoming the 'technical' supervisor of the thesis. His assistance and encouragement helped in no small measure to bring this thesis to completion. He personally, facilitated my attendance of a CGE workshop organized by the IFPRI in Abuja. That was actually my first time in a CGE class! My thanks are also due to Dr. O. A. Oni, who even when he became part of the thesis committee toward the end, contributed greatly, especially by insisting on oral assessment rather than just written output. Last but by no means the least in my gratitude to the committee, is my (posthumous) appreciation to late Dr. (Mrs.) O. I. Y. Ajani, who was part of the supervision in the beginning but did not live to see the completion of this work. May God Almighty grant her humble soul eternal rest!

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CERTIFICATION

I certify that this work was carried out by Mr. Nkang Moses NKANG in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy in Agricultural Economics, under my supervision.

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CHAPTER ONE

INTRODUCTION

No Society can surely be flourishing and happy, of which the far greater part of the members are poor and miserable.

- Adam Smith

1.1 Background to the Study

Economic crises have often been accompanied by shocks which may be idiosyncratic or covariate (macroeconomic) in nature. Existing empirical evidence suggests that macroeconomic shocks can cause social distress, which manifests directly or indirectly in increased poverty and inequality levels among other welfare issues, as a result of a fall in output and real incomes associated with a crisis (Lustig, 1998 and 2000; Skoufias, 2003; Damuri & Perdana, 2003; Essama-Nssah, 2005; Conforti and Sarris, 2009).

Further evidence reported by Lustig (2000), Mbabazi (2002), Skoufias (2003), World Bank (2008), among others, has shown that developing countries are mostly affected by the impact of macroeconomic shocks following an economic crisis. In particular, according to the World Bank (2008) an additional 20 million people on average are pushed into poverty, as a result of a one percent fall in the growth of output of developing countries following a crisis. This, they however stated depends, amongst other factors, on the distribution of income, social policies, and the sector/geographic incidence of changes in income.

Poverty and inequality have been found to be implicitly related apart from their indirect relationship via economic growth (Bourguignon, 2004; Aigbokhan, 2008). Given this relationship, it has been recognised by Hanmer and Naschold (2000), that at least in the context of Africa, the Millennium Development Goals (MDGs) on poverty reduction cannot be achieved without reductions in inequality, as it has been documented that income inequality matters when it comes to making progress on poverty reduction (Addison and Cornia, 2001; Naschold, 2002). Thus, as a developing country and one that has had a historical record of high levels of poverty and inequality, the recent world economic crisis would have impacted Nigeria's economy in several ways and in varying degrees.

The economic crisis, which started with the steep rise in world food prices between mid-2007 and mid-2008, was a cause of grave concern among policymakers as it portended huge implications for poverty and food insecurity in low income countries

(Ellis and White, 2010). The food price crisis was linked to poor harvests in Australia and Russia, increase in bio-fuel production, diminished world food stocks, export bans in leading exporting countries, among other factors. World Bank researchers had predicted that rising commodity prices would cause the poverty headcount in low income countries to increase by more than 100 million (Ivanic and Martin, 2008), including over 30 million in Africa alone (Wodon and Zaman, 2008).

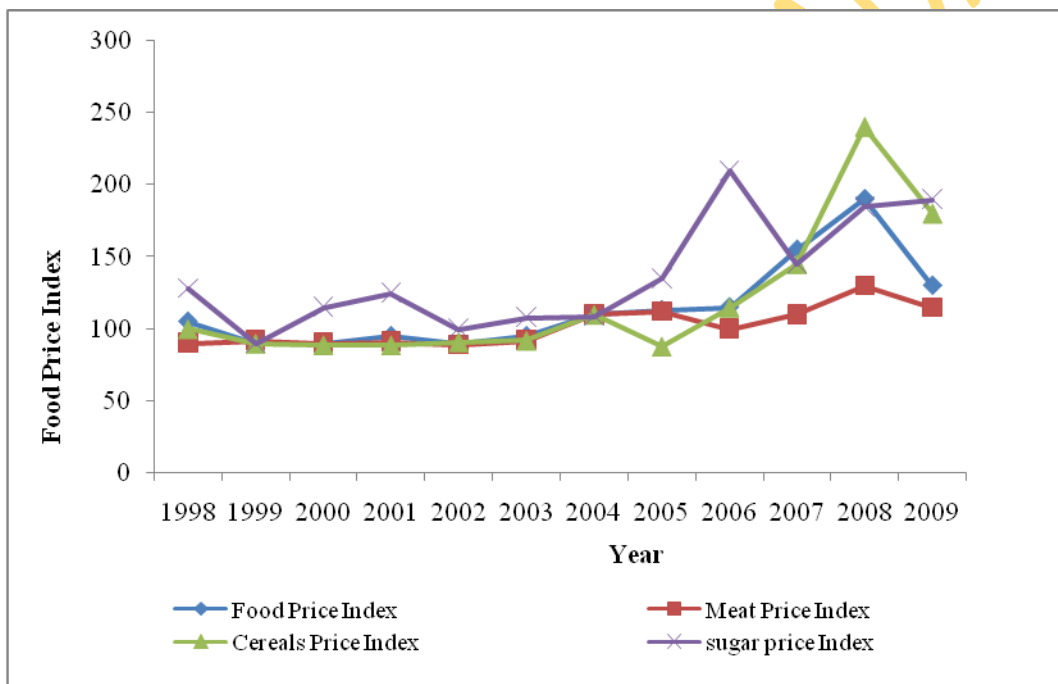
Worsening the food price crisis was a quick upward jump in oil prices, which was attributed on one hand to rapid economic growth, particularly in India and China, and on the other, to speculative behaviour around future long-run scarcity. Indeed, the price of oil hit an historic high of US\$140 per barrel in June 2008. For a net oil exporting country like Nigeria, this was a signal of good fortunes, but it turned out to be very short-lived.

From June 2008, all prices began to decline, although at various rates. The decline in cereal prices was initially linked to good harvests arising from favourable weather conditions and the incentive provided by the initial high prices which had boosted planted area. However, the major reason for this rapid decline was the emerging global financial crisis which was triggered by global banking crisis caused by the over-exposure of banks in the US and Europe to financial derivatives based in non-performing loans. By September 2008 a meltdown of the international financial system was in sight, prompting one of the most dramatic reversals in oil prices, which in turn fed into the cereal price fall. Thus, the financial crisis was seen as adding to the severity of the circumstances facing the poorest countries, and the discussion turned to the so-called '3 Fs crisis' for food, fuel, and finance (Ellis and White, 2010).

During the crisis, the Nigerian economy experienced a flurry of exogenous shocks, which could portend far-reaching macroeconomic impacts, especially on the wellbeing of households which are a core entity in development and poverty reduction endeavours. Prominent among these shocks were increased domestic and imported food prices, a fall in oil revenues, following the sudden plunge in oil prices in the international market, and depreciation of the real exchange rate, among others (see, Soludo, 2009).

The food price shocks experienced during the crisis, and attributed to increasing global demand for food, high fuel prices and adverse supply movements could portend diverse implications for the poor, especially the impact on their real incomes. Agenor (2005) notes that because the poor allocate a large share of their income (or own

production, if they are self-employed in agriculture or the urban informal sector) to subsistence, the impact of macroeconomic price shocks on the goods and services that they consume matters significantly. Indeed, it is widely accepted that high food prices were having a more adverse impact on the poor because of the disproportionately high amount that is spent on food, since they pay more for their food and receive less for their produce (FAO, 2009). World food prices had risen by 53 percent during the crisis, based on the FAO food price index for the first three months of 2008, (Reyes, Sobrevinas, Bancolita and de Jesus, 2008; FAO, 2009), thus leading to increased social tensions and political upheavals in net food importing countries, and food export restrictions in net exporting countries. The extent of this shock, based on FAO statistics, is depicted in Figure 1.1 below.



Source: Boccanfuso and Savard, 2009

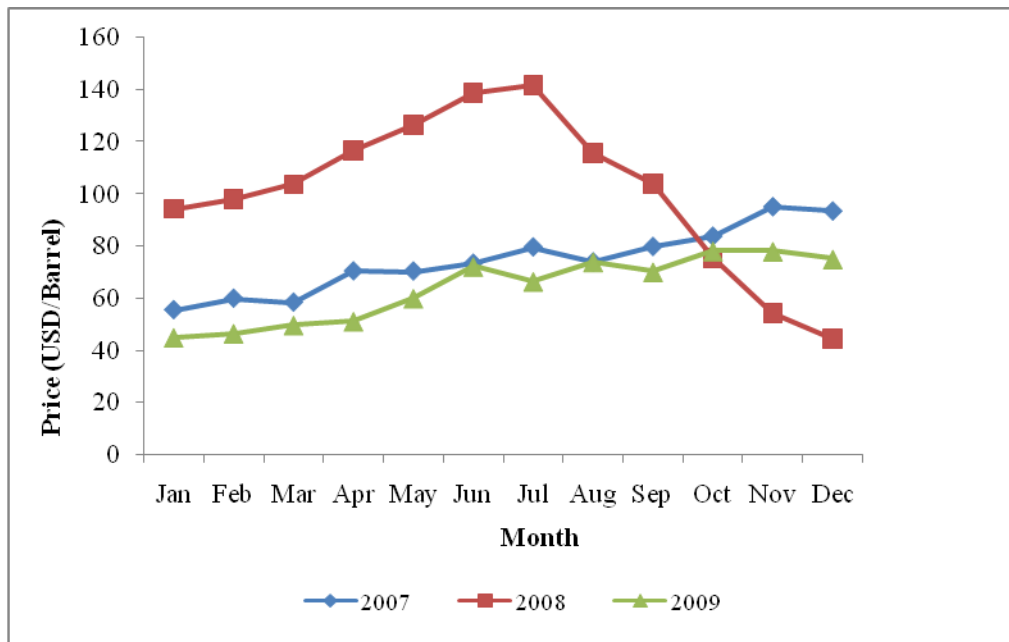
Figure 1.1: Annual food price indices of selected food commodities, 1998 – 2009 (2002-2004=100)

The intervention in the food price crisis in Nigeria in 2009 by the Federal Government underscores the explosive nature of food prices during the crisis. To ameliorate the impact of this shock, government had announced the removal of import tariff on rice, the single most important staple food import in Nigeria, for six months, in order to mitigate the adverse impact of increased prices on consumers. The intervention by government was not only a temporary measure of mitigating the social cost of adverse price shocks, but was also hardly, informed by facts regarding the segments of the

economy that needed the most help. Thus, the need for an empirical investigation of the impacts of the food price shocks on socioeconomic groups, merits consideration.

Away from the food price shocks, the plunge in oil prices was also a cause for concern for a net oil exporting country like Nigeria. The effect of extreme volatility, especially, falling crude oil prices can be better appreciated from the point of view of its importance in fiscal (budget) policy. Crude oil exports play a significant role in the Nigerian economy as evidenced not only in being the largest contributor in terms of total government revenue but also as the overall leader in her exports composition. Approximately 95 percent of Nigeria's exports come from oil and this, according to the World Bank (2003), has not changed much since 1974. More recent data show that crude oil contributes over 90 percent to total exports and roughly 30 percent to Gross Domestic Product (GDP), aside constituting about 80 percent of government revenues (CBN, 2006; Akpan, 2009; Kilishi, 2010, among others). Consequently, a small change in oil price, be it a rise or fall, can have a large impact on the economy. For example, Kilishi (2010), notes that a US\$1 increase in oil price in the early 1990s increased Nigeria's foreign exchange earnings by about US\$650 million (2 percent of GDP) and its public revenues by US\$320 a year.

In 2008, oil prices rose to an all time high of over US\$140 per barrel in July/August (see, figure 1.2) and dropped abruptly to less than US\$40 per barrel by December, when the 2009 appropriation bill was presented to the National Assembly. This indicates a decline of about 250 percent at the time, thus fuelling concerns about its impacts on the economy and the wellbeing of citizens. The explosive nature of oil prices in the world market makes the Nigerian economy vulnerable to this external shock despite being the 6th largest producer of crude oil in the world, and has caused among other problems, instability in government fiscal revenues as well as terms of trade shocks owing to the country's high dependence on oil. Given that fiscal revenue volatility is frequently cited as a source of difficulty in delivering high quality public services that reduce poverty, then investigating the effect of this shock in the context of the recent crisis becomes very vital.



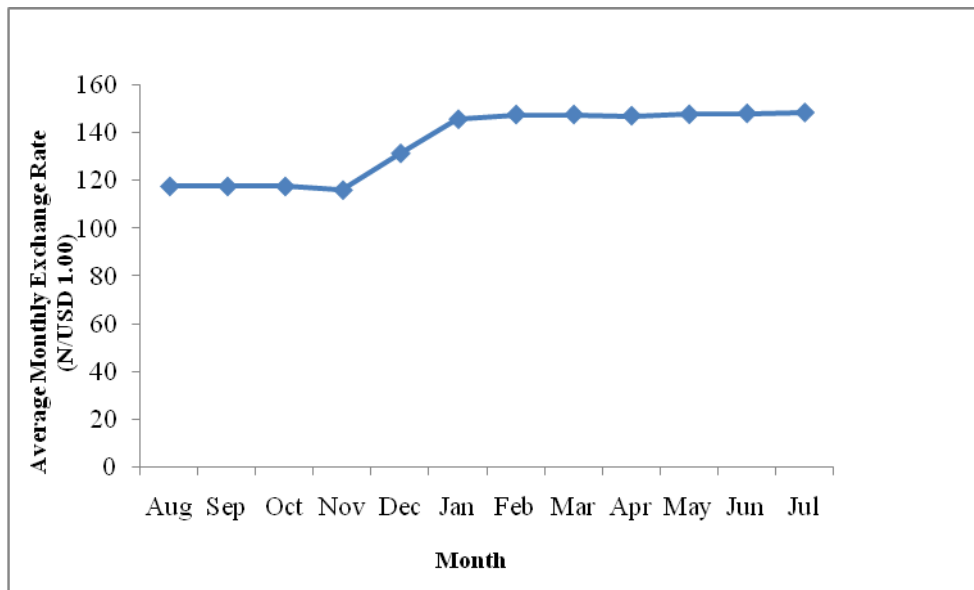
Source: Central Bank of Nigeria (CBN) Statistical Bulletin, 2010

Figure 1.2: Average Monthly Crude Oil Prices, 2007 - 2009

Following the depression in oil prices during the economic crisis, was the depreciation in exchange rate, made worse by the financial contagion from the global crisis. Aliyu (2009), observed that with the deregulation of the foreign exchange market in 1999 after the era of guided deregulation, the naira-dollar exchange rate stood at N86.322 to a dollar, but with the huge inflow of oil revenue, occasioned by a hike in oil price in December, 2007, the exchange rate stood at N117.97 to a dollar, which remained relatively stable until towards the end of 2008 when the global financial crisis took its toll and the naira exchange rate depreciated from N116.20 in November to N131.5 in December, 2008, and further to N142.00 in February, 2009. This marked a decline in value of 22.20 percent from the November, 2008 value (see, figure 1.3).

Fluctuations in the real exchange rate, which manifests as appreciation or depreciation, or sometimes premeditated devaluation shocks, as part of policy interventions, could have important implications on incomes and inequality (Cororaton and Cockburn, 2004; Tomori, Akano, Adebisi, Isola, Lawanson and Quadri, 2005). Generally, devaluation may be seen as a conscious use of the real exchange rate as a tool to improve balance of payments by increasing exports, boosting prices of domestically produced import substitutes and reducing imports, since importing would become more expensive, resulting in a more diversified production structure. Changes in the above described phenomena have varied implications on different segments of the economy, relative prices, household incomes, and poverty depending on the initial

economic structure, available incentives, safety-net programmes and level of social protection and or policy responses.



Source: Central Bank of Nigeria (CBN) Statistical Bulletin, 2010

Figure 1.3: Average Monthly Exchange Rate (N/USD 1.00) August 2008 – July 2009

Literature has shown that the impacts of the outline shocks are economy-wide in nature, having direct and indirect as well as micro and macro repercussions in the economy and on poverty and income distribution (Lustig and Walton, 1998; Ferreira, Prenushi and Ravallion, 1999; Winters, 2000; Cockburn, Decaluwe and Robichaud, 2008; Mendoza, 2009). In view of their economy-wide nature, these shocks are better studied in a general equilibrium framework in order to capture the interrelationships among all sectors and agents in the economy. Consequently, this study is an attempt to quantitatively trace the impacts of the previously highlighted negative macroeconomic shocks on Nigerian households in terms of poverty and inequality, using general equilibrium techniques with a view to providing empirical evidence to guide policy intervention and stimulate further inquiry in this area of study.

1.2 Poverty and Inequality Trends in Nigeria

According to the NBS (2005), Nigeria emerged from colonial status as a poor country. This situation has not changed much until now. Instead, poverty in Nigeria has worsened and remained widespread and persistent. Be that as it may, in Nigeria, poverty is largely a rural phenomenon, as the economy is characterized by a large rural, mostly agriculture-based, traditional sector, which is home to about three-fourths of the poor,

and by a smaller urban capital intensive sector, which has benefited most from the exploitation of the country's resources and from the provision of services that successive governments have provided (Omonona, 2001 & 2009; Yusuf, 2002; NBS, 2005; Obi, 2007, among many). In spite of the benefits enjoyed by the urban sector, poverty still exists in urban areas substantially thus mirroring the endemic nature of the problem.

Thus, according to Obi (2007), the poor in Nigeria are not a homogeneous group. They can be found among several social/occupational groups and can be distinguished by the nature of their poverty. Using 1992/93 household survey data, the World Bank poverty assessment on Nigeria showed that the nature of those in poverty can be distinguished by several characteristics, which include sector, education, age, gender and employment status of the head of household (FOS,1995). Other characteristics included household size and the share of food in total expenditure.

Several causes have been advanced for the precarious poverty and inequality situation in Nigeria. They include, but may not be limited to, inadequate access to employment opportunities for the poor, lack or inadequate access to assets such as land and capital by the poor; inadequate access to the means of fostering rural development in poor regions; inadequate access to markets for the goods and services that the poor produce; inadequate access to education, health, sanitation and water services; the destruction of the natural resource endowments, which has led to reduced productivity of agriculture, forestry and fisheries; the inadequate access to assistance by those who are the victims of transitory poverty such as droughts, floods, pests and civil disturbances and inadequate involvement of the poor in the design of development programmes. These multidimensional causes of material and non-material deprivation make poverty to be very endemic in Nigeria (FOS, 1996).

However, the worsening of poverty in Nigeria, according to UNSN (2001) can be traced to factors such as poor and inconsistent macroeconomic policies, weak diversification of the economic base, gross economic mismanagement, weak inter-sectoral linkages, and persistence of structural bottlenecks in the economy, high import dependence and heavy reliance on crude oil exports. Other factors include the long absence of democracy and the usurpation of political power by the military elite, lack of transparency and high level of corruption, declining productivity and low morale in the public service, as well as ineffective implementation of relevant policies and programmes (Tomori *et al*, 2005).

The National Bureau of Statistics (NBS), formerly Federal Office of Statistics (FOS) has conducted several nationally representative household surveys (1980, 1985/86, 1992/93 and 2003/2004) with a view of providing a poverty profile for Nigeria, among other considerations. Based on these surveys, a summary of the poverty and inequality statistics in Nigeria is presented in the tables that follow (see also Aigbokhan, 2008). NBS (2005) reports that the relative poverty measure used was based on one-third and two-third of mean per capita expenditure for core poor and moderately poor, respectively.

The statistics for poverty incidence and estimated population poverty shown in Table 1.1 revealed that poverty headcount dropped from 46.3 percent in 1985 to 42.7 percent in 1992; it rose sharply to 65.6 percent of the population in 1996 and then declined moderately to 54.4 percent in 2004. Nonetheless, in terms of absolute number of people living in poverty, the population of the poor in Nigeria increased almost four-fold between 1980 and 2004.

Table 1.1: Poverty Headcount in Nigeria, 1980 - 2004

Year	Poverty Incidence (%)	Estimated Population (Millions)	Population in Poverty (Millions)
1980	28.1	65	17.7
1985	46.3	75	34.7
1992	42.7	91.5	39.2
1996	65.6	102.3	67.1
2004	54.4	126.3	68.70

Source: National Bureau of Statistics (NBS, 2005)

Statistics showing the proportion of the non-poor, moderately-poor and core-poor shown in Table 1.2 reveal that the core-poor still make up about 40 percent of the poor in Nigeria as at 2004. Of particular note is that the proportion of the core-poor was more than doubled between 1992 and 1996 compared with that of the moderately-poor which increased only slightly.

Table 1.2: Poor and Core Poor in Nigeria, 1980 - 2004

Year	Non Poor (%)	Mod. Poor (%)	Core Poor (%)
1980	72.8	21.0	6.2
1985	53.7	34.2	12.1
1992	57.3	28.9	13.9
1996	34.4	36.3	29.3
2004	45.6	32.4	22.0

Source: National Bureau of Statistics (NBS), 2005

The statistics in Table 1.3 further shed light on the nature of poverty in Nigeria. It can be observed that urban poverty rose from 17.2 percent in 1980 to 58.2 percent in 1996, and by 2004 it declined substantially to 43.2 percent. In the same vein, there was a rise in rural poverty from 28.3 percent in 1980 to 69.3 percent in 1996, but dropped marginally to 63.3 percent in 2004, suggesting a more precarious situation in rural areas. Furthermore, when disaggregated by zones, it was clear that poverty is more concentrated in the northern zones compared with the southern zones. For example, in 2004, over 70 percent of those living in the north-east and north-western zones were poor.

Table 1.3: Incidence of Poverty by Sector and Zones in Nigeria, 1980-2004

	1980	1985	1992	1996	2004
National	28.1	46.3	42.7	65.6	54.4
<i>Sector</i>					
Urban	17.2	37.8	37.5	58.2	43.2
Rural	28.3	51.4	66.0	69.3	63.3
<i>Geo-Political Zone</i>					
South South	13.2	45.7	40.8	58.2	35.1
South East	12.9	30.4	41.0	53.5	26.7
South West	13.4	38.6	43.1	60.9	43.0
North Central	32.2	50.8	46.0	64.7	67.0
North East	35.6	54.9	54.0	70.1	72.2
North West	37.7	52.1	36.5	77.2	71.2

Source: NBS, 2005 and Aigbokhan, 2008

Looking more into the challenge of poverty in Nigeria, we consider the educational dimension of poverty as depicted in Table 1.4. First, it can be observed that poverty incidence decreases as one moves from no schooling to post secondary schooling, except for 1980, indicating that heads of household with no education are most likely to be in poverty. Second, the table reveals that between 1980 and 2004, poverty incidence increased over two-fold for all educational groups and all Nigeria.

Table 1.4: Poverty Incidence by Educational Levels of Household Heads in Nigeria, 1980-2004

	1980	1985	1992	1996	2004
No schooling	30.2	51.3	46.4	72.6	68.7
Primary	21.3	40.6	43.3	54.4	48.7
Secondary	7.6	27.2	30.3	52.0	44.3
Post secondary	24.3	24.2	25.8	49.2	26.3
All Nigeria	27.2	46.3	42.7	65.6	54.4

Source: FOS (1999) Poverty Profile for Nigeria 1980 – 96, and NBS (2005) Poverty Profile for Nigeria, Abuja

The occupational dimension of poverty incidence is pictured in Table 1.5. Generally, households whose heads engaged in agriculture had the highest incidence of poverty, except in 1980 and 1996. This was followed by households whose heads were engaged in the transport and production sector. About 67 percent of those in agricultural occupation in 2004 were poor compared with 31.5 percent in 1980. The highest poverty levels across almost all the occupations were experienced in 1996. This was probably due the abandonment of the rural agricultural policies implemented between 1986 and 1992 as part of the Structural Adjustment Programme (SAP). In all, the occupational perspective of poverty in Nigeria further affirms the endemic nature of the problem.

Table 1.5: Poverty Incidence by Occupation of Household Heads in Nigeria, 1980 - 2004

	1980	1985	1992	1996	2004
Professional & Technical	17.3	35.6	35.7	51.8	34.2
Administration	45.0	25.3	22.3	33.5	45.3
Clerical & related	10.0	29.1	34.4	60.1	39.2
Sales Workers	15.0	36.6	33.5	56.7	44.2
Service Industry	21.3	38.0	38.2	71.4	43.0
Agricultural & Forestry	31.5	53.5	47.9	71.0	67.0
Production & Transport	23.2	46.6	40.8	65.8	42.5
Manufacturing & Processing	12.4	31.7	33.2	49.4	44.2
Others	1.5	36.8	42.8	61.2	49.1
Student & Apprentices	15.6	40.5	41.8	52.4	41.6
Total	27.2	46.3	42.7	65.6	54.4

Source: NCS 1980, 1985, 1992, 1996, 2004

Since inequality as a measure of wellbeing matters for poverty, any meaningful discussion of poverty indices should consider inequality indices too. Inequality is important for poverty because according to McKay (2002), for a given level of average

income, education, land ownership, etc, increased inequality of these characteristics will almost always imply higher levels of both absolute and relative deprivation in these dimensions. Based on this reasoning, it is expected that efforts to bridge inequality gaps would most likely result in poverty reduction. Table 1.6 shows inequality trends by sector and zones in Nigeria as measured using the Gini coefficient.

Estimates in the table clearly indicate that at the national level, there was a rise in inequality from 1985 to 2004, although a slight decline was witnessed in 1992. At the sectoral and regional levels, there are some noticeable deviations from the national average inequality for the years under consideration. Furthermore, inequality increased markedly between 1996 and 2004. Aigbokhan (2008) contends that the national average inequality may have concealed rising inequality across states and sectors since the mid-1990s.

The statistics underlying the poverty and inequality situation in Nigeria seem incongruous in the face of the perceived abundant national wealth and the various programmes and policies that have been geared at poverty reduction in almost the last three decades. In next subsection we shall briefly discuss some key the poverty alleviation initiatives in Nigeria.

Table 1.6: Inequality Trend by Sector and zones in Nigeria, 1985 -2004

	1985	1992	1996	2004
National	0.43	0.41	0.49	0.488
<i>Sector</i>				
Urban	0.49	0.38	0.52	0.544
Rural	0.36	0.42	0.47	0.519
<i>Geo-Political Zone</i>				
South South	0.48	0.39	0.46	0.507
South East	0.44	0.40	0.39	0.449
South West	0.43	0.40	0.47	0.554
North Central	0.42	0.39	0.50	0.393
North East	0.39	0.40	0.49	0.469
North West	0.41	0.43	0.47	0.371

Source: Aigbokhan, 2008

1.3 Poverty Alleviation Initiatives in Nigeria

Following NBS (2005), past government efforts in poverty alleviation can be categorized into three main eras. These include those pursued before the Structural Adjustment Programme (SAP), during the Structural Adjustment Programme era/the Abacha regime and those initiated during the return to civil rule from 1999 to present.

Prior to the SAP era, poverty reduction programmes emphasized increased production and supply of food on the premise that availability of cheap food will mean higher nutrition levels and invariably lead to national growth and development. The programmes were also aimed at the provision of basic social and economic infrastructure that would boost employment generation, increase productivity, enhance incomes, and lead to a more egalitarian distribution of incomes. Notable among these programmes were the Operation Feed the Nation, OFN (1979) of the Military regime of Obasanjo and the Green Revolution (1979-1983) of the Shagari's administration.

The military regime of Buhari (1983-1985) did not have a specific poverty alleviation programme, as it clearly focused on fighting indiscipline and corruption, through the War Against Indiscipline, WAI, initiative, which, according to some analysts was equal to a poverty alleviation programme in the sense that indiscipline and corruption were partly the reason why many Nigerians were poor (Anonymous, 2011).

The Structural Adjustment Programme, SAP era, which spanned almost the entire Babangida administration (1985 – 1993), witnessed a broad range of poverty alleviation projects/programmes. The SAP stressed greater realization of the need for policies and programmes to alleviate poverty and provide safety-nets for the poor. Government efforts then could be categorized into nine groups: These were Agricultural Sector Programmes; Health Sector Programmes; Nutrition-related Programme; Education Sector Programmes; Transport Sector Programmes; Housing Sector Programmes; Financial Sector Programmes; Manufacturing Sector Programmes and Cross-Cutting Programmes. To implement some of these programmes, some institutions and agencies were established. These included People's Bank, Community Banks, Directorate of Food, Roads and Rural Infrastructure (DFRRI), Nigerian Agricultural Land development Authority (NALDA), National Directorate of employment (NDE) and Better Life for Rural Women.

According to analysts, the SAP failed because it had no human face in its implementation and it did not emphasize on human development which thereby aggravated socio-economic problems of income inequality, unequal access to food, shelter, education, health and other necessities of life. It ended up aggravating poverty especially among the vulnerable.

The Abacha regime introduced the Family Economic Advancement Programme (FEAP) out of the pursuit for a way out of unbearable poverty, occasioned by the ranking of Nigeria as one of the 25 poorest nations in the world. FEAP existed for about

two years (1998 – 2000) during which it received funding to the tune of N7 billion out of which about N3.3 billion was disbursed as loans to about 21,000 cooperative societies nationwide that were production oriented. There was also the Family Support Programme (FSP) which was basically targeted at women during the Abacha regime. The FSP introduced a gender element into anti-poverty programmes, based on the assumption that women needed special treatment because of their immense contributions to the national economy, both as small-scale entrepreneurs and home keepers.

However, based on a recent government assessment, most of these poverty alleviation programmes failed due largely to the fact that they not only lacked a clearly defined policy framework with proper guidelines for poverty alleviation but also lacked continuity as they suffered from policy instability, political interference, policy and macroeconomic dislocations, among other problems (Obadan, 2002).

Consequent upon the experiences of the past, the Obasanjo civilian administration which had at inception in May 1999 set out poverty reduction as one of its areas of focus, approved the blueprint for the establishment of the National Poverty Eradication Programme (NAPEP) – a central coordination point for all anti-poverty efforts from the local government level to the national level by which schemes would be executed with the sole purpose of eradicating absolute poverty. Some of such schemes identified include: Youth Empowerment Scheme (YES), Rural Infrastructures Development Scheme (RIDS), Social Welfare Services Scheme (SOWESS) and Natural Resource Development and Conservation Scheme (NRDCS) (see, Aliu, 2001). With a take-off grant of N6 billion approved for it in 2001, NAPEP has established structures at all levels nationwide. Under its Capacity Acquisition Programme (CAP), it trained 100,000 unemployed youths just as 5,000 others who received training as tailors and fashion designers, were resettled. A total of 50,000 unemployed graduates have also benefited from NAPEP's Mandatory Attachment Programme, which is also an aspect of CAP. The World Bank (2001/2002) later had to assist Nigeria in formulating poverty strategy programmes and policies through Interim Poverty Reduction Strategy Paper (IPRSP) with the aim of building on the gains of the earlier efforts on poverty programmes (PAP and PEP).

In the face of the growing concern to sustain the gains of the poverty efforts, the administration came up with a comprehensive home-grown poverty reduction strategy known as National Economic Empowerment and Development Strategy (NEEDS) in

2004. The NEEDS also builds on the earlier two years' efforts to produce the interim PRSP. The NEEDS as conceptualized is a medium term strategy (2003-2007) which derived from the country's long term goals of poverty reduction, wealth creation, employment generation and value re-orientation. The NEEDS is a national coordinated framework of action in close collaboration with the state and local governments and other stakeholders. The equivalent of NEEDS at State and Local Government levels are State Economic Empowerment and Development Strategy (SEEDS) and Local Government Economic Empowerment and Development Strategy (LEEDS). The NEEDS, in collaboration with the SEEDS will mobilize the people around the core values, principles and programmes of the NEEDS and SEEDS. A coordinated implementation of both programmes was expected to reduce unemployment, reduce poverty and lay good foundation for sustained development.

The findings of the Poverty Profile for Nigeria Report (2003/2004) from the Nigeria Living Standard Survey 2003/2004 showed the positive impact of the recent government anti-poverty reforms. The findings showed declining poverty rates compared with past figures. Nevertheless, anti-poverty efforts must be sustained and accelerated for their impact to be felt (NBS, 2005).

Based on the poverty and inequality statistics presented in the previous section, the highlighted government's poverty alleviation initiatives do not seem to have changed the widespread nature of poverty and inequality in Nigeria, probably due to some of the reasons earlier suggested, like lack of a clearly defined policy framework and inconsistencies in policy and implementation of poverty eradication programmes. Nonetheless, it may well be that there were no informed bases for policy efforts in the direction of poverty reduction.

1.4 Problem Statement

Poverty and inequality are huge development challenges in Nigeria. This is more so because, as Ajakaiye and Adeyeye (2002) notes, even in times of perceived economic progress in Nigeria, poverty and income inequality have remained widespread and pervasive. The National Bureau of Statistics (2005) reported that over 54 percent of Nigerians are poor in the relative sense, while it puts national inequality at 0.4882. These indices are even worse for the rural sector of which poverty incidence is 63.3 percent, with inequality coefficient of 0.5187. With the recent macroeconomic shocks that were experienced in the country, occasioned by the global economic crisis, the

poverty and inequality situation could have been aggravated as developing countries have been known to suffer the impact of macroeconomic shocks more, because of poor policy responses and social protection mechanisms, aside already existing poor welfare conditions. Furthermore, in the context of attaining the Millennium Development Goals (MDGs), especially MDG 1 which is targeted at reducing poverty and hunger by half by the year 2015 (United Nations, 2000) and in view of the fact the world poverty has been trending downward overtime (USAID, 2005), the challenge of poverty reduction as a topmost development priority becomes even more urgent in the Nigerian context, in the face of the already high levels of absolute and relative deprivation. However, in order to tackle this issue adequately, empirical evidence is required to provide an informed basis for policy interventions.

Past studies on the impact of macroeconomic shocks in Nigeria are few and far between. Some of the studies have pursued the impact of individual shocks in partial equilibrium frameworks without tracing the impacts at the household level (for example Tomori, *et al*, 2005; Olomola and Adejumo, 2006; Akpan, 2009; Aliyu, 2009; Kilishi, 2010). A good number that have been carried out in an economy-wide context have also fallen short of assessing the combined impact of prevailing shocks on poverty and inequality at the household level, aside not addressing the set of exogenous shocks considered in this study (examples include Yusuf, 2002; Oyeranti, 2005; Nwafor, Ogujiuba and Adenikinju (2005); Nwafor, Ogujiuba and Asogwa, 2006; Adenikinju and Falobi, 2007; Obi, 2007; Ekeocha and Nwafor, 2007; Busari and Udejaja, 2007). In all, there is still very scanty information on studies which have attempted to explore the impact of economic shocks (of food price, oil price and exchange rate shocks, individually and in combination) arising from the recent global economic downturn on Nigerian households. Consequently, the current study is an attempt to fill the these research gaps by measuring the impacts of these macroeconomic shocks which arose as a result of the economic crisis at the national level as well as on different household groupings in Nigeria, using an economy-wide framework with a view to providing an informed basis for government efforts to mitigate adverse impacts and or provide the required safety-nets. To pursue this broad goal, the following research questions were posed:

- i. What was the structure of the Nigerian economy in the base year, before the shocks?
- ii. What was the poverty status of the nation in the base year?

- iii. To what extent did the outlined shocks, separately and in combination impact households in terms of poverty and inequality?
- iv. How can the impacts of adverse shocks be mitigated in the short- and long-term?

In order to address these questions, this study uses a macro-micro analytical framework which links micro-level household data to macro outputs from a representative household (RH) computable general equilibrium (CGE) model to capture the impacts of macroeconomic shocks on household poverty and income inequality.

1.5 Objectives of the Study

The main objective of this study is to determine the impact of macroeconomic shocks on household poverty and income inequality in Nigeria. To achieve this main objective, the study pursued the following specific objectives:

- (i) to describe the structure of the Nigerian economy in the base year;
- (ii) to examine the poverty status of household groups in the study in the base year;
- (iii) to simulate the impacts of highlighted macroeconomic shocks on households' poverty indices and inequality using a CGE model;
- (iv) to draw policy implications and make recommendations based on the results of the study.

1.6 Justification of the Study

Although poverty reduction has received increased attention in major development discourses in over the past two decades, it remains one of the greatest development challenges in Nigeria, as it is still widespread and persistent, and even made worse because of widespread inequality in the distribution of incomes. However, in view of its importance, progress in poverty reduction has become a major indicator of the success of development policy, as well as that of the performance of socioeconomic systems (see, United Nations, 2000; Aigbokhan, 2008). Consequently, it becomes necessary to periodically assess the poverty and inequality status of a nation and its socioeconomic groups as well as the variables which may improve or aggravate it with a view of knowing who becomes worse or better off due to economic policies or shocks, so as to pursue the relevant policy options. This informs part of the motivation for the current study.

Beyond these, the Poverty Reduction Strategy Paper (PRSP) process of the World Bank/IMF unreservedly requires policy makers in developing countries seeking aid to help them in poverty reduction and other development projects, to present a framework for linkages between macroeconomic reforms/shocks and poverty (see Savard, 2003). The results from this study could help in fostering such a framework.

Since the income and expenditure structures of households are different, changes in factor remunerations and relative prices also affect households differently. Thus, it becomes necessary to assess the impacts of shocks on households' poverty and inequality, in recognition of the heterogeneity of households in any given population, and the need for proper targeting of interventions where the need arises (see Boccanfuso and Savard, 2009)

In Nigeria, the fact that over 50 percent of total population are poor should be of concern to policymakers and researchers, alike and thus any economic phenomena that is likely to aggravate this already precarious situation deserves attention and proper evaluation with a view to proffering policy recommendations. In the light of this consideration, the impact of the recent global economic recession and its attendant shocks on households' incomes, and consumption expenditures in Nigeria also makes the current study worthwhile. Again, poverty is increasingly being recognised not only as a social and economic problem but also as a policy problem in Nigeria. Thus, policy makers need evidence-based information regarding poverty dynamics to enable them to tackle it adequately (see Olaniyan and Bankole, 2005). This study serves to provide the much needed evidence for that purpose.

Other than these, in the context of achieving the Millennium Development Goals (MDGs) by 2015, particularly MDG1, which seeks to reduce hunger and poverty by half in the next few years, and for which Nigeria is still lagging behind as far as the indicators are concerned according to MDG Report (2010), the need for informed policy choices arising from empirical research findings becomes an imperative, in recognition of the danger in planning without facts. Thus, this study is also motivated by the fact that a lot more needs to be understood as far poverty mechanisms in Nigeria are concerned in the face of perceived abundant wealth in the country.

From a methodological point of view, this study is unique in the sense that previous studies (for example, Yusuf, 2002; Nwafor *et al*, 2005; Adenikinju and Falobi, 2006; Obi, 2007, among others) that have examined the impact of economic shocks using the same methodology of general equilibrium have assessed the impact of

individual shocks without finding the impact of such shocks in combination with others that may have been existing at the same time. This study addresses that gap by assessing the impact of individual shocks that prevailed in the wake of the economic crisis, and in combination, in recognition of the fact that the effect of some shocks could be counteracted by others, thus making the implications of such findings of little or no policy relevance if other shocks prevailed at the time.

1.7 Organisation of Study

This study is structured around six chapters. Chapter one is the introduction; made up of the background to study, poverty and inequality trends as well as poverty alleviation initiatives in Nigeria, problem statement, objectives and justification of study. In Chapter two the conceptual framework and a review of the theoretical literature guiding the study are presented. The conceptual framework covered the concepts of economic shocks and transmission channels, poverty and inequality as well as their types and measurement, while the review of theoretical literature was focussed on general equilibrium theory, computable general equilibrium analysis and approaches to CGE modelling in the context of poverty and inequality. Next is Chapter three which dealt broadly with a review of the body of empirical literature related to the study; first studies carried in Nigeria were pursued then studies outside Nigeria especially those focussed on Africa and other parts of the developing world. The methodology of the research, comprising data description, analytical framework, model specification and description as well as model implementation procedures, is presented in chapter four. The fifth chapter is comprised of the results and the discussion of same; first are the results from the SAM describing the economy in the base year, followed by the results of the equilibrium solution of the CGE model, the simulation results and finally the poverty and inequality results. The last chapter, six, is made up of a summary of the major findings and their implications, the main conclusions as well as recommendations.

CHAPTER TWO

CONCEPTUAL FRAMEWORK AND THEORETICAL LITERATURE REVIEW

2.1 Introduction

This chapter presents the conceptual framework for and theoretical literature review regarding the study of macroeconomic shocks in relation to poverty and income distribution mechanisms, in order to broaden our understanding especially of the conceptual meaning of the key terms and the relationships or mechanisms which theoretically tie them together. Section 2.2 deals with the concept of shock; the subsections provide conceptual definition to economic shock, macroeconomic shock and types of economic shocks. Section 2.3 presents the concept of poverty; similarly, the subsections deal with measurement of poverty and causes of poverty. Section 2.4 discusses the concept of inequality, while the subsections specifically deal with measurement of inequality, and the nexus between poverty and inequality. In section 2.5, we discuss the relationship between macroeconomic shocks with poverty and inequality by focussing especially on the transmission channels; however, in section 2.6 the discussion is focussed on the specific channels of transmission of the shocks studied. Finally, in section 2.7, we present the general equilibrium theory, computable general equilibrium analysis and the various approaches to CGE modelling in practice.

2.2 Concept of Shock

A shock could be defined as a sudden event beyond the control of economic authorities that has a significant impact on the individual or economy (see, Varangis, Varma, dePlaa and Nehru, 2004). This definition highlights essential characteristics of shocks, namely, a deviation from the normal or the expected, a trend that is unanticipated or exogenous, which results in significant effects on the individual or economy, and requiring adjustment on several fronts. Shocks are different from volatility because of their degree, and so shocks may be classified as instances of extreme volatility. A shock could either be positive or negative depending on whether its effect is beneficial or detrimental to the individual or economy. At the individual or household level, shocks can cause changes in household income, consumption and/or their capacity to accumulate productive assets. Similarly, shocks can cause fluctuations in national income, output and employment at the economy or community level.

Following the above distinction along the lines of the impact of shocks on either the household or community, they may broadly be divided into either idiosyncratic or covariate. Idiosyncratic shocks (e.g. non-communicative illness or accidents, frictional unemployment, etc) affect only the household while covariate shocks (e.g. financial crisis, inflation, crop failure, bad rainfall, drought, hurricane, etc) involve the entire community (World Bank, 1999). It is possible that covariate and idiosyncratic shocks may have different effects on the behaviour of the households. But more generally, a shock that affects the entire community may have a higher impact on the household (Hernandez-Correa, 2002). This may explain why economy-wide (or covariate) shocks have great influence on households and individual wellbeing, and consequently why their transmission mechanisms need be studied if their effects need at best be mitigated. Next we develop a definition for economic shock.

2.2.1 Economic Shock

An economic shock is an event that produces a significant change within an economy, despite occurring outside of it. Economic shocks are unpredictable and typically impact supply or demand throughout the markets. More formally, we may define an economic shock as an unexpected or unpredictable exogenous event that affects an economy, either positively or negatively (Lutkepohl, 2008; Investopaedia, 2011). In a technical sense, it refers to an unpredictable change in exogenous factors that is factors unexplained by economics – which may have an impact on endogenous economic variables, like income, output, employment, etc. An economic shock might emanate internally (from within the economy) or externally (from outside of the economy), and it may come in a variety of forms. For example, a shock in the supply of staple commodities, such as oil, can cause prices to skyrocket, making it expensive to use for business purposes. Another example is the rapid devaluation of a currency, which typically produces a shock for the import/export industry because a nation might have difficulty bringing in foreign products. Economic shocks are mostly covariate in nature, in the sense that their effects are felt through almost the entire economy but the signal, magnitude and duration of the shocks can vary markedly among different agents, sectors or markets in the economy.

2.2.2 Macroeconomic Shock

In the literature, the term macroeconomic shock has loosely been used to refer to an economic shock with economy-wide or aggregate effects on the economy. This presupposes that macroeconomic shocks are covariate in nature affecting both the individual economic units as well as the economy, as a whole. Consequently, macroeconomic shocks as used in this study refer to exogenous shocks, which could emanate internally (e.g. policy changes) or externally (e.g. changes in world commodity prices, droughts, hurricanes, etc.) but which outcomes have economy-wide implications through their effects on demand and supply.

In the current study, we explore the impacts of three major macroeconomic shocks, variously as well as in combination, experienced in the wake of the global economic crisis. Of this number, two - rise in the world price of food imports and fall in the world price of oil exports - are typically external, while the third - depreciation in the naira/dollar exchange rate - is internal (arising from a policy choice), though induced by financial contagion from the crisis in the global financial markets. Next we briefly explore the major types of shocks and how they can broadly impact the economy.

2.2.3 Types of Economic Shocks

There are many different ways of categorising shocks. The World Bank (1999) for instance classifies shocks into three major groupings based on the nature of the shocks. These are:

- i. Patterned versus generalised shocks (also known as idiosyncratic or covariate shocks): shocks which affect only certain individuals or households (e.g. non-communicative illness or accidents, frictional unemployment, etc.) call for different preparations and responses from shocks which affect all those in the society or region under question (e.g. financial crisis, inflation, crop failure in a monoculture rural economy).
- ii. Single versus repeated shocks: Many shocks are associated (e.g. disease following famine). Strategies capable of mitigating or coping with a single shock may give way under the impact of repeated shocks.
- iii. Catastrophic versus non-catastrophic shocks: This essentially relates to the magnitude of the shock, as discussed above: some shocks are relatively small, and can be absorbed through minor adjustments in the household

economy (selling some assets, reducing non-essential consumption etc.) but others are potentially devastating.

However, for the purpose of easy economic analysis, by way of providing the underlying economic impact of shocks, we would broadly categorise economic shocks in terms of how they affect demand or supply, and so we would basically distinguish between demand and supply shocks.

2.2.3.1 Demand Shocks

A demand shock is a sudden event that increases or decreases demand for goods or services temporarily. A positive demand shock increases demand and a negative demand shock decreases demand. Prices of goods and services are affected in both cases. In figure 2.1, a negative demand shock causes the aggregate demand curve to shift to left as a result, initial equilibrium level of national output, Y_e declines to Y_2 thus forcing equilibrium price to drop from P_e to P_2 . When demand for a good or service increases, its price typically increases because of a shift in the demand curve to the right. When demand decreases, its price typically decreases because of a shift in the demand curve to the left (Investopedia, 2011).

Demand shocks could emanate internally as a result of a fall in domestic demand or externally from outside the domestic economy due to a fall in foreign demand for domestically produced goods and services, as no country is immune to unexpected external economic shocks. In fact for countries which a large and rising share of their national output is linked directly to international trade in goods and services, and inflows and outflows of foreign investment, unexpected external shocks can cause huge fluctuations in their national income, output and employment (Adamu, 2009).

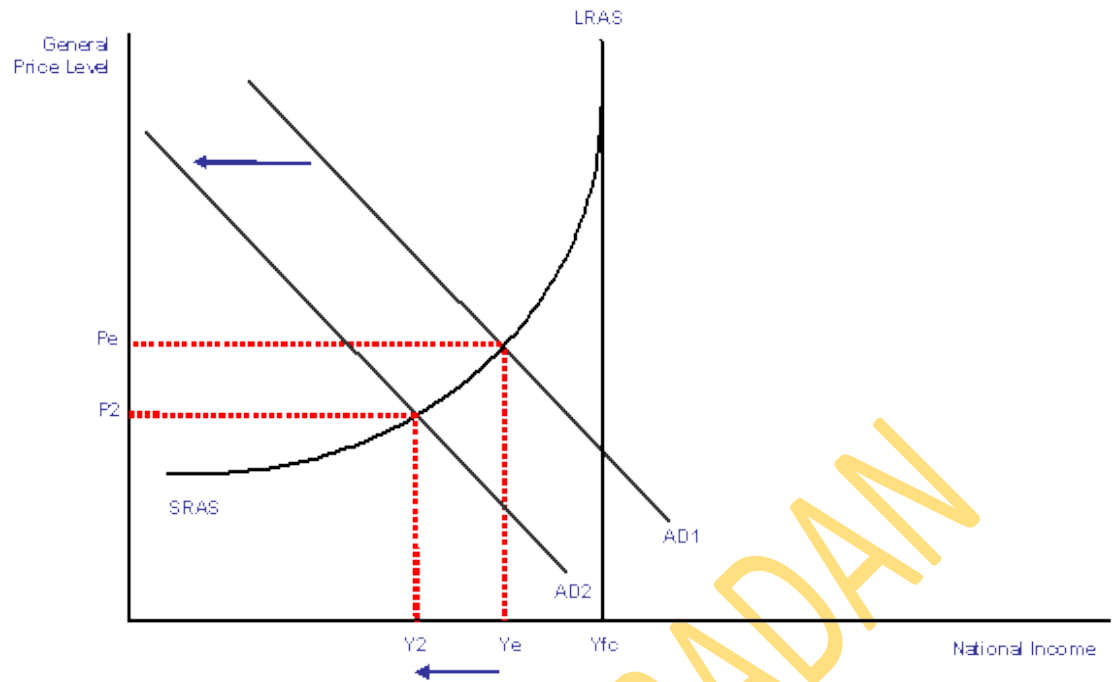


Figure 2.1: Impact of a Demand Shock in the Economy

Demand shocks can originate from changes in things such as tax rates, money supply, and government spending. During the global financial crisis of 2008, a negative demand shock in the United States economy was caused by several factors that included falling house prices, the subprime mortgage crisis, and lost household wealth, which led to a drop in consumer spending.

2.2.3.2 Supply Shocks

A supply shock is an unexpected event that triggers an increase or decrease in supply of goods or services temporarily. The sudden change in supply affects the prices of goods and services, hence the equilibrium price. When supply for a good or service increases, its price typically decreases because of a shift in the supply curve to the right. When supply decreases, its price typically increases because of a shift in the supply curve to the left.

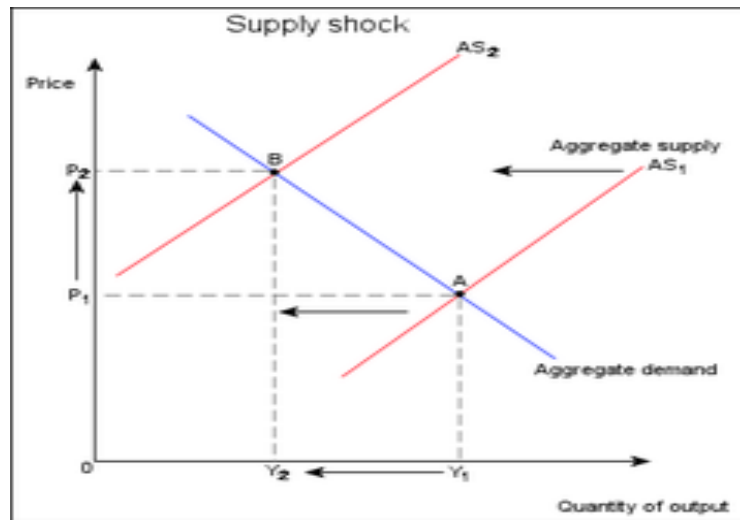


Figure 2.2: Impact of a Supply Shock in the Economy

Just like demand shocks, supply shocks could emanate internally as a result of a sudden change in domestic supply or externally from outside the domestic economy due to a sudden change in foreign supply. A negative supply shock (sudden supply decrease) will raise prices and shift the aggregate supply curve to the left (figure 2.2). This causes the equilibrium price P_1 to rise to P_2 , and aggregate output to decline from Y_1 to Y_2 thus establishing a new equilibrium at B. A negative supply shock can cause stagflation due to a combination of raising prices and falling output. A positive supply shock (an increase in supply) on the other hand will lower the price of said good and shift the aggregate supply curve to the right. A positive supply shock could be an advance in technology (a technology shock) which makes production more efficient, thus increasing output. An example of a negative supply shock is the increase in oil prices during the 1973 energy crisis.

2.3 Concept of Poverty

Put simply, poverty is concerned with whether households or individuals possess enough resources or abilities to meet their current needs. This characterization is based on a comparison of individuals' income, consumption, education, or other attributes with some defined threshold below which individuals are considered as being poor in that particular attribute. However, poverty defies a straightforward definition because it is a general and multifaceted concept, as it affects many aspects of the human conditions, including physical, moral and psychological (Ajakaiye and Adeyeye, 2002; Ogwumike, 2002; Olaniyan and Bankole, 2005).

Be that as it may, poverty has to be defined, or at least grasped conceptually, before it can be measured. Poverty means different things to different people. For example, Maxwell (1999) provides a listing of current terminology used variously in describing poverty to include:

- i. Income or consumption poverty
- ii. Human (under)development
- iii. Social exclusion
- iv. Ill-being
- v. (Lack of) capability and functioning
- vi. Vulnerability
- vii. Livelihood un-sustainability
- viii. Lack of basic needs
- ix. Relative deprivation

These terminologies have led to different views and definitions over time, and thus, conceptualizing poverty is by no means easy. According to Misturelli and Hefferman (2009), researchers have found 179 formal definitions to poverty constructed between 1970 and 2000, which translates to six new definitions a year. To help us grasp the subject matter of poverty, some of the definitions which have evolved over time up to the current thinking on the concept are attempted here.

According to the Asian Development Bank (undated), poverty is a deprivation of essential assets and opportunities to which every human is entitled. Based on this definition, Poverty is, thus, better measured in terms of basic education, health care, nutrition, water and sanitation, as well as income, employment, and wages. Such measures must also serve as a proxy for other important intangibles such as feelings of powerlessness and lack of freedom to participate.

While many economists and poverty researchers view poverty in terms of inadequate income for securing basic goods and services, other researchers have denoted poverty with the inability to meet basic nutritional needs (Dreze and Sen, 1990; among others). Some others view poverty, as functionally dependent on some social indicators such as level of education, state of health, life expectancy, child mortality, etc (Singer, 1975). Yet, a host of others use levels of consumption and expenditure as the criteria of identifying the poor (Musgrave and Ferber (1976); Blackwood and Lynch, 1994). But Sen (1983) relates poverty to entitlements (which are taken to be the various bundles of goods and services) over which one has command, taking into cognisance

the means by which such goods are acquired (for example, money and coupons, etc) and the availability of the needed goods. Poverty has also been viewed as inability of individuals to subsist and to produce for themselves as well as inability to command resources to achieve these (Sen, 1981; Amis and Rakodi, 1994). Even then, other experts see poverty in very broad terms, such as being unable to meet “basic needs”, namely, physical (such as food, health care, education, shelter etc) and non-physical (for instance, participation, identity, etc) requirements for a meaningful life (Streeten, 1979; Blackwood and Lynch, 1994; World Bank, 1996). According to Gordon, Nandy, Pantazis, Pemberton and Townsend (2003), poverty is also regarded as a condition characterised by severe deprivation of basic human needs, including food, safe water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to social services.

Given the fact that poverty is viewed and defined in many different ways, a succinct and generally accepted definition of poverty is yet still hard to pin down. However, as a multifaceted concept, poverty manifests itself in different forms depending on the nature and extent of human deprivation. Based on the many different views and conceptions of poverty, plus a consideration of its multi-dimensional nature, we rely on the World Bank (2000 and 2001) definition and conceptualization of poverty straightforwardly, as it has more adequately captured most of the yardsticks echoed by other researchers and poverty scientists, to depict the concept of poverty.

According to the World Bank (2000), in absolute terms, poverty suggests insufficient or the total lack of basic necessities like food, housing and medical cares. It embraces the inadequacy of education and environmental services, consumer goods, recreational opportunities, neighbourhood amenities and transport facilities. In relative terms, people are poverty-stricken when their incomes fall radically below the community average. The above definition suggests that such people cannot have what the larger society regard as the minimum necessity for a decent living.

More precisely, the poor can be defined as follows:

- i. Individuals and households lacking access to basic services, political contacts and other forms of support;
- ii. Households whose nutritional needs are not met adequately;
- iii. Ethnic minorities who are marginalized, deprived and persecuted economically, socially, morally, and politically; and

- iv. Individuals and households below the poverty line whose incomes are insufficient to provide for their basic needs (World Bank 2001).

A synthesis of the various positions has been made by the World Bank (2001) and thus

Poverty is the lack of, or the inability to achieve, a socially acceptable standard of living.

But a more recent definition of poverty by Veechi (2007) summarizes its meaning in three statements thus:

- i. Poverty is having less than an objectively defined absolute minimum.
- ii. Poverty is having less than others in society.
- iii. Poverty is feeling you do not have enough to get along.

In the above definition by Veechi (2007), absolute poverty is defined in the first statement while relative poverty is depicted in the second. These conform to the World Bank (2000) definition. However, the third statement in Veechi's definition introduces the element of subjectivity in defining poverty which is lacking in the World Bank's definition. Putting these definitions together, we find that the multifaceted nature of poverty is somewhat adequately captured, including Sen (1983) capabilities approach and Atkinson (1998) social exclusion view of poverty, among others.

The multi-dimensional nature of poverty has made income based measures and definitions of poverty to be widely criticized in the sense that income-poverty which gained prominence in the 1960s and later expanded in the 1970s to include basic needs (such as access to health, education and other services) by the International Labour Organisation (ILO), do not provide a true picture of the state of deprivation of the poor. However, Maxwell (1999) and Thorbecke (2005) have observed that the broader the definition of poverty the more difficult is its measurement, thus the complexity of measurement mirrors the complexity of definition, and this complexity increases where participatory methods are used and people define their own indicators of poverty. Little wonder why absolute and relative measures of poverty are more popular than subjective measures.

In spite of this criticism and the difficulty in measurement of poverty due to complex definitions, the standard way of assessing whether an individual is above or below the poverty threshold, according to Thorbecke (2005), is income. The logic and rationale behind the money-metric approach to poverty is that, in principle, an individual above the monetary poverty line is thought to possess the potential

purchasing power to acquire the bundle of attributes yielding a level of well-being sufficient to function. Agenor (2005) argues that the focus on income is justified to a reasonable extent because the impact of macroeconomic policy on the poor operates essentially through changes in earnings, and because changes in income tend to be highly correlated in the medium and long term with other social and demographic indicators, such as life expectancy, infant mortality, fertility and the literacy rate (the direction of causality remaining, of course, a matter of debate). In this study therefore, we rely on income/expenditure to measure household poverty in line with the arguments advanced above and the fact that the approach is much less cumbersome. Thus having attempted a grasp of the concept of poverty, next we expand the concept to discuss the different measures of poverty.

2.3.1 Measurement of Poverty

Like conceptualizing poverty, the measurement of poverty is complex and varies widely in practice. However, Wodon and Yitzhaki (2002) noted that three ingredients are required in computing a poverty measure. First, is the choice of relevant dimension and indicator of well-being, whether monetary or nonmonetary or both. Second, is the selection of a poverty line (whether absolute, relative, etc), that is, a threshold below which a given household or individual will be classified as poor. Finally, a poverty measure to be used for reporting for the population as a whole or for a population subgroup only, is chosen, and according to (Vecchi, 2007), the choice of different poverty measures can lead to conflicting results.

One of the major issues in the measurement debate is the use of monetary or monetary plus non-monetary components of poverty (Maxwell, 1999). Within this framework the assessment of the incidence, depth and severity of poverty, for example, using traditional money-metric measures, as it is often the case, is sometimes considered inadequate, in recognition of the multifaceted nature of poverty. However, for low income countries, measures which incorporate the non-monetary components like the capabilities approach, for instance, may not be very useful given that a certain threshold of income/expenditure might be required for certain capabilities to be attained. Thus using income and expenditure to measure poverty provides an adequate proxy for poverty, plus it allows us to by-pass the huge data requirements and computational complexities that the more encompassing capabilities approach for instance would entail (see for instance, Agenor, 2005; Thorbecke, 2005).

In spite of all the difficulties in conceptualizing and measuring poverty, why are economists, researchers, and policy makers interested in poverty measurement? This we address in the next subsection.

2.3.1.1 Why Measure Poverty

Poverty is measured because of a number of considerations. Many authors have documented the reasons why the measurement of poverty is important (Ajakaiye and Adedeye, 2002; World Bank, 2003; Olaniyan and Bankole, 2005; Tomori et al, 2005; among others). The reasons centre round the need for better living standards and well-being, particularly in the context of developing countries, aside the need for the assessment of the success of development policy, especially since the adoption of the Millennium Development Goals of the United Nations. Thus this section highlights the main reasons for measuring poverty, and benefits immensely from the thoughts of Ajakaiye and Adeyeye (2002) and the World Bank (2003).

For there to be improvements in living standards and/wellbeing, there need be a yardstick for measuring standard of living in the first place. Thus, one of the reasons why poverty measurement is important is to determine such a yardstick. There may be more than one criterion for measuring standard of living, but poverty measurement is one of the most important given that it is a broader concept in terms of scope of the parameters it can account for.

Understanding the characteristics of poverty can help policy makers think about the impact of growth strategies, and thus help them in developing a growth strategy as well as a guide on poverty alleviation. For example, with measures of poverty over time, we can assess if poverty has increased or decreased, or whether general economic growth helped the poor. With changes in relative prices, we can evaluate how these changes affect the poor. We can use poverty data to inform economy-wide policy reforms and how the poor are affected by such reforms.

Furthermore, measuring poverty helps us to track social spending. By collecting information on households and their economic status, we can assess who uses public services and who gains from government subsidies. If programmes are cut or there is retrenchment of the public sector, poverty data help inform us of the effects of these plans on the poor. Using information on poverty, we can simulate the impact of different policies.

One of the major reasons for poverty measurement is that it helps in the targeting of interventions. With data on household poverty status, we can evaluate the impact of

programmes on the poor and determine whether these programmes meet their goals with respect to targeting certain households. Targeting the design and placement of anti-poverty programmes is essential to effectively and efficiently reach disadvantaged groups and backward areas. Poverty profiles can help governments identify potential targeting by region, employment, education and gender. Probably the most important use of the poverty profile is to support efforts to target development resources towards poorer areas, aiming to reduce aggregate poverty through regional targeting and employment targeting, education targeting, gender targeting, and sectoral targeting.

Measuring poverty provides us with information and data that can be useful in making poverty comparisons over time, regimes, among individuals, households, socioeconomic groups, or even nations. This is necessary because it may be important to know why some countries, for example have better living standards even when their resource endowments may be very smaller compared with those found in poorer societies.

Counting the poor is very important to help policymakers to design programmes and policies to fight poverty. The World Bank introduced the Poverty Reduction Strategies Paper (PRSP) for the Highly Indebted Poor Countries (HIPC) in 1999, which is supposed to be a country-driven policy paper setting out a strategy for fighting poverty. The PRSP is becoming a central instrument of the Bank's lending programmes in many poor countries. The underlying principles of the PRSP are that this policy paper on fighting poverty should be country-driven, results-oriented and comprehensive, based on the participation of civil societies along with partnerships from donors. The key step for developing the PRSP lies in understanding the characteristics and causes of poverty, once it is known how many poor are there in a country. Thus, measuring poverty is the central theme of policy papers such as the PRSP.

In sum, the World Bank (undated Core techniques) summarises the reasons why poverty is measured into the following:

- i. cognitive purposes (to know what the situation is),
- ii. analytical purposes (to understand the factors determining this situation),
- iii. policy making purposes (to design interventions best adapted to the issues),
and
- iv. for monitoring and evaluation purposes (to assess the effectiveness of current policies and to determine whether the situation is changing).

The preceding discussion has shed light on the importance of measuring poverty. However, there are many different poverty measures in existence, each requiring different sets of data and also yielding different results, some of which may not be as desirable in terms of what they can be used for. For this reason, it is important to examine the properties of a good poverty measure in order to know which poverty measure is suitable in most situations. This we address in the next subsection.

2.3.1.2 Properties of a Good Poverty Measure

Before we begin discussion on the types of poverty measures in the subsections which follow, let us look at the properties that a good poverty measure should possess. In choosing any one poverty measure, there a number of properties that such a poverty measure should fulfil. According to Fields (2000), a good poverty measure must satisfy two main properties, which include strong monotonicity and distributional sensitivity. The monotonicity axiom presupposes that an increase in some poor person's income, holding the other poor persons' incomes constant must necessarily reduce poverty; or on the other hand, that the measure of poverty should increase when the income of some poor person or poor household decreases. This means that the poverty measure should be responsive to the severity of poverty of each individual.

In the case of distributional sensitivity, also referred to as the transfer axiom, a transfer of income from a poor individual to any other individual that is richer than him must increase poverty measure. According to Fields (2000) the most common poverty measures that satisfy these axioms are the Sen's index of poverty and the Forster-Greer-Thorbecke (FGT) class of measures. Other important properties of a poverty measure are that the measure should be additively decomposable among population sub-groups as well as ability to demonstrate the distribution of living standard among the poor. The FGT class of poverty measures satisfies these axioms, and thus was used in the analysis of poverty in this study.

2.3.1.3 Absolute Poverty

Generally poverty is conceptualized or measured in absolute or relative terms, though other approaches, like objective and subjective measures also exist. Absolute poverty can be defined as the lack of adequate resources to obtain and consume a certain bundle of goods and services deemed basic. Such a bundle of goods and services would contain an objective minimum of basic necessities such as food, shelter and

clothing (see Ogwumike and Odubogun, 1989; Odusola, 1997; Olaniyan and Bankole, 2005). Thus, absolute poverty is characterized by low calorie intake, poor housing conditions, inadequate health facilities, poor quality of educational facilities, low life expectancy, high infant mortality, low income, unemployment and underemployment (Olaniyan and Bankole, 2005).

Absolute poverty is measured using absolute poverty lines after choosing the dimension or indicator of poverty, such as aggregate income, consumption, or nonmonetary measure, defined at the household or individual level. A poverty line can be defined as a cut-off point separating the poor from the non-poor. They can be monetary, for example, a certain level of consumption, or nonmonetary, for instance, a certain level of literacy (World Bank, 2002), and they are based on some absolute standard of what households should be able to count on in order to meet their basic needs. For monetary measures, these absolute poverty lines are often based on estimates of the cost of basic food needs, that is, the cost of a nutritional basket considered minimal for the health of a typical family, to which a provision is added for non-food needs. Considering that large parts of the populations of developing countries survive with the bare minimum or less, reliance on an absolute rather than a relative poverty line often proves to be more relevant. An absolute poverty line has fixed real value over time and space. It can be derived by calculating the costs of bundle of goods deemed to assure that basic consumption needs are met in the specific domain of poverty comparison (Kabubo-Mariara and Kiriti, 2002). A good example is the cost-of basic-needs, which stipulates a consumption bundle adequate for basic consumption needs and then estimates its cost for each of the sub-groups being compared in the poverty profile. Absolute poverty can be measured in several ways. These include: headcount ratios/incidence of poverty, poverty gap/income shortfall, composite poverty measures, physical quality of life index, augmented physical quality of life index, and human development index (Ajakaiye and Adeyeye, 2002).

2.3.1.4 Relative Poverty

In simple terms, relative poverty refers to lacking a usual or socially acceptable level of resources or income as compared with others within a society or country. Thus, relative poverty is conceptualised on the basis of the standard of living that prevails in a given society. Accordingly the World Bank (1997), asserts that relative poverty exists where households within a given country have per capita income (or expenditure) of

less than one-third of the average per capita income (or expenditure) of such a country. Similarly, Ajakaiye and Adeyeye (2002), opine that relative poverty measures define the segment of the population that is poor in relation to the set income of the general population. Such a poverty line, according to them is set at one-half of the mean income or at the 40th percentile of the distribution. In Nigeria, for example, the National Bureau of Statistics (NBS) measures relative poverty on the basis of one-third and two-thirds of mean per capita household expenditure. These separate the so-called core poor and moderately poor. Relative poverty would occur where certain sections of a society do not have adequate income to enable them have access some basic needs being enjoyed by other sections of such society.

Relative poverty is measured using relative poverty lines. These are defined in relation to the overall distribution of income or consumption in a country (as in the NBS example above). The relative poverty line on its own is the poverty line that is set as a constant proportion of the mean income. The poverty line in this case is dependent on the community. The usual practice is to set the poverty line at some proportion of the mean per capita income or expenditure. A relative poverty line rises with average income or expenditure.

There are two main kinds of relative poverty measures. The first is average income, which is the average income of the poorest 40 percent of the population and/or average income of the poorest 10 or 20 percent of the population. The second is the number or population of people whose incomes are less than or equal to predetermined percentage of the mean income, say 50 percent or less of the mean income.

2.3.2 Causes of Poverty

The causes and/or determinants of poverty are diverse. In a strict sense, there is no one cause or determinant of poverty, as it is shaped by the interaction of several factors working together to give rise to the situation. The literature implicates slow or negative economic growth, macroeconomic shocks and policy failure, labour market deficiencies, unemployment and underemployment, national debt burden, environmental degradation, bad governance, wars/crime/violence, poor health/disease, among others, as the major causes of poverty (see Tomori, *et al*, 2005; Ajakaiye and Adeyeye, 2002; FOS, 1996; UNSN, 2001). This subsection draws immensely from Ajakaiye and Adeyeye (2002).

Although the relationship between economic growth and poverty has remained a subject of controversy (Todaro and Smith, 2009), there is ample and extensive evidence that points to the fact that growth is necessary but may not be sufficient for poverty reduction (see for instance, see World Bank 1990). For example, in Indonesia and Thailand poverty was reduced by between 30 and 40 percent respectively during a twenty-year period in which annual growth rates were approximately 3 percent (investments in the social sectors also contributed). Accordingly, of a sample of countries, those that reduced poverty the least (for example, India and Sri Lanka) had growth rates of less than 1 percent. Growth can reduce poverty through rising employment, increased labour productivity and higher real wages it generates (Naschold, 2002). In developing countries such as Nigeria growth that is employment generating and with a good export base is desirable in order to achieve growth that is poverty-reducing with equity.

The links between macroeconomic/policy shocks and poverty through varied transmission channels have firmly been established in literature (see Mendoza, 2003 among others). Macroeconomic shock and policy failure have been a major cause of poverty in many countries of the world especially in developing countries where institutions are weak and coping mechanisms are almost always not available (see, World Bank, 2003). According to Conceição, Kim, and Zhang (2009), shocks often increase transitory income poverty and may also have a permanent effect on poverty if they deplete the assets and hurt the human capital of affected people, especially the poor. These shocks give rise to macroeconomic disequilibrium, mostly in the balance of payments, due to expansive aggregate demand policies, terms-of-trade shocks, and natural disasters and make the economies of such countries to be vulnerable to poverty (Ajakaiye and Adeyeye, 2002).

Labour markets deficiencies are also a major cause of poverty. The poor's most abundant resource is their labour, a virile labour market is important to reducing poverty and income inequality. In most countries of the world the majority of poor households participate in the labour market in one way or another, and thus poverty is a problem of low wages (in the informal sector), low labour returns to rural self-employment activities, underemployment, and in some cases, protracted unemployment. These problems are influenced in different ways by deficiencies in labour market, which affect the poor via limited job growth and absorption capacity in the formal sector.

Employment is a key determinant of poverty, as it is important for individuals to earn income and escape from “income” poverty. The poor are typically faced with problems of structural unemployment because they lack skills or have low education, are faced with health problems, geographical isolation and in some countries, discriminated against, while the non-poor suffer from transitional or involuntary unemployment. Unemployment is due more to slow economic growth than to the direct effects of imperfections in the labour market, although regulations affecting the formal sector are likely to induce more underemployment in the informal sector.

In several developing countries of the world, debt burden is assuming increasing importance as a cause of poverty, in the sense that the resources that would otherwise be used for socio-economic development are used to pay debts. The amount of money required to service debt annually is enough to hamper government expenditure for the provision of social and physical infrastructure for the poor in highly indebted poor countries.

The persistence and pervasiveness of poverty in several countries has been linked to the lack of popular participation in governance and decision-making, corruption as well as weak institutional base. This has led among other things to poor accountability, transparency in resource allocation, weak programme implementation and monitoring. Ultimately, development programmes and poverty reduction initiatives are rendered ineffective as resources are wasted.

Environmental degradation is a major cause of poverty. Similarly, poverty itself can lead to environmental degradation. This bi-directional causality arises because for the poor in developing countries, a number of environmental resources are complementary in production and consumption to other goods and services while a number of environmental resources supplement income, especially in time of acute economic stress (Falconer and Arnold, 1989). This can be a source of cumulative causations, where poverty, high fertility rates and environmental degradation feed upon one another. In fact, an erosion of the environmental resource base can make certain categories of people destitute even when the economy on the average grows (Dasgupta, 1993). In several countries of the world inaccessibility of the poor to credit and resource inputs leave them with no choice than to exploit natural resources such as forests, woodlands and rivers for their survival. Quite often, their continuous exploitation of these resources have led to stress/depletion and environmental degradation thereby making the poor both agents and victims of unsatisfactory ecological practices.

2.4 Concept of Inequality

Inequality is not a self-defining concept, as its definition may depend on economic interpretations as well as ideological and intellectual positions. Although inequality is related to poverty, it is different from it. According to McKay (2002), inequality concerns variations in living standards across a whole population, while poverty focuses only on those whose standard of living falls below an appropriate threshold level (such as a poverty line). This threshold may be set in absolute terms (based on an externally determined norm, such as calorie requirements) or in relative terms (for example a fraction of the overall average standard of living). Thus, the concept of inequality is more closely related to relative poverty in that what it means to be poor reflects prevailing living conditions in the whole population.

Just as poverty is multidimensional in nature, the same also applies to inequality. Thus economic inequality has both income and non-income dimensions. This suggests that income inequality is a part of a more general concept of economic inequality, even though income conditions are often a good proxy for economic conditions, because income shapes people's living standards and it is generally highly correlated with other well-being indicators (FAO, 2006). This multidimensional nature of inequality is implied. For instance, Ray (1998) views economic inequality as the fundamental disparity that permits one individual certain material choices, while denying another individual those very same choices. These material choices, and the factors that permit or deny them, are themselves multidimensional. Furthermore, the definition reflects a fundamental focus on inequality between individuals (or groups of individuals). It encompasses both inequality in opportunities and inequality in outcomes (McKay, 2002).

Income inequality mainly focuses on a concept of inequality of outcomes, arising from the normal functioning of the market, for example, the extent to which people take up the opportunities they have, while an alternative, or rather complementary, view is to focus on inequality of opportunities, which considers how people are favoured or disfavoured according to where they live, parental circumstances and so on. There is a relationship between the two concepts, as inequality of outcomes may well derive from inequality of opportunities. Based on the above conceptualization, we proceed with some definitions which touch on the dimensions of inequality highlighted.

Bourguignon (2004) defined inequality as disparities in relative income across the whole population, that is, disparities in income after normalizing all observations by the population mean so as to make them independent of the scale of incomes. It can also be defined as the way an actual income distribution deviates from a benchmark for income distribution, according to the Bellu and Liberati (2006). The benchmark in this definition may refer to the mean or median income of the distribution as the case may be. Or more generally inequality can be viewed as having little in a specific dimension compared to other members of society.

2.4.1 Measurement of Inequality

Unlike poverty indicators, inequality measures are harder to develop because they essentially summarize one dimension of a two-dimensional variable. Inequality measures can be calculated for any distribution—not just for consumption, income, or other monetary variables—but also for land and other continuous and cardinal variables (Coudel, Hentschel and Wodon, 2002). Given data on the variables of interest such as the ones mentioned above and which are typically available from household surveys, inequality in such variables is generally estimated using an inequality index. The index can be expressed as the degree of dispersion (or “width”) of the distribution. While a wide range of inequality indices have been developed, some commonly used measures are Gini coefficient of inequality, Theil index, Decile dispersion ratio, share of income and consumption of the poorest x percent, etc (Coudel, Hentschel and Wodon, 2002).

Just like with poverty measures, there are also some desirable properties (axioms) that an inequality index must satisfy. The axioms are mathematical properties of the index that help us to choose the index that would behave the way we expect it to behave when an income distribution changes from one state, A, for example to another state, B. For example, if our feeling is that income inequality would be lower if richer people transfer income to poorer people, we should choose an index with this mathematical property, excluding all indexes that have mathematical properties at odds with our expectation. This therefore, suggests that it might well be the case to have different indexes giving conflicting answers on inequality changes from state A to state B.

The main axioms considered here based on FAO (2006) include:

- i. Principle of transfers (also known as the Pigou-Dalton principle), which requires the inequality measure to change when income transfers occur

among individuals in the income distribution. In particular, based on this principle, the inequality index should fall with an income transfer from richer to poorer individuals or households and *vice versa*.

- ii. Scale invariance, which requires the inequality index to be invariant to equi-proportional changes of the original incomes. This means that if all incomes in the distribution were increased or reduced by the same proportion, the inequality index should not change.
- iii. Translation invariance, which requires the inequality index to be invariant to uniform additions or subtractions to original incomes. Translation invariance means that income changes are distributionally neutral only if they occur in the same absolute amounts for all individuals in the income distribution.
- iv. Principle of population axiom, which requires the inequality index to be invariant to replications of the original population.
- v. Decomposability axiom, which requires a consistent relation between overall inequality and its parts, that is, total inequality must be equal to the sum of the various group inequalities.

The Gini index satisfies all the axioms except the translation variance axiom, and because we neither expect our distribution to increase or decrease by the same amount of income, we do not bother and so the Gini index was relied upon for the inequality analysis in this study.

2.4.1.1 Why Measure Inequality?

The importance of measuring and seeking to reduce inequalities of outcome as well as of opportunities in our society cannot be overemphasized. Recent developments in the world, especially in the Arab nations have clearly shown that large inequalities are most undesirable, as they are a significant factor behind crime, social unrest or violent conflict and wars, as well as present and potential threats to political stability. However, there many other reasons why everyone; economists, policy analysts, governments, development agencies, etc, should concerned with inequality. Killick (2002) and McKay (2002) provide a good summary of the importance of measuring inequality, which is presented below.

- i. Inequality exacerbates poverty in that for a given level of average income, education, land ownership, etc, increased inequality of these characteristics

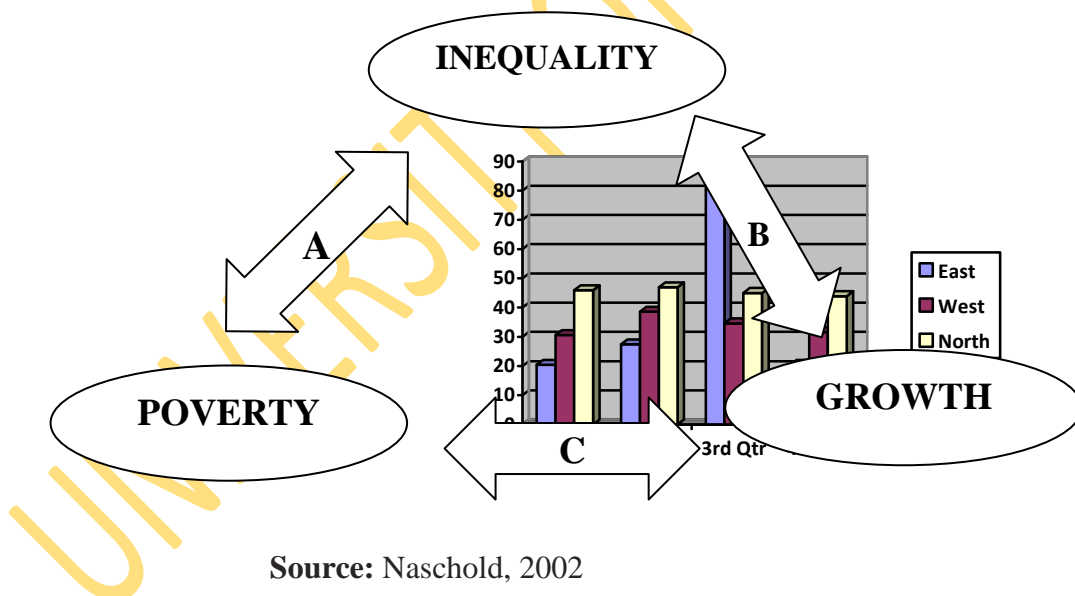
will almost always imply higher levels of both absolute and relative deprivation in these dimensions

- ii. Inequality matters for growth and poverty reduction, as there is increasing evidence that countries with high levels of inequality – especially of assets – achieve lower economic growth rates on average. In addition, a given rate and pattern of growth of household incomes will have a larger poverty reduction impact when these incomes are more equally distributed in the first instance (World Bank, 2000; International Fund for Agricultural Development, 2001; Birdsall and Londono, 1997; and, Deininger and Olinto, 2000). Much of Latin America's continuing poverty is explainable in terms of large inequalities rather than weak economic performance. In Africa much more weight needs to be attached to weak long-term growth but it has been shown that here too the poverty problem is exacerbated by apparently rapidly widening inequalities.
- iii. Inequality is important in its own right because there is a strong, and quite widely accepted, ethical basis for being concerned that there is a reasonable degree of equality between individuals, though there might be disagreement about the question 'equality of what' (for instance, outcomes or opportunities?), as well as about what might be 'reasonable'. For other reasons, concern with poverty cannot be separated from distributional questions, for most measures of absolute poverty actually contain elements of relativity, and because people's perceptions of their own conditions are inseparable from their standing in society.
- iv. Underlying skewed income or consumption distributions are likely to be large differences on the basis of gender, ethnicity and region, with the latter two aspects acting as potential threats to political stability.
- v. Inequality is likely to be critically important for the attainment of the Millennium Development Goals (MDGs). This is not confined only to the income poverty MDG.

2.4.2 Poverty versus Inequality: The Nexus

There is an implicit relationship between poverty and inequality based on what they measure, their dimensions and the practical application of the concepts. More formally, Inequality and poverty affect each other directly and indirectly through their link with economic growth (see for instance, Naschold, 2002; Bourguignon, 2004; Coudouel *et al*, 2002; Aigbokhan, 2008, among many). Thus, any meaningful discussion on the relationship between these two concepts of wellbeing should incorporate economic growth. Consequently the formal approach in the literature of discussing the nexus between inequality and poverty is the tripartite connection depicted in the so-called Poverty-Growth-Inequality triangle.

According to Naschold (2002), Poverty, inequality and growth interact with one another in the triangle through a set of two-way links. For instance inequality can indirectly influence poverty as inequality affects growth (B) and growth in turn influences poverty (C) as shown in figure 2.3



Source: Naschold, 2002

Fig. 2.3: Poverty-Growth-Inequality Triangle

In the first set of two-way links, inequality and poverty can affect each other directly as depicted by (A) in the figure. In this relationship, empirical evidence has shown that small changes in income distribution can have a large effect on poverty, because of the sensitivity of poverty to distributional changes. For example, White and Anderson (2001) illustrate with an example from a country where the share of national income

that goes to the poorest 20% of the population increases from 6% to 6.25%. They show that a change in income distribution of one quarter of one percent would barely affect the Gini coefficient, but for the poor this represented a 4% increase in their total income. Such a small redistribution would have the same effect on poverty as doubling the annual growth of national income from 4% (which is the projected growth rate of many African countries) to 8%, which is necessary to achieve the income poverty Millennium Development Goal (MDG). Furthermore, Wodon (1999) shows that changes in inequality have even larger effects on measures of the depth and severity of poverty, based on evidence from Cote d'Ivoire and Bangladesh. Thus, the distribution of income is important not only for making progress towards the income poverty MDG and the headcount, but even more so when considering the depth and severity of poverty.

In the next set of links, inequality can influence poverty indirectly through growth as inequality affects growth or as growth affects inequality as shown in link (B) in figure 2.3. Evidence from empirical works in the 1990s has reconfirmed the classical view that distribution is not only a final outcome, but also a determinant of economic growth (see Birdsall *et al.* (1995). Most of the evidence suggests that inequality is bad for growth. Recent evidence using an updated and more comparable inequality data reconfirms the negative effects of inequality on growth (Knowles, 2001).

Generally, the evidence indicates that lower inequality can create faster growth, which in turn can benefit the poor in the third set of links (C) in two ways: first by increasing overall growth and hence average incomes and second by letting them (the poor) to share more in that growth. However, according to Ravallion (1997), countries which would be on a high growth path if income distribution was equitable may experience slow growth and even slower poverty reduction if inequality is high. Thus, Naschold (2002) surmises that both ways the level of inequality in a country greatly affects the impact of growth on poverty. Similarly, White and Anderson, (2001) argue that based on the significant number of countries where redistribution has proven more important for poverty reduction than growth, redistribution may still be the most effective way of reducing poverty.

The possibility of a reverse causality in the link between inequality and growth has also been widely explored. Most of the economic literature on the relationship between inequality and economic growth has its origin in the path-breaking work of Kuznets (1955). In his “inverted - U” hypothesis, Kuznets suggested that economic

growth (that is, a rise in average per capita income) can initially lead to a rise and then fall in income inequality within a country. Since then, however, much evidence has been accumulated both for and against this hypothesis, with virtually all recent evidence rejecting this pattern (see for instance, Fields, 2000; Ravallion and Chen (1997), Demery and Squire (1996), Bruno, Ravallion and Squire (1996) and Ravallion (2001).

However, according to Naschold (2002), the agreement in the literature is that inequality can either rise or fall in periods of economic growth and increasing inequality is not an unavoidable consequence of early growth. He explains that, it is the kind of economic growth, which affects inequality and not its rate or the stage of economic development. Consequently, Atkinson (1997) asserts that economic theory does not tell us why or how inequality may affect growth. As a result, research on this relationship tends to be *ad hoc*, and the evidence mostly speculative. The links have mainly been explained either in terms of political economy, and economic or social factors.

The main argument from the political economy point of view hinges on the notion that inequality creates political instability which leads to lower investment and more resources being wasted bargaining over the distribution of rents (Alesina and Perotti, 1993); Rodrik, 1997). Economic factors of why inequality reduces growth centre around capital market imperfections and on the role of the poor, not only as beneficiaries but also as contributors to economic growth, while social inequality may create self-fulfilling expectational equilibria with lower growth. Thus, the finding of no correlation between growth and distribution does not mean there is no impact. In sum, poverty and inequality are intrinsically linked. Poverty reduction - especially for the poorest - can be greatly enhanced through distributional policies.

2.5 Macroeconomic Shocks, Poverty and Inequality: The Transmission Channels

There is consensus in the literature that macroeconomic shocks could have profound impacts on poverty and the distribution of household incomes, generating both direct and indirect effects that can be beneficial or harmful in the short- and long-run (see Dorosh, 1996; Mendoza, 2003; World Bank, 2003; Tomori *et al*, 2005). Although not all macroeconomic shocks lead to negative outcomes, the effect of positive shocks hardly offset their negative impacts partly because most negative shocks have irreversible effects, thus the emphasis cannot be shifted from the overarching impacts of negative shocks on households and the economy, which very often lead to increased

poverty and the accentuation of inequalities (see, Naschold, 2002; Bourguignon, 2004; Varangis *et al*, 2004).

The transmission of the impacts macroeconomic shocks to poverty and income inequality could be traced from several adjustment mechanisms or channels. From the existing literature, the transmission channels can broadly be grouped into two, namely direct and indirect, which cover adjustments at both the micro and macro levels (see variously, Feridhanusetyawan, 1999; Damuri and Pardana, 2003; Nwafor, Ogujiuba and Adenikinju, 2005 and Mendoza, 2009). Apart from this, the timing of the impact is another dimension of transmission that is of immense essence, since impacts can either manifest in the short-term or the long-run. The literature has shown that most direct impacts manifest in the short-run while the indirect impacts are experienced in the long-run. For example, an increase in the value-added tax will translate directly into lower purchasing power for a given disposable income in the very short-term, while the indirect impacts of improved service delivery and higher growth, as a result of increased government revenue and expenditure will typically take more time to materialize. Stakeholders might therefore feel both negative and positive impacts, but at different points in time (World Bank, 2003).

The key transmission mechanisms identified in the literature regarding the impact of macroeconomic shocks to households' poverty (and inequality) are changes in prices (relative prices), employment and incomes, and changes in government expenditures, and there is very strong evidence that these three channels, individually or in combination, are pervasive during aggregate economic shocks (see, for example, Lustig and Walton, 1998 & 1999; Agenor and Montiel (1999); Siddiqui and Iqbal, 1999, Ferreira *et al* (1999); Damuri and Perdana (2003); World Bank (2003); Tomori *et al*, 2005; Tambunan (2005); Boccanfuso and Savard, 2005 & 2009; Coceicao, Kim and Zhang, 2009). However, several other adjustment mechanisms have also been identified. For example, changes in the real exchange rate (Agenor and Montiel, 1999); trade openness and external debt service obligations (Tomori *et al*, 2005); and access to goods and services as well as assets; and transfers and taxes (World Bank, 2003). From the foregoing discussion, we explain five transmission channels in detail namely, changes in prices (relative prices), employment and incomes, changes in government expenditures, access to goods and services, and assets, drawing mostly from the World Bank (2003), in recognition of the fact that almost other adjustment mechanisms are subsumed in the afore-mentioned.

2.5.1 Prices (production, consumption, and wages)

Macroeconomic shocks can be transmitted to household poverty and inequality through changes in prices of goods and services affecting the cost of consumer baskets and also the variations in prices of production factors, and so the real income of households, would be determined by these price changes. However, changes in prices for goods and services affect households differently, depending on the degree that they consume or produce these products. As owners of primary factors of production, household incomes will increase if the prices of their own factors increase following an economic shock, while their incomes will fall if the opposite happens. Since each household controls a different combination of primary factors, the resultant impact on their incomes also varies across households.

The extent to which shocks or policy changes affect prices has important implications for income and non-income measures of welfare, either directly or indirectly. For all households, especially for small farmers and the self employed, price changes will affect both consumption and resource allocation decisions. On the consumption side, shocks that cause an increase in the prices of goods consumed by the poor will have a direct negative effect on household welfare. Consumer prices may be indirectly affected as well, for example through expansionary monetary policy that leads to general price inflation, which erodes purchasing power with potentially dramatic consequences at the lower end of the income distribution. Producers will also be affected by shocks that cause relative price changes—particularly changes to the prices of their products or factors (as reallocation of factors takes place). Wage changes will affect net buyers and sellers of labour differently, and policies that change relative prices will induce shifts in both demand and supply.

2.5.2 Employment and Incomes

The most important resource available to poor households is their labour, thus the employment of this labour is major source of income for most households. Consequently, any macroeconomic shock that impacts the structure of the labour market or the demand for labour, especially in sectors that employ the poor (such as unskilled, rural off-farm, and agricultural labour) will affect the income of poor households, directly or indirectly. Generally, changes in relative prices as a result of macroeconomic shocks mainly affect the profitability of the different sectors in the economy, generating changes in real wages and labour demand, which then affect employment levels,

including the distribution between the formal and informal labour markets, work hours, wages and other employee benefits, among others. For example, restructuring of a state enterprise following an economic downturn may lead directly to retrenchment of workers. In other cases transmission may be indirect. For instance, a policy change may stimulate faster growth, leading in turn to increased employment among the poor; a trade shock may result in contractions and layoffs in the non-tradable sector.

2.5.3 Government Expenditures

According to Ferreira *et al* (1999), changes in government expenditure following an economic shock can affect households through changes in labour demand, relative prices, and direct transfers, apart from its effect on the provision of public goods. Government expenditure channel leads to budgetary constraints during adverse shocks, which can lead to smaller public spending for education, health and other services, as well as reducing government's ability to maintain subsidies for fuel, electricity, etc or to make transfers to households. Again, social protection programmes, which may be useful in protecting the poor against shocks and vulnerability, depending on their targeting, may suffer setbacks, when fiscal stance is tight. On the other hand, if there is a positive impact on the fiscal stance of the country; which translates into increased government expenditure, it will have impacts on various groups of households through the goods, services, transfers, and subsidies they receive. Such a stronger fiscal stance also will likely generate improved growth, affecting household welfare.

2.5.4 Assets

According to the World Bank (2003), household assets of relevance to poor households can be grouped into five classes. These include physical (such as housing); natural (such as land, water), human (such as education, skills); financial (such as a savings account); and social (such as membership in social networks that increase access to information or resources). Economic shocks can cause changes in the value of assets as a result of changes in their levels or their returns, and thus directly or indirectly affect their (households') income and non-income dimensions of welfare. For example, a policy shock in the form of a land reform may directly result in an increase or decrease in land assets of the poor. Policy changes can also impact assets through indirect channels. For example, the negative wealth effect of inflationary policies on

households with monetary savings, while participatory budgeting or community programmes may increase social capital.

2.5.5 Access to Goods and services

Lack of access to key infrastructure or services either because they do not exist or because they are of poor quality, can limit the impact of a positive economic shock or worse still aggravate the effect of a negative shock on the wellbeing of the poor. This can come about either through access to markets and service outlets or through improvements in the quality and responsiveness of public or private service providers. Policy can affect access directly by enhancing provision of the infrastructure or services in question, or indirectly by removing constraints to access by particular households or groups. For example, improved road infrastructure could dramatically enhance access to markets and services for groups in certain geographic areas. A policy that expands connections to an electricity grid, particularly among the poor, can also represent a welfare gain.

2.6 Transmission Mechanisms of Shocks Studied

The magnitude and direction of specific shocks on household poverty and income distribution depends on a variety of factors, which include: nature of the shock, country's macroeconomic fundamentals, initial household conditions as well as the extent and type of policy responses by government, among others, and thus, can only be determined empirically (see Mendoza, 2003; Essama-Nssah, 2005; Conforti and Sarris, 2009). In what follows, we highlight the expected impacts of the aforementioned shocks on the households.

2.6.1 Food Price Shocks

Generally, a rise in the world price of food imports would affect poverty and income inequality of households in Nigeria through several channels, mostly through changes in prices, income and consumption of households. For households whose consumption basket contains mostly imported food, the impact of a price hike of food imports would be expected to be higher than for households that consume mostly domestically produced foods. In the same manner, households who are net food

consumers would suffer a greater loss in real incomes compared with households that are net food producers. This means that the distributional impacts are not homogenous.

2.6.2 Oil Price Shocks

The transmission mechanisms of world oil price shocks to households' poverty and incomes are mostly indirect, with different effects for net oil exporters and net oil importing nations. According to Akpan (2009), it is generally argued that for net oil-exporting countries, a price increase directly increases real national income through higher export earnings, though part of this gain may be later offset by losses from lower demand for exports generally due to the economic recession suffered by trading partners. A price fall is likely to have the opposite effect. Since Nigeria is a net oil exporter that relies heavily on crude oil export revenues, which represent about 90 percent of total export earnings and on average about 70 percent of government revenues in annual budgets, a fall in the price of oil would have profound effects on the government spending, which can affect labour demand, relative prices, direct transfers to households and the provision of public goods, which benefit the poor. Oil price changes also entail demand-side effects on consumption and investment. Consumption is affected indirectly through its positive relation with disposable income. Oil price rises reduces the consumers spending power. Investment may also be affected if the oil price shock encourages producers to substitute less energy intensive capital for more energy-intensive capital (see, Daniel, 1997; Hamilton, 1996). Again, if there is a reduction in government spending, inflationary pressures are likely to be low, and depending on the consumption patterns of household categories, some would likely experience an improvement in their real incomes (see, Cashin and Patillo, 2000; Olomola and Adejemo, 2006). Thus, the major transmission channel of oil price shock to households in Nigeria is via government expenditure.

2.6.3 Exchange Rate Shocks

The Nigerian economy is highly susceptible to exchange rate changes because of the import-dependent nature of its largely uncompetitive manufacturing industries (Tomori *et al*, 2005). The impact of exchange rate depreciation can be transmitted to poverty and incomes distribution via both direct and indirect mechanisms. Exchange rate depreciation refers to a decrease in foreign price of the domestic currency, triggered by a desire to reduce the current account deficit and the surplus on the capital account, which might for example come about as a result of a decline in foreign investment or

foreign aid in loan form, or a reduced willingness to draw on foreign reserves (see, Krugman, 2006). Alternatively, it may be seen as a conscious use of the real exchange rate as a tool to promote tradables and a more diversified production and export structure (Lofgren, Chulu, Sichinga, Simtowe, Tchale, Tseka and Wobst, 2001). The direct effects of these mechanisms are basically at the micro-level. A real depreciation increases producer prices for exports, with a larger impact in relatively export-oriented sectors, and demand-side prices for imports, which boost prices of domestically produced import substitutes. This has the effect of making exports cheaper and imports, expensive (see, Oyeranti, 2005). Thus, for households employed in the export oriented sectors and import substitute sectors, real incomes and consumption might increase, while households that consume mostly imported commodities might suffer a reduction in real incomes and a fall in consumption. The indirect effects are at the macro level, where more exports and fewer imports reduce the trade deficit and foreign savings (the current account deficit). This may be desirable from a balance of payments perspective. However, it might be necessary to maintain government consumption by increasing government savings through higher direct taxes, which can impact household consumption negatively.

2.7 Methodological/Analytical Concepts

In this study, several methods and analytical procedures were used in the analyses of the various data that were sourced, in order to arrive at the results presented and discussed in chapter five. Thus, the aim of this section is to provide a succinct description of the procedures that were so deployed, but which have not been described in the previous subsections, so as to enhance our understanding of how they fit into the research problem and the objectives of the study. In the subsections that follow, we present the broad foundations of the theory of general equilibrium, followed by a description of the analytical tool of computable general equilibrium (CGE) model, as well as, the various methods used in the general equilibrium modelling of poverty and income distribution, in practice.

2.7.1 General Equilibrium Theory

General equilibrium theory is a branch of theoretical economics that seeks to explain the behaviour of supply, demand and prices in a whole economy with several or many interacting markets, by seeking to prove that a set of prices exists that will result in an overall equilibrium, consequently general equilibrium (see, Mas-Colell, Whinston and Green, 1995). Precisely, a general equilibrium can be defined as a state in which all markets and all decision making units are simultaneously in equilibrium. This is in contrast to partial equilibrium, which only analyses single markets. The theory dates back to the work of French economist Léon Walras. It is often assumed that agents are price takers, and under that assumption two common notions of equilibrium exist: Walrasian (or competitive) equilibrium, and its generalization; a price equilibrium with transfers (see, Black, 1995).

The concepts regarding the Walrasian general equilibrium system were formalized and expanded by Arrow and Debreu (1954). In the Arrow and Debreu formulations, there are a specified number of consumers each of which has an initial endowment of commodities and a given set of preferences. Thus there are market demand functions for each commodity, which are given by the sum of each individual's demand. These market demand functions for commodities are determined by all prices with all the functions being well behaved and satisfy Walras' law that is the total value of consumer expenditures equals consumer incomes. On the production side, assumptions of constant returns to scale and profit maximization were made in order to generate the competitive solution. Thus, with these model characteristics, relative rather than absolute prices are of relevance. Hence general equilibrium is characterised by a set of relative prices and pattern of production that clears the market for each commodity.

More formally, we can present the theory of general equilibrium following Koutsoyiannis (1985); Greenaway and Milner (1993) and Yusuf (1999). Given a simple model of two sectors, households and firms in which all production takes place in the business sector; all factors of production are owned by households; there is full employment of all factors of production; and all incomes earned are spent, then the economic system attains equilibrium when a set of prices is attained at which the magnitude of income flow from firms is equal to the magnitude of money expenditure flow from households to firms. However, each decision making unit takes independent action with the objective of attaining independent equilibrium. The general equilibrium

theory therefore, centres on the problem of whether the independent action of each decision making unit leads to a situation in which equilibrium is attained by all. Thus, general equilibrium emerges from the solution of a simultaneous equations model of millions of equations in millions of unknowns. The unknowns include the prices of all factors and all commodities as well as the quantities purchased and sold of factors and commodities by each consumer and each producer. The equations of the system are derived from the maximising behaviour of consumers and producers. These equations are of two types; the behavioural equations – describing the demand and supply functions in all the markets by all individuals – and the market clearing equations. Based on the above description, it is evident that general equilibrium deals with the interrelationships between different markets and different sectors of an economy. If there are i commodity markets and j factor markets, there will be $i + j = n$ markets and $n - 1$ equilibrium prices to be determined if all markets are to be in equilibrium, which translates to the economy being in a state of general equilibrium. This situation is captured by Walras' Law, which states that for a given set of prices, the sum of the excess demand over all markets must be equal to zero.

2.7.2 Computable General Equilibrium Analysis

In simple terms, computable general equilibrium (CGE) models are a class of economy-wide models that use actual economic data to estimate how an economy might react to changes in policy, technology or other exogenous factors, variables, or shocks. Unlike other general equilibrium models, CGE models convert Walrasian principles to realistic and operational models of actual economies by specifying production and demand parameters through the use of data which capture the economy involved. While other general equilibrium models have specific purpose with restrictive assumptions, CGE models have assumptions which permit the understanding of the underlying structure of the economy (Shoven and Whalley, 1992; Yusuf, 1999). Thus, the general equilibrium macroeconomic models, unlike partial equilibrium models, cover all major economic sectors with emphasis on feedbacks and interrelationships between sectors as well as the optimisation of all economic agents within all sectors. CGE models provide a complete specification of the economy, in varying degrees of aggregation. In theory, a well-specified general equilibrium model can capture indirect impacts of policy generated from all other markets. However, in practice, as with any economic estimation, it captures indirect impacts only from those markets that are included in the

model, and results depend on the model specification and parameters. While general equilibrium analysis can be used to analyze most types of policy reform, it is most relevant to reforms with multiple and significant indirect impacts on the economy through a number of transmission channels (see, Savard, 2003; Boccanfuso and Savard, 2005).

CGE analysis can be regarded as an extension of the input-output and linear programming models with the introduction of an endogenous output price system, neoclassical substitution in production and demands, optimization of individual agents and a complete treatment of income flows in an economy. The model consists of equations describing the model variables, and a database (usually very detailed) consistent with the model equations. The equations tend to be neoclassical in spirit, often assuming cost-minimizing behaviour by producers, average-cost pricing, and household demands based on optimizing behaviour (see, Dervis, de Melo and Robinson, 1982, Shoven and Whalley, 1992).

The database for the calibration of a CGE model consists of a table of transaction values (usually an input-output table or a social accounting matrix (SAM), which in either case, covers the whole economy of a country and distinguishes a number of sectors, commodities, primary factors and perhaps types of households), and a set of elasticity parameters that capture behavioural response. CGE models contain more variables than equations – so some variables must be set outside the model. These variables are termed exogenous; the remainder, determined by the model, are called endogenous. The choice of which variables are to be exogenous is called the model closure, and may give rise to controversy.

Many CGE models are solved in comparative static mode in that they model the reactions of the economy at only one point in time. For policy analysis, results from such a model are often interpreted as showing the reaction of the economy in some future period to one or a few external shocks or policy changes. That is, the results show the difference (usually reported in percent change form) between two alternative future states (with and without the policy shock). The process of adjustment to the new equilibrium is not explicitly represented in such a model, although details of the closure (for example whether capital stocks are allowed to adjust) lead modellers to distinguish between short- and long-run equilibrium (Decaluwe, Patry, Savard and Thorbecke, 1999; Decaluwe, Dumont and Savard 1999; Yusuf, 2002; Lofgren, Harris and Robinson, 2002; Savard, 2003; Adenikinju and Falobi 2006; Obi, 2007; etc). In

contrast, dynamic CGE models explicitly trace each variable through time – often annual intervals. These models are more realistic, but more challenging to construct and solve – they require for instance that future changes are predicted for all exogenous variables, not just those affected by a possible policy change (see, Nwafor *et al*, 2005; Oyeranti, 2005; Ekeocha and Nwafor, 2007; among many).

One of the problems that usually arise in CGE modelling is lack of empirically estimated elasticity parameters. This arises due to unavailability of data. Yet the selection of parameter values for the functional forms is very crucial in determining results of the various policy simulations of CGE models. The procedure involved in choosing values for the model parameters is known as benchmark equilibrium. These parameters are chosen such that the model can replicate the benchmark data set for a particular year (base year data). Thus a common practice is literature search and the use of ‘best guess’ values to fill data gaps.

As noted earlier, another controversial issue in CGE modelling literature is the problem of model closures. The term ‘closure’ can be defined as the specification of endogenous and exogenous variables in the model or assumptions about how a model is closed. A model is assumed closed if there is sufficient information to complete a solution. Four major macroeconomic closures, namely, Keynesian, Kaldon, Johansen and Classical, have been identified in the literature and applied to CGE models in developing countries. While the Keynesian closure permits unemployment and a fixed nominal wage, the Kaldonian closure assumes full employment and defies the wage-marginal labour productivity relationship. Under the Johansen closure, investments are exogenous so that consumption must adjust endogenously. Finally, the classical closure assumes real investment to be endogenous and this adjusts to total available savings.

In the current study, we combine CGE analysis with the analysis of poverty and income distribution in order to capture the economy-wide effects of macroeconomic shocks on households, in the so-called CGE macro-micro modelling framework. Thus, in the next subsections, we present a brief description of the various approaches to general equilibrium modelling of poverty and distributional issues in practice, since its evolution from the early years. Savard (2003) categorizes them into three, namely representative household CGE model, integrated multi-household CGE model and the sequential micro simulation CGE model.

2.7.2.1 Representative Household (RH) CGE Model

The representative household CGE model, is the traditional method, and has been widely used in the literature particularly for income distribution issues. Poverty analysis is performed using the variation of the average income of the representative households generated by the CGE model (output of the CGE model) alongside household survey data to perform ex ante poverty comparisons. Income distribution analysis is implemented by comparing variation of income between groups using the CGE model output (see, Dervis *et al*, 1982; de Janvry, Sadoulet, and Fargeix, 1991; Chia, Wahba and whalley, 1994; Decaluwé *et al*, 1999a; Colatei and Round, 2001).

The main advantage of this approach is that it is easier to use than other approaches, as it does not require specific modelling effort outside what is done in standard CGE modelling exercise. The modeller can simply use a standard CGE model and apply the outputs to perform poverty analysis. However, the main drawback to this approach is that it either supposes there is no intra-group income distribution change, or that this intra-group distribution change is linked to a theoretical statistical relationship.

2.7.2.2 Integrated Multi-Household (IMH) CGE Model

This approach consists of increasing the number of representative households compared to the RH CGE approach. It allows the addition of as many households in the CGE model as what is found in income and expenditure household surveys. Decaluwé *et al* (1999b) were the first to explore this approach; in which they used fictitious data. Cockburn (2001) on Nepal, Cororaton (2003) for the Philippines and Boccanfuso and Savard (2003) in Senegal applied this approach to real country data. The main advantages of this approach, compared to the previous approach, are that they allow for intra-group income distributional changes as well as leaving the modeller free from pre-selecting household grouping or aggregation. The main disadvantages of this approach are the limits it imposes in terms of microeconomic household behaviours. As a matter of fact, the size of the model can quickly become a constraint, and data reconciliation can be relatively difficult. According to Rutherford, Tarr and Shepotylo (2005), data reconciliation can be very problematic; and second, the numerical resolution can be challenging (Chen and Ravallion, 2004).

2.7.2.3 Micro-simulation (MS) CGE Model

The general idea of the MS approach is that a CGE model feeds market price changes into a micro-simulation household module, which is lacking in the IMH CGE model. According to Bonnet and Mahieu (2000), micro-simulation is required to analyse income distribution (dispersion) as opposed to RH CGE model, which is a good indicator of changes in averages, but not in dispersion, while mostly using micro-econometrics modelling of household behaviours and using price vector generated by a CGE model or even exogenous price vector changes. An illustration of this approach can be seen in Bourguignon, Robilliard and Robinson (2002). The main advantage of this approach is that it provides richness in household behaviour, while remaining extremely flexible in terms of specific behaviours that can be modelled. The main drawbacks to the approach are the coherence between the macro and micro models, which is not always guaranteed, and the fact that the feedback effects of household behaviours are not taken into account in the CGE or macro model.

In the current study, we use the first approach, mainly because of its advantage of relative computational ease and data requirements, but we extend it by endogenizing the poverty line using the households' minimum consumption as the monetary poverty line from the linear expenditure system (LES) demand function used to model household demand in the CGE model. In the next chapter, we present a review of related empirical literature.

CHAPTER THREE

REVIEW OF RELATED EMPIRICAL LITERATURE

3.1 Introduction

In this section a review of various empirical research carried in Nigeria and elsewhere outside Nigeria, related to the research focus, is presented, with a view to broadening our understanding of what has been done in this area, how the current endeavour fits in and perhaps how it differs from previous studies in its approach and anticipated output and relevance. Generally, the body of literature in this area has shown that there has been concern regarding the wellbeing of households as far as the effects of government policy or macroeconomic shocks or phenomena are concerned. We shall begin with related studies focussed on Nigeria in section 3.2, followed by studies outside Nigeria in section 3.3, and finally we present a summary of what makes the current study different from past studies.

3.2 Nigeria-based Studies

Motivated by the need to assess the impact of the Structural Adjustment Programme (SAP) of the mid 1980s, which included exchange rate devaluation, trade reforms, fiscal belt-tightening and liberalization of export crop, on macroeconomic outcomes and real household incomes, Dorosh (1996) studied the implications of macroeconomic policy for the poor in Nigeria. The study sought to answer three key questions: (i) does exchange rate liberalization help or hurt the poor? (ii) how are the poor affected by oil price shocks? (iii) who benefits from increases in government recurrent expenditures? To accomplish this task, he employed a computable general equilibrium model to carry out both static and dynamic policy simulations based on a 1987 SAM of Nigeria, with six household categories. Among others, results suggested that in combination, liberalization of foreign exchange and export crop markets in 1986 and 1987 increased overall incomes and benefitted both the urban and rural poor, because these households had no access to economic rents associated with the rationing of foreign exchange and import restrictions; also the combined effect of liberalization of the foreign exchange market and exchange rate depreciation tended to benefit the urban and rural poor since the shift in relative prices led to increases in demand for rural and urban labour. Moreover, he found out that higher world oil prices benefitted the poor more, when the foreign exchange regime was liberalised than when foreign exchange controls were

imposed. Similarly, reductions in the world price of oil hurt the poor less if real exchange rate was allowed to depreciate than if foreign exchange restrictions prevented a real exchange rate adjustment. He concluded that two key policies stand out in terms of reducing poverty in Nigeria: exchange rate policy and fiscal policy, stressing that maintaining a liberalized exchange rate and trade regime should be a central part of Nigeria's development strategy. Further than this, he proposed that government spending should be targeted towards areas that have the greatest potential for achieving growth and poverty reduction, and that re-targeting of government spending toward development of infrastructure and human capital may be the most effective way of using oil revenues to benefit the poor. The current study however differs from this one in the sense that it assesses the impact of exchange rate depreciation, oil price decline and food price increase on poverty and inequality. Plus, it is being carried out under a different policy environment with more recent data. Thus the results and conclusions are likely to be very different.

In a related study, Yusuf (2002) examined the effect of two liberalization measures that were part of the SAP policy adopted in the mid 1980s on the poverty situation of households in Nigeria. Specifically, the study utilized a computable general equilibrium model and a SAM built around the 1995 input-output table of the Federal Office of Statistics (FOS), to simulate the effects of (i) a fall in world price of agricultural exports and (ii) a reduction in import tariffs, on the poverty situation of households, using the Foster-Greer-Thorbecke class of poverty measures to estimate poverty indices for the four household categories that were considered in the study. His results showed that poverty was both an agricultural and rural phenomenon. However, urban low-education households were found to be poorer than their rural non-agriculture household counterparts, indicating the endemic nature of poverty in Nigeria. Additional results indicated that the quantum of resources required to lift people out of poverty differs across household categories, and was highest in rural agricultural households. Furthermore, a fall in the price of agricultural exports led to a reduction in income of the rural agricultural households, hence their purchasing power. Although there was a reduction in the general price level, as a result of this simulation, the fall in income outweighed the fall in prices of the items thus aggravating poverty.

On the other hand, a fall in the import tariff on all commodities led to a substantial fall in prices in all sectors of the economy, and consequently to a fall in incomes due to movement away from the production of import substitutes. Based on

the results, he recommended the provision of alternative opportunities for employment in rural areas as means of diversifying the economic base of the rural sector; provision of support for the development of the informal sector through improving infrastructure, credit facilities, tax relief for those operating in the rural areas, export subsidies; and protection of vulnerable groups from the negative effects of external shocks through export subsidies or direct income transfers to rural agricultural households.

Away from SAP motivated studies to one assessing the impact of investment and employment focussed policies on poverty and income distribution, Iwayemi and Adenikinju (2001), explored poverty-reducing alternative policy scenarios and their implications for investment-led and employment-intensive, broad-based economic growth using an economy-wide model. The study was carried out to provide an analytical framework for a better understanding of the dynamic inter-linkages between investment, employment, output and income growth, poverty reduction and income distribution in Nigeria. The authors used a computable general equilibrium model to simulate the impact of (i) increase in government investment expenditure; (ii) increase in labour demand (iii) rise in foreign inflow (iv) rise in income transfer to rural and urban poor households, on growth, employment and income distribution based on a SAM built around the 1995 input-output table of Nigeria, with six household categories. Results revealed that increased domestic investments, either by government or foreign investors have very strong impacts on growth and employment. Particularly, their results showed impressive reductions in unemployment under the four scenarios, with the highest occurring under foreign investment. However, the four scenarios differed in terms of distribution of benefits to various households. Among others, they recommended that government should put mechanisms that will ensure that growth dividends are evenly distributed, given the need to protect the interests of the core poor. Also, they recommended an increase in government investment expenditure by directing it toward development of infrastructures like health, education, transportation and energy.

In their study of the impact of trade liberalization on poverty in Nigeria, Nwafor, Ogujiuba and Adenikinju (2005) examined the effects that reduction in import tariffs would have on poverty and income distribution in Nigeria based on the Economic Community of West African States' (ECOWAS) Common External Tariff (CET) regime. To achieve their objectives, the authors made use of a Sequential Dynamic CGE model of the Nigerian economy, which was a modification of the EXTER CGE

model, and a 2005 SAM built around the 1997 input-output and supply and use tables of the FOS. The model employed a top-down representative household approach, which adjusts surveys according to model results, for poverty analysis of the two household categories in the study. The simulation results of adoption of the ECOWAS tariffs were mixed, with positive implications for urban households and negative implications for rural households due to the dependence of the latter on mostly land and labour income. As a result urban poverty decreased in both the short- and the long-run while rural poverty increased in both periods. They recommended that for the ECOWAS tariffs to have positive effects on poverty, policies which will make the sectors' products more competitive, both in terms of quality and price, have to be pursued alongside the ECOWAS tariffs reform, while they recommended policies which can attract more investment into the sectors over time, on the supply side.

Driven by the controversy regarding petroleum products pricing and subsidy in Nigeria, Nwafor, Ogujiuba and Asogwa (2006) carried out a study to investigate the impact of explicit and implicit petroleum subsidy removal on poverty status of households in Nigeria. They further examined changes in government expenditure level as well as reallocation of government expenditure. The study used a modified version of the International Food Policy Research Institute (IFPRI) CGE model and a micro-simulation representative household (MS-RH) approach to assess the impacts of subsidy removal on poverty by incorporating information on households from the Nigeria Living Standards Survey (NLSS) in the model. A 2003 SAM was used, with eight household groups distinguished as representative households in the analysis. Their results showed that the national poverty level increased when subsidy was removed, without spending the associated savings, implying that government fiscal stance following subsidy removal is important in determining poverty effects. Furthermore, a highly expansionary policy of spending all savings from subsidy removal tended to favour rural and disfavour urban households, since an expansionary policy fuels inflation and worsens urban income while it improves rural incomes, as output prices rise, generally. They concluded that an increase in transfers to households would reduce the poverty effects, while a non-inflationary expansionary policy which increases transfers to households would have the least poverty effect.

Adenikinju and Falobi (2006) examined the impact of domestic oil supply shocks on the Nigerian economy, by investigating the economic and distributional costs of oil supply shocks on the economy, as a main objective among other ancillary ones. The

study made use of a CGE model based on a 1999 SAM of the Nigerian economy, with two highly aggregated household categories, to simulate the impact of reduction in capacity utilization of the refineries and reduction in capacity utilization of the refineries, plus, an increase in import price of petroleum products on the economy. Their findings revealed that oil supply shocks resulted in lower real gross domestic product (GDP), higher average prices and greater balance of payment deficits. Other macroeconomic variables such as private consumption, investment, government revenue and employment also declined. Furthermore, the distributional impact of the quantitative energy supply shocks was higher for poor households than for rich households. Specifically, real incomes of poor households declined more than that of rich households. The study surmised that quantitative restrictions on energy supply have varied and intensive negative impacts on the economy. Thus, they recommended that government should reduce its extensive involvement in the energy sector and allow the market to play a greater allocative role in the sector, since the price changes required to clear the market were quite high due to attendant distortions in the economy.

Obi (2007) examined the likely impact of fiscal policy on various productive sectors and on different socioeconomic groups in the economy, with a view to presenting a framework for the use of budget policy to improve income distribution and poverty reduction within a stable macroeconomic framework in Nigeria. The author used the RH CGE model with six household categories based on a 1999 SAM and 1996 FOS household survey to simulate the impact of three counterfactual scenarios, namely (i) transfers to poor household (ii) targeting of government expenditure and (iii) import tariff adjustment on employment, household incomes, consumption and inequality. His results revealed that the targeting of public expenditure tended to out-perform other fiscal stances in reducing poverty and inequality, while the use of import tariffs to redistribute income was observed to be biased against the poor, as it increased the reward to capital and other urban-based inputs in a greater proportion. He thus concluded that targeting of government spending tends to be a real and potent tool for income redistribution and poverty reduction in Nigeria, and that although direct transfer of a portion of government revenue was also a positive means of income redistribution; it was less effective compared with expenditure targeting.

Ekeocha and Nwafor (2007) studied the short- and long-run poverty implications of “Swiss Formula” adoption in Nigeria with a view to facilitating our understanding of the policy and consequently provide policy-makers with an informed basis for effective

bargaining and decision-making. The authors employed a sequential dynamic CGE model, a variant of the EXTER model, spanning 2005 to 2020, to simulate tariffs reduction proposed in the “Swiss Formula”, based on an updated 1997 SAM with two household categories and 2005 import tariff levels. From the two simulations carried out in the study, they found that in the short-run incomes of both urban and rural households increased as the fall in the consumer price index is lower than the fall in the producer price index. Further results indicated that rural households experienced larger increase in real income as the agricultural sectors from which they obtain a large part of their labour and land incomes were relatively better off. However, in the long-run, the effects are reversed as the agricultural sectors performed worse than the non-agricultural sectors due to increased investment in the latter. Thus, urban households continued to experience increased incomes while rural households experienced decreased incomes. The authors observed that adopting the “Swiss Formula” tariff rates had strong effects on both rural and urban incomes and thus they concluded that the effects of uniform tariff reduction were linear, such that the higher the rates of reduction, the stronger the impacts, whether positive or negative. Thus, as most poor people and most people resided in rural areas it was clear that poverty would increase under the “Swiss Formula” tariff regime since the decrease in rural incomes was much stronger in regime than the increase in urban incomes.

Concerned about the advocacy of minimum wage increment, which arises because of social concerns for the need to protect those in low-paid and low-productivity jobs from poverty, Taiwo, Oladeji, Akerele, Adenikinju, Bamidele and Uga (2009), studied the political economy of minimum wage legislation in Nigeria. The objectives of their investigation were to empirically determine a realistic national minimum wage and to analyse the potential consequences of a national minimum wage on employment, inflation, poverty and budgetary position in the country. The authors used a modified version of the RH CGE model for developing countries by Condon, Dahl and Devarajan (1987) and then incorporated the main features of the model developed for Nigeria by Dorosh (1996) and applied by Iwayemi and Adenikinju (2001) to simulate a 25 percent increase in the national minimum wage based on the 1999 SAM for Nigeria, with six household categories, built around the 1999 input-output table of Nigerian Institute for Social and Economic Research (NISER). Among, other results, the simulation showed significant macroeconomic impacts on the economy and marginal impact on the income of households; particularly, unemployment increased by 35.6 per cent, while investment

fell by 11 per cent. Imports, exports, consumption and real GDP fell by 2.65, 1.88, 0.46, and 0.83 per cent, respectively. Furthermore, a fall in household income between 0.553 and 1.337 percent was also observed for the six household categories in the model. The authors concluded that changes in the minimum wage generated significant macroeconomic impacts on the economy and that wage changes in the urban formal sector had significant impacts on other labour markets in Nigeria, and unemployment as well. Thus an increase in the minimum wage should be accompanied by higher labour productivity in the economy as well as policies to stimulate domestic employment.

3.3 Other Studies

Inspired by the need to show how Social Accounting Matrices (SAM) and Computable General Equilibrium (CGE) Models can be used to highlight and address issues related to income distribution and poverty, especially in developing African countries, Decaluwe, Patry, Savard and Thorbecke (1999), calibrated a CGE model on a SAM based on fictive data of an archetype African economy. The model was made up of six branches of production, five commodities, five factors of production and six representative households, and was used to simulate the impact of two exogenous shocks namely, a fall in the price of the export crop and an import tariff reform, specifically on poverty, and further on the distribution of income within the six household categories considered in the study. A distinguishing feature of their CGE model specification was that the poverty line was endogenized and that the income distribution was represented with a flexible Beta distribution function. Though they used fictive data, their results indicated that the reductions in import tariffs were beneficial to the alleviation of social poverty. On the other hand, the three measures of poverty for the society rise with a decline in the world price of the country's export crop. They concluded that, the approach suggested in the paper has gone part of the way in endogenizing the effects of exogenous shocks on poverty within a general equilibrium framework, and hoped that it will encourage researchers to analyze and explain more deeply the mechanisms affecting the shape of intra-group income distributions following a shock.

In attempting to answer the key question as to whether economic policy reform in sub-Saharan Africa worsened income distribution and exacerbated poverty, Dorosh and Sahn (2000) examined the impact of macroeconomic policy reform on real incomes of

poor households in four countries (Cameroon, The Gambia, Madagascar and Niger) in sub-Saharan Africa. They used a computable general equilibrium model to simulate the effect of two broad types of adjustment policies – trade and exchange rate liberalization, and reduction in government spending – on real incomes of poor households in the African context. The four CGE models followed Dervis, de Melo and Robinson (1982) and shared most of the same characteristics. To facilitate comparison, their functional income distribution distinguished four household groups (urban non-poor, urban poor, rural non-poor and rural poor) on which their simulations and analysis were based. The authors found that the terms-of-trade shocks were so persistent in Africa, and reduced incomes for most household groups, especially producers of commodities with falling world prices. In addition, their results showed that the beneficiaries of maintaining an overvalued exchange rate and related policy distortions were the urban non-poor, which explained why such policies prevailed for so long without being challenged, even in the face of obvious economic decline. They also found that at the margin, cutting government recurrent expenditures appeared to be generally preferable to raising trade taxes for increasing the pool of savings and total investment, both in terms of efficiency and overall equity. However, the results also showed that lower income urban groups tend to suffer more through the cut in recurrent expenditures. The four models also indicated that there is enough room to achieve welfare objectives without sacrificing macroeconomic stability and growth so long as efforts were made to ensure that foreign borrowing was used in such a way as to limit the adverse effects of real exchange rate appreciation. They however, concluded that the magnitude of the effects and the differential impact of policies on various income groups in the four countries illustrated the importance of proper country-specific policy analysis. Like-wise, the indirect effects of certain policies often outweighed the direct or expected effects, further increasing the importance of examining policies in a general equilibrium framework.

Lofgren, *et al* (2001) assessed the two sets of economic issues that loomed large on the economic horizon of Malawi – poverty alleviation and the country's vulnerability to external shocks. Specifically, their study simulated the impact of changes in the international prices of tobacco and petroleum products and fluctuations in the real exchange rate, as well as two types of poverty-alleviating domestic policy shifts - a public works programme and a land reform programme - on the economy and households' welfare, using a CGE model of the Malawian economy based on a 1998 SAM for Malawi and the Malawian Integrated Household Survey (IHS) of 1997/98.

Their model was made up of 33 activity sectors and 14 household categories comprised of rural-agriculture, rural-non-agriculture and urban households. Their result confirmed that Malawi's economy was highly sensitive to external shocks of the magnitudes that the country had experienced in the past few years, and that the impact on the non-agricultural population was particularly negative. Beyond this, real depreciation in the exchange rate indicated a pro-rural bias, with potential for eliminating balance-of-payment difficulties, while a real appreciation protected the urban population (which may be more powerful politically) and total household consumption. Further evidence, suggested that agricultural households were less exposed to changes in Malawi's external environment since their incomes tended to be more diversified with a substantial non-agricultural component. Also, the expanded public works programme generated significant gains for the rural poor but had a negative impact on non-agricultural households, especially in urban areas, while the results for the land reform simulations showed that a tax-based land reform programme had the potential of generating substantial gains for the household groups that received the redistributed resources. One of the main conclusions of the study was that if the government wanted to improve its budgetary balance while attaching priority to poverty alleviation, then it should strive to rely more heavily on direct taxes (which in practice are collected from the better-offs) rather than indirect taxes (which impose a more widely shared burden).

Owing to the growing concern regarding the impacts of macroeconomic policies such as fiscal reform and trade liberalization on income distribution and poverty Cockburn (2001), studied the impact of trade liberalization on poverty in Nepal using a CGE micro-simulation approach. Household income, expenditure and savings data based on a nationally representative sample of 3373 households from the 1995 Nepalese Living Standards Survey (NLSS) were used, in combination with the 1986 SAM for Nepal, to carry out the analysis. Specifically, the impact of the elimination of all import tariffs with a compensatory uniform consumption tax designed to maintain government revenue constant, was simulated on the welfare and income distribution of the highly disaggregated households in the model. His results indicated that revenue-neutral trade liberalisation has practically no aggregate welfare effects. However, in terms of its distributive effects, urban households benefit from liberalisation as initial tariffs were highest in agricultural sectors, whereas rural households of the Terai and Hill-Mountain lose out due to the pro-urban income effects. He concluded that the strength of the impacts increases with the level of income and especially strong, mostly positive,

effects are observed in the highest income levels. This may explain the apparent increase in income inequality in the urban and rural hills and mountains region in Nepal.

In recognition of the fact that trade liberalization is one of the tools that can be used to reduce poverty, but which however results in decreased fiscal revenue of government, Bhasin and Obeng (2007) investigated the impact of trade liberalization and increase in foreign aid (as a means of maintaining government revenue) on household poverty and income distribution in Ghana. The authors used a CGE model of the Ghanaian economy, with 3 branches of production and 5 household groups, based on a 1999 SAM and the Ghanaian Living Standards Survey (GLSS) 4 to simulate the impact of trade liberalization - elimination of import tariff in combination with increase in foreign aid and the elimination of export tariffs in combination with increased foreign aid – on poverty and income distribution. Their results show that in the first simulation, reduction in consumer prices reduced the poverty line and incomes of all households increased, this caused poverty to fall in all household groups, especially in the non-farm self-employed households, whereas public sector employees experienced the least reduction in poverty. Also, in the second simulation, a fall in consumer prices reduced the poverty line and increased the income of all households thus reducing the poverty level of all household categories. While agricultural households experienced the highest reduction in poverty under this scenario, public sector employees recorded the least improvement in poverty. Beyond these, their analysis of income distributions revealed that there was a reduction of the population below the poverty line in each household group. Particularly, the income distributions of agricultural households and non-working improve to a larger extent when trade-related export duties were eliminated in comparison to import duties accompanied by budget-neutral increase in foreign aid. On the other hand, the income distributions of public and private sector employees and non-farm self employed improve to a larger extent when trade related import duties are eliminated in comparison to export duties accompanied by an increase in foreign aid. They conclude that the elimination of trade related import duties and export duties accompanied by an increase in foreign aid reduces the incidence, depth, and severity of poverty of all categories of households. Both shocks improved the income distributions of households. However, the income distributions of agricultural households and non-working households improve to a larger extent in the second shock, whereas the income distributions of public and private sector employees and non-farm self employed improve to a larger extent in the first shock.

In a related study, Aka (2006) examined the impact of combined external trade tax and domestic tax reform on poverty and income distribution in Côte d'Ivoire by analyzing the effects of fiscal adjustment required to compensate for the drop in fiscal receipt because of the trade liberalization and adoption of common external tariff (CET) in West Africa Economic and Monetary Union (WAEMU) countries on income distribution and poverty in the context of Cote d'Ivoire. To achieve this broad objective, the author used an extended representative household CGE model in the class of models used by Decaluwé, Patry, Savard and Thorbecke (1999), Azis and Thorbecke (2001) and Decaluwé, Savard and Thorbecke (2005) to answer questions of poverty and income distribution. The CGE model was calibrated on a 2003 SAM which was built around the 1997 input-output table for Cote d'Ivoire, with 3 tradable and 1 non-tradable branches of production and 9 households groups based on the Cote d'Ivoire 1998 household survey (ENV98). To address the objectives of the study, the author pursued three sets of simulations - elimination of taxes on agricultural exported goods, elimination of taxes on agricultural exported goods, combined with an increase of 20% in indirect taxes, and elimination of taxes on agricultural exported goods combined with taxation of 20%. Overall, his results indicated that following the elimination of export taxes, domestic prices of products and the consumer price index rise. Thus raising the poverty line in simulations 1 and 2 and lowering it slightly in simulation 3. The elimination of agricultural export taxes (simulations 1 and 2) leads to more poor households than in simulations 3, where poverty decreases for all groups, except for other food crop farmers and agricultural workers. Public employees are the most affected by poverty in all cases. Further results indicated that inequality increased from 0.60 to 0.72 for the three simulations. The results by subgroup show that inequality increased for all the socioeconomic groups, but is higher in the coffee and cocoa farmers group followed by the unemployed and non-active and the public employees groups.

In an attempt to answer the important and contentious question of the extent to which poverty in Africa can be attributed to trade liberalisation, Chitiga, Mabugu and Kandiero (2007), explored how successful trade liberalisation has been in alleviating poverty and improving income distribution in Zimbabwe. Their specific goal was to establish the longer-term impact of trade liberalisation, through a complete removal of tariffs, on incomes, poverty and inequality. To accomplish the above objective, the authors used a computable general equilibrium (CGE) micro-simulation model that was

benchmarked to the 1995 social accounting matrix (SAM), and micro-simulation data obtained from a 1995 household survey of Zimbabwe. The CGE model is in the class of the EXTERPLUS models developed by Decaluwe, Martens and Savard (2001) and Cockburn, Decaluwe and Robichaud (2004) and contains 16 sectors, four factors of production and 14,006 households. Their results showed that the policy reduced overall poverty in the economy. However, poverty fell more in the urban than in the rural areas and in terms of income distribution, only a marginal change in inequality was recorded but which had a slight tendency towards more equitable distribution, thus implying that poor people gained while the capital owners and the skilled labourers were adversely affected. They concluded that although the magnitude of the impact was relatively small, valuable insights into the direction of change in poverty due to tariff removal in Zimbabwe were gained.

Concerned about the relatively small welfare and poverty impacts of trade liberalisation in most past studies (e.g. as in Chitiga, Mabugu and Kandiero, 2007), due a static framework of analysis usually employed and which results in only a short-term reallocation of resources, Annabi, Cisse, Cockburn and Decaluwe (2007) contribute to the literature in their study by integrating the growth effects of trade liberalisation and the resulting long-run impacts on welfare and poverty using an integrated dynamic CGE micro-simulation model of the Senegalese economy to simulate the impacts of a complete unilateral trade liberalisation policy. The integrated dynamic micro-simulation CGE model developed by the authors to analyze the potential poverty and inequality effects of complete and unilateral trade liberalisation in Senegal uses a 1996 social accounting matrix with four activity sectors and 3278 households based on the 1995 household survey (ESAM I). Their results indicated that in the short-run, the three measures of poverty increased more for rural households than for urban households. However, in the long-run, trade liberalisation and accumulation effects led to a significant decrease in poverty, which benefitted the urban households more - the head-count ratio fell by 7.41 and 1.42 percent respectively among urban and rural dwellers. Further results showed increased inequality with a higher increase among rural households in the short-term, while in the long run, the Gini coefficient increased by 0.84 and 0.67 percent, respectively for rural and urban households. However, these changes were less important among rural households because of the lower initial level of inequality (32.09 percent in rural areas against 52.06 percent in urban areas). They concluded that full tariff removal in Senegal led to a small increase in poverty and

inequality in the short run, as well as contractions in the initially protected agriculture and industrial sectors. Whereas, it enhanced capital accumulation, particularly in the service and industrial sectors, and brought about substantial increases in welfare and decreases in poverty in the long-term, even though a decomposition of poverty changes showed that income distribution worsened, with greater gains among urban dwellers and the non-poor.

In a similar study in East Africa, Aredo, Fekadu, and Workneh (2008) analysed the impact of unilateral trade liberalization in Ethiopia on poverty and inequality, owing to the inconclusive results about the relationship between trade liberalization and poverty. To achieve their goal, the authors used a CGE micro-simulation model, which was based on the now familiar EXTER model, calibrated to the 2001/2002 SAM for Ethiopia, and linked to the micro-simulation module with 17332 households derived from the 1999/2000 Household Income Consumption and Expenditure (HICE) survey, in a sequential fashion. The results of their study showed that nationally poverty incidence increased marginally. However, while farm households gained from the reform, entrepreneurs neither gained nor lost. On the other hand, urban wage-earner households showed a significant increase of 21.43 percent in the head count index. Moreover, the poverty gap and severity indices suggested that farm households gained from the reform, while the reform makes wage earners worse-off. They concluded that the welfare effects of trade liberalization as captured by the poverty indices showed that at the national level, poverty increases contrary to what is envisaged in the Ethiopia's Poverty Reduction Strategy Papers (PRSP). It is found that in general, the welfare of farm households improved after the reform, while that of wage earners' decreased. The simulation exercise has suggested that trade liberalization does not have significant welfare impacts on entrepreneurs, while it may have an adverse effect on wage earners. Finally, the study found that full liberalization may not have a significant effect on inequality.

Following the Indonesian economic crisis, which led to an increasing number poor people and deteriorating income distribution, Damuri and Perdana (2003) studied the impact of fiscal policy on income distribution and poverty by assessing what role fiscal policy intervention can play in alleviating poverty and redistributing incomes in Indonesia. Particularly, four fiscal policy scenarios were pursued by the authors – 20 percent increase in government expenditure under the condition of government's budget deficit; adjusting the income tax rate to ensure that the government borrowing is

unaffected by the increase in the expenditure; swapping income tax adjustment to the adjustment of sales; and 20 percent increase in government expenditure under the condition of government's budget deficit with fixed trade balance. To implement the above policy experiments, the authors used the WAYANG CGE model of the Indonesian economy, which derives its structure from the ORANI model developed by Dixon, Parmenter, Sutton and Vincent (1982) for Australia. The model is based on 1995 input-output tables and the 1995 SAM produced by the BPS with 10 different household groupings, 5 primary factors of production and 65 activity sectors. Results showed that population under the poverty line declined by 9.5 percent and faster in the urban compared with rural areas, following fiscal expansion financed by increasing the budget deficit. But due to the relatively small size of the urban poor population, the decline in poverty among the group in absolute terms was smaller than the decline in rural poor population. Increasing either income or sales taxes, resulted in more people living below the poverty line. Higher income taxes were associated with almost 13 percent increase in the number of the poor, while higher sales taxes increased the poor population by more than 17 percent. The effect of income tax was larger since income tax rate was progressive. The income distribution results indicated that the Gini ratio in all four scenarios was relatively unchanged, thus suggesting that income distribution was not affected much by the policies. The reason for the inequality result was that since the population of urban and non-labour rural households is only a smaller part in total population, a big gain received by those households does not affect the overall income distribution very much.

Motivated by the need to assess the controversial issue of the impact of trade (tariff) reforms on the poor, in the context of the Philippines, Cororaton and Cockburn (2004), studied the impact which the actual reduction of sectoral tariff rates observed between 1994 and 2000 in the Philippines would have had on poverty and inequality status of households. In doing this, they employed the CGE micro-simulation model calibrated on the 1994 SAM of the Philippines' economy. The model contained 12 production sectors and 24,797 households from the Family Income and Expenditure Survey (FIES), integrated into the model from the micro-simulation module. The main result of their simulation exercise indicated that the reduction in tariff rates between 1994 and 2000 was generally poverty-reducing. However, the decline was much higher in the National Capital Region (NCR) where the initial poverty level was lowest than in other areas, especially rural areas, where the initial poverty level was highest. The authors attributed

the result to reallocation effects of tariff reduction that favour the non-food manufacturing sector, as tariff cuts lower the cost of local production and bring about real exchange rate depreciation. On the other hand, agriculture contracts, while agriculture factor prices decline. Overall income inequality worsens as a result. The other crucial poverty-reducing effect of tariff reduction is through the lowering of consumer prices. In fact, the overall reduction in consumer prices is significantly higher than the total increase in household income.

3.4 Summary

From the Nigerian studies surveyed, all except the study by Obi (2007) used two representative household categories, a limitation that obscures the true picture of poverty and inequality effects (especially as far as geographical locations and socioeconomic grouping are concerned). Moreover, even Obi (2007) did not explicitly analyse the effects of the various simulations on inequality, aside pursuing an entirely different set of simulations. In fact, the study claimed that intra-group inequality could be obtained directly from survey data used. In the current study, we use the extended representative household methodology, where poverty is endogenized, thus allowing us to calculate the poverty lines as prices change in the CGE model. Proceeding along these lines allows us to successfully integrate poverty and income inequality analyses in the CGE model that is analysing micro issues in an economy-wide framework. This allows us to obtain both the macro impacts as well as the poverty and inequality impacts. Next we present the methodology in detail.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

This chapter is concerned with the techniques that were followed in the execution of the research. It begins with the description of the sources and types of data that were used in the analysis in section 4.2. This is followed by the presentation of the analytical framework in section 4.3, comprised of model specifications, the procedures for model implementation and concluded with a description of the rationale for the simulation experiments that were pursued in the study.

4.2 Data and Sources of Collection

The data for the study were obtained from several secondary sources. In the main, the 2006 Social Accounting Matrix (SAM) for Nigeria by the International Food Policy Research Institute, IFPRI (Nwafor, Diao and Alpuerto, 2010) provided the main database for the implementation of the CGE model, while the updated 2004 Nigeria Living Standards Survey (NLSS) by the National Bureau of Statistics, NBS (NBS, 2005) supplied the database for the analysis of poverty and income inequality. Lastly, the free parameters that were used alongside other parameters in the calibration of the CGE model were obtained from past studies in line with standard practice and good judgment (see for instance, Annabi, Cisse, Cockburn, and Decaluwe, 2009; Adenikinju, Ajakaiye, Decaluwe and Iwayemi (2009); Busari and Udejaja, 2007). The data are subsequently described in turn.

4.2.1 Description of the Social accounting Matrix

The data for the implementation of a CGE model derive from the SAM, designed to capture the micro and macroeconomic structure of the economy. A SAM is a square matrix that provides a snapshot of the economy by showing the circular flow of income and expenditure, usually for a given year. It also sheds light on the activities of different economic agents by describing the interrelationships between firms, households, investors, and the external sector (see, Pyatt and Round, 1985; Nwafor, *et al*, 2010). According to Sen (1996), a SAM is a snapshot of the inter-industry and inter-activity flows of value within an economy that is in equilibrium in a particular benchmark period, usually one year, and can be seen as a means of presenting in a single matrix the interaction between production, income, consumption, and capital

accumulation. Each transaction or account in a SAM has its row and column; payments or expenditure are listed in columns and receipts or incomes in rows. Each row's sum must equal to the corresponding column sum. The data sources for a SAM are input-output tables, national income statistics, and household income and expenditure statistics. The equations for the CGE model follow closely the structure of the SAM.

The 2006 Nigeria SAM used in the study was constructed under the aegis of the Nigeria Strategy Support Programme, NSSP of the International Food Policy Research Institute, IFPRI. It is the latest and the most detailed SAM of the Nigerian economy, especially as it concerns the agricultural sector. The SAM represents the Nigerian economy in 2006, the most recent year for which sufficient data were available. According to Nwafor *et al* (2010), the data used to build the SAM were obtained from publications of the National Bureau of Statistics, Central Bank of Nigeria (CBN), and the Federal Ministry of Agriculture and Water Resources (FMAWR), alongside data from an earlier SAM of Nigeria developed by United Nations Development Programme in 1995.

The original 2006 Nigeria SAM is made up of 147 balanced matrix accounts comprising 61 activity sectors, 62 commodities, 3 factors of production, 12 different households, 4 tax accounts, as well as, transaction costs, enterprises, government, saving and investment and the rest of the world accounts. Of the 61 sectors, over half, specifically, 33, are in agriculture, 13 in manufacturing, 13 service sectors and 2 mining sectors. For the purpose of achieving the objectives of the current study, the activity sectors in the original SAM were aggregated as shown in Table 4.1 to obtain the SAM which was relied upon in the study, as shown in Appendix 1, using Microsoft Excel package. The new SAM shown in Appendix 1, comprises of 4 production activity sectors (food, other agriculture, crude oil, manufactures/services), 4 commodities (food, other agriculture, crude oil and manufactures/services), 2 factors of production (labour and capital), 4 different households (rural-south, rural-north, urban-south and urban-north), 4 tax accounts (direct tax, indirect sales tax, import tax and activity tax), government, saving and investment and the rest of the world accounts. This gives a balanced SAM of 21 square matrix accounts. From the information contained in the SAM, all the data needed for calibration of the CGE model, aside the free parameters were obtained.

Table 4.1: Aggregation of Sectors in the Original into Sectors in the New SAM

Sectors in the Original SAM	Sectors in the New SAM
(1) Rice (2) Wheat (3) Maize (4) Sorghum (5) Millet (6) Cassava (7) Yams (8) Cocoyam (9) Irish Potato (10) Sweet Potato (11) Banana and Plantain (12) Beans (13) Groundnuts (14) Soybeans (15) Beniseed (16) Vegetables (17) Fruits (18) Cattle (19) Live Goats and Sheep (20) Live Poultry (21) Other Livestock (22) Fish/Fish meat	Food
(23) Cocoa (24) Coffee (25) Cotton (26) Oil Palm (27) Sugarcane (28) Unprocessed Tobacco (29) Nuts (30) Cashew (31) Rubber (32) Other unspecified crops (33) Forestry	Other Agriculture
(34) Crude Petroleum and Natural Gas	Crude Oil
(35) Beef (36) Goat and Sheep meat (37) Poultry meat (38) Eggs (39) Milk (40) Other meat (41) Beverages (42) Other Processed food products (43) Textiles (44) Wood, Wood Products, Furniture (45) Transportation and Other Equipment (46) Other Manufacturing (47) Refined oil (48) Other mining (49) Building and Construction (50) Electricity and Water (51) Road Transport (52) Other Transportation (53) Wholesale and Retail Trade (54) Hotel and Restaurants (55) Telecommunications, Post, Broadcasting (56) Finance and Other Business Services (57) Real Estate (58) Education (59) Health (60) Public Administration (61) Other Private Services	Manufactures/ Services

Source: Nigeria SAM, 2006

4.2.2 Nigeria Living Standards Survey Data

In addition to the SAM data, the study made use of household expenditure data from the Nigeria Living Standards Survey of 2004, to carry out poverty and inequality analyses. The choice of expenditure over income is informed from the fact that it has been oft-cited that expenditure is better suited than income as indicator of wellbeing, particularly in many developing countries. This is perhaps because, instantaneous utility depends directly on consumption and not income *per se*, and again, current consumption may also be a better indicator of long-term average well-being, as it will

reveal information about incomes at other dates, in the past and future (see for instance, Ajakaiye and Adeyeye, 2002; Coudouel, *et al*, (2002); Duclos and Araar, 2006).

The NLSS was conducted by the National Bureau of Statistics in urban and rural areas in the 36 states of the Federation plus the Federal Capital Territory, FCT. The survey made use of a two-stage cluster sampling technique. The first stage was a cluster of housing units called Enumeration Area (EA), while the second stage was the housing unit. A total of one hundred and twenty EAs were selected and sensitized in each State, while sixty were selected in the Federal Capital Territory. This implies that ten Enumeration Areas (EAs) were studied in each of the States while 5 EAs were covered in the FCT, every month for the one-year period. Ten EAs with five housing units were studied per month in each State while five EAs and five housing units were studied in the FCT. This meant that fifty housing units were canvassed per month in each State and twenty-five in Abuja. This implied that the survey had an anticipated national sample size of twenty-one thousand and nine hundred (21,900) HUs for the country for the 12-month survey period. Each State had a sample size of 600 HUs, while the Federal Capital Territory had a sample size of 300 (NBS, 2005). Of this sample size, results for 19158 were reported. From this number, we disaggregated the distribution into the four household groups in the study with the following sample sizes: 5907 for rural south; 8605 for rural north; 2733 for urban south and 1913 for urban north. These formed the 4 household groupings earlier mentioned in the SAM used for the study.

4.3 Analytical Framework

Two major analytical procedures were pursued in this study – the computable general equilibrium analysis and the analysis of poverty and inequality. Since we are studying the impact of macroeconomic shocks on households, we used the CGE model to generate the economy-wide (or macro) impacts of the shocks on households' incomes and expenditures. This is because macroeconomic shocks are economy-wide in nature and are characterised by strong general equilibrium effects, and thus, are preferably studied in the context of a computable general equilibrium (CGE) model, based on national accounting data. In contrast, poverty and inequality issues are generally analysed on the basis of household or individual (micro) data, in recognition of their heterogeneity and the importance of capturing their full distribution (see, Cockburn, Decaluwe and Robihaud, 2008).

Consequently, in the current study, these two approaches are bonded together in a macro-micro modelling framework, which explicitly integrates household categories into a CGE model, to obtain the extended representative household (ERH) model, a popular approach in general equilibrium analysis of distributional implications of macroeconomic shocks and policies (see, variously, Cockburn, 2001; Bhasin and Obeng, 2004; Essama-Nssah, 2005).

With some modifications, this study adopted the ERH approach proposed by Decaluwe *et al* (1999) and applied to Ghana by Bhasin and Obeng (2004) and (2005), Cameroon by Decaluwe, Savard and Thorbecke (2005), Cote d'Ivoire by Aka (2006), and Ethiopia by Aredo, Fekadu and Workneh (2008), among others. One of the key features of the model is that the poverty line is endogenized, and so it changes with changes in relative prices in the CGE model following an exogenous shock. This allows us to by-pass the problem of constructing and re-constructing (outside the model) poverty lines used in poverty analysis after each simulation run.

The actual implementation of this modelling approach involved two major steps. First, a CGE model, based on the 2006 social accounting matrix (SAM) for Nigeria, containing four representative household groups from the Nigeria Living Standards Survey (NLSS), was built. This allowed us to get the benchmark equilibrium (base) solution to the model and to perform simulation experiments, in order to mimic the impact of the exogenous shocks considered in the study. From the simulations, we obtain the average household income/expenditure variations following a shock as estimated at the household category level in the CGE model. In the second step, the income/expenditure variations were then applied to individual households within each category using base-year income/expenditure data from the (NLSS) household survey. The resulting new income/expenditure values were then compared with initial income/expenditure values through the estimation of standard Foster-Greer-Thorbecke (FGT) poverty indicators and the Gini index for inequality. This allowed us to calculate the impact of the shocks before and after the simulations.

4.3.1 Model Specification

4.3.1.1 Specification and Description of the CGE Model for the Study

The CGE model for this study is inspired by the class of poverty-based models of the Poverty and Economic Policy Network (see, for instance, Decaluwe *et al* (1999) and 2005; Cockburn *et al*, 2008; etc) and was calibrated on the 2006 Nigeria SAM by the

International Food Policy Research Institute (IFPRI), using techniques advanced by the Global Economic Modelling (EcoMod) Network CGE model for a small open economy (EcoMod, 2010). The model employs the standard assumptions, and assumes that producers maximize profits subject to production functions, while households maximize utility subject to budget constraints. Furthermore, factors are mobile across activities, available in fixed supplies, and demanded by producers at market clearing prices. The model satisfies Walras' law in that the set of commodity market equilibrium conditions are functionally dependent, and it is homogenous of degree zero in prices.

The model is made up of four sectors (food, other agriculture, crude oil as well as manufactures/services), two factors of production (labour and capital), and four household categories (rural-north, rural-south, urban-north and urban-south households). The geographical structure of the country, socioeconomic characteristics and the availability of reliable data, mainly defined the grouping. The model comprises six blocks of equations describing production and factor demand, income and savings, demand for commodities, prices, international trade as well as equilibrium and market clearing. Next, we present a listing of the model parameters, variables and equations, followed by a description of the model equations by block.

4.3.1.1.1 Definition of Parameters and Variables in the CGE Model

In this subsection, the definitions of the model parameters, endogenous variables, exogenous variables and definition of sets, is presented.

A: PARAMETERS

Production Functions

$\gamma_{F_{sec}}$ = Constant elasticity of substitution (CES) distribution parameter in the production function of firm

$\alpha_{F_{sec}}$ = Efficiency parameter of CES production function of firm

$i0_{sec,sec}$ = Technical coefficients (Leontief Production Function)

Constant elasticity of substitution (CES) Function between Capital and Labour

$\sigma_{F_{sec}}$ = CES capital-labour substitution-elasticities of firm

Constant elasticity of substitution (CES) Function between Imports and Domestic Production

$\gamma_{A_{sec}}$ = CES distribution parameter of ARMINGTON function of commodity

$\alpha_{A_{sec}}$ = Efficiency parameter of ARMINGTON function of commodity

σA_{sec} = Substitution elasticities of ARMINGTON function

Constant elasticity of transformation (CET) Function between Exports and Domestic Sales

γT_{sec} = CET parameter regarding destination of domestic output

αT_{sec} = Shift parameter in the CET function of firm

σT_{sec} = Elasticities of transformation in CET function

Linear Expenditure System (LES) Consumption Function (Households)

$\alpha HLES_{sec,h}$ = Marginal budget share of good in household's total expenditure

$\mu H_{sec,h}$ = Subsistence household consumption quantities (minimum consumption parameter)

$elasY_{sec,h}$ = Income elasticities of demand for commodity

$Frisch_h$ = Value of Frisch parameter in LES utility function

Cobb-Douglas Utility Function (Investment)

αI_{sec} = Cobb-Douglas parameter in the investment utility function

Cobb-Douglas Utility Function (Government)

αCG_{sec} = Cobb-Douglas parameter in government utility function for commodities

Tax Rates

tC_{sec} = Tax rate on consumer commodities

tCZ_{sec} = Initial tax rate on consumer commodities (used in PCINDEX)

tm_{sec} = Tariff rate on imports

ta_{sec} = Activity tax rate on production

ty_h = Tax rate on income of households

Other Parameters

mps_h = Household's marginal propensity to save

δW_h = Share of labour income received by households

δF_h = Share of capital income received by households

B: ENDOGENOUS VARIABLES

XD_{sec} = Gross domestic production (output)

XDD_{sec} = Domestic production delivered to home markets

X_{sec} = Domestic sales of composite commodity
 K_{sec} = Capital demand by sector
 L_{sec} = Labour demand by sector
 PK = Return to capital
 $PCINDEX$ = Consumer price index (commodities)
 PD_{sec} = Price level of domestic output of firm
 PDD_{sec} = Price of domestic output delivered to home market
 P_{sec} = Price level of domestic sales of composite commodities
 PM_{sec} = Import price excluding tariffs in local currency
 PE_{sec} = Price of exports in local currency
 I_{sec} = Investment demand
 CG_{sec} = Government commodity demand
 $C_{sec,h}$ = Consumer demand for commodities
 $CBUD_h$ = Household expenditure (commodities)
 E_{sec} = Export supply
 M_{sec} = Import demand
 Y_h = Household income level
 YD_h = Household disposable income
 YT = Household total income
 S = Total savings
 SH_h = Household savings
 SHV = Total household savings
 $TAXR$ = Total government tax revenues
 YG = Total government income
 TRC_{sec} = Tax revenue on consumer commodities
 TRA_{sec} = Activity tax revenue
 TRM_{sec} = Tax revenue on imports
 TRY_h = Income tax revenue
 $OMEGA$ = Objective variable

C: EXOGENOUS VARIABLES

SG = Government savings

SF = Foreign savings

KS = Capital endowment

LS = Supply of labour

PL = Wage rate

ER = Exchange rate

PWE_{sec} = World price of exports

PWM_{sec} = World price of imports

$DIVG$ = Dividends paid to government

PFC = Dividends paid to foreigners

TPC = Total dividends paid to government and foreigners

TFT = Total foreign transfers

FTG = Foreign transfers to government

FTR_h = Foreign transfers to households

GTH = Government transfers to households

D: SETS

$sec, secc \in SEC$ (*Food, Other agriculture, Crude oil, Manufactures/services*) All activities and commodities

$h \in H$ (*Rural-south, Rural-north, Urban-south, Urban-north*) Households

4.3.1.1.2 Equations in the CGE Model for Nigeria

This subsection presents the equations of the CGE model as well as a description of the equations by block, as highlighted in subsection 4.3.1.1, above.

A. Production and Factor Demand

The production system in the model is nested; at the top level of aggregation, value-added and intermediate inputs combine in fixed proportions, via a Leontief aggregator function to produce gross sectoral output. At the next level of aggregation, value-added is a constant returns to scale constant elasticity of substitution (CES) function of labour and capital, as factors of production and intermediate inputs in Leontief technology. From the above-named functions, the demand equations for labour and capital as well

as the zero-profit condition for firms, which define the firms' behaviour in the model, are derived. The resulting equations are shown in equations 1-3 below:

Capital demand function for firms

$$1. K_{sec} = \left(\frac{XD_{sec}}{aF_{sec}} \right) \gamma F_{sec}^{\sigma F_{sec}} PK^{-\sigma F_{sec}} (\gamma F_{sec}^{\sigma F_{sec}} PK^{1-\sigma F_{sec}} + (1 - \gamma F) \sigma F_{sec} PL^{1-\sigma F_{sec}})^{\frac{\sigma F_{sec}}{1-\sigma F_{sec}}}$$

Labour demand function for firms

$$2. L_{sec} = \left(\frac{XD_{sec}}{aF_{sec}} \right) 1 - \gamma F_{sec}^{\sigma F_{sec}} PL^{-\sigma F_{sec}} (\gamma F_{sec}^{\sigma F_{sec}} PK^{1-\sigma F_{sec}} + (1 - \gamma F) \sigma F_{sec} PL^{1-\sigma F_{sec}})^{\frac{\sigma F_{sec}}{1-\sigma F_{sec}}}$$

Zero profit condition for the firms

$$3. PD_{sec} \cdot XD_{sec} = PK \cdot K_{sec} + TRA_{sec} + PL \cdot PL_{sec} + \sum_{secc} i_{0_{secc,sec}} \cdot XD_{sec} \cdot P_{secc}$$

B. Income and Savings

In this model, households derive their income from three sources: primary factor payments, transfers from the government and transfers from the rest of the world. From this income, we derive the disposable income by subtracting the direct taxes collected by the government. Household savings is specified as a fixed proportion of household's disposable income. Government revenue is generated from direct taxes collected on household income, indirect taxes on domestic goods and production activities, and taxes levied on imports, plus dividends paid to government as well as foreign transfers to government. Government savings are obtained from the difference between government income and expenditures; made up of government consumption and transfers made to households. Income and savings block is depicted in equations 4 to 16 below.

Household income

$$4. Y_h = PK \cdot KS \cdot \delta F_h + PL \cdot LS \cdot \delta W_h + GTH_h + FTR_h$$

Household disposable income

$$5. YD_h = Y_h - TRY_h$$

Total household income

$$6. YT = \sum_h Y_h$$

Household savings

$$7. SH_h = Y_h (1 - ty_h) mps_h$$

Total household savings

$$8. SHV = \sum_h Y_h (1 - ty_h) mps_h$$

Total tax revenues

9.

$$TAXR = \sum_h ty_h \cdot Y_h + \sum_{sec} P_{sec} \cdot tc_{sec} \cdot \sum_h C_{sec,h} + \sum_{sec} TRA_{sec} + \sum_{sec} tm_{sec} \cdot M_{sec} \cdot ER \cdot PWM_{sec}$$

Government income

$$10. \quad YG = TAXR + DIVG + FTG$$

Government savings

$$11. \quad SG = YG - \sum_{sec} CG_{sec} - PCINDEX \cdot \sum_h GTH_h$$

Total savings

$$12. \quad S = SHV + SG \cdot PCINDEX + SF \cdot ER$$

Activity tax Income

$$13. \quad TRA_{sec} = ta_{sec} \cdot XD_{sec}$$

Import tax Income

$$14. \quad TRM_{sec} = tm_{sec} \cdot M_{sec} \cdot ER \cdot PWM_{sec}$$

Sales tax Income

$$15. \quad TRC_{sec} = tc_{sec} \cdot \sum_h C_{sec,h} \cdot P_{sec}$$

Income tax revenue

$$16. \quad TRY_h = ty_h \cdot Y_h$$

C. Demand for Commodities

The demand system adopted in this study is the Stone-Geary linear expenditure system (LES), which is better suited for poverty analysis since it allows us to differentiate between minimum (subsistence) consumption and discretionary consumption. The consumption function of households is obtained by maximization of this system as it is supposed to reflect the household utility function. This system assumes that the demand for commodities by households is made up of two components: minimum consumption and the discretionary consumption. In this system, a household-specific minimum consumption bundle which represents the minimum quantity of each of the four commodities is postulated. This system allows us to determine the poverty line endogenously given the monetary value of the committed minimum consumption. Household's total consumption expenditure is given by household disposable income less savings. Government demand for commodities as well as investment demand is modelled using a Cobb-Douglas utility function. Equations 17 to 20 describe the demand for commodities block of the model.

Consumer demand for commodities

$$17. \quad (1 + tc_{sec})P_{sec}C_{sec,h} = (1 + tc_{sec})P_{sec}\mu H_{sec,h} + \alpha HLES_{sec,h} (CBUD_h - \sum_{sec} \mu H_{sec,h} (1 + tc_{sec}) P_{sec})$$

Household expenditure on commodities

$$18. \quad CBUD_h = ((1 - ty_h) \cdot Y_h) - SH_h$$

Government demand for commodities

$$19. \quad P_{sec} \cdot CG_{sec} = \alpha CG_{sec} \cdot (TAXR - (\sum_h GTH_h) - SG \cdot PCINDEX)$$

Investment demand function for commodities

$$20. \quad P_{sec} \cdot I_{sec} = \alpha I_{sec} \cdot S$$

D. Prices

The prices block of the model is given by equations 21 to 23, which define the import price, export price and the consumer price index.

Export price equation

$$21. \quad PE_{sec} = PWE_{sec} \cdot ER$$

Import price equation

$$22. \quad PM_{sec} = (1 + tm_{sec}) \cdot PWM_{sec} \cdot ER$$

Consumer Price Index

$$23. \quad PCINDEX = \frac{\sum_{sec} (1 + tc_{sec}) \cdot P_{sec} \cdot \sum_h CZ_{sec,h}}{\sum_{sec} (1 + tc_{sec}) \cdot PZ_{sec} \cdot \sum_h CZ_{sec,h}}$$

E. International Trade

In modelling the foreign sector, we follow the Armington (1969) assumption of imperfect substitutability between domestically produced and imported goods, using a CES import function. In a similar manner, exports are modelled using a constant elasticity of transformation (CET) function, with the believe that exports are also not perfect substitutes for domestically produced goods in importing countries, thus characterising the relative facility of a producer to switch between producing for the domestic and foreign markets. This behaviour is described using the equations of import demand, export supply, demand for domestic goods, supply of domestic goods and the accompanying Armington zero-profit and CET zero-profit conditions in equations 24 to 29.

Export supply

$$24. E_{sec} = \gamma T_{sec}^{\sigma T_{sec}} \cdot PE_{sec}^{-\sigma T_{sec}} \cdot [\gamma T_{sec}^{\sigma T_{sec}} \cdot PE_{sec}^{1-\sigma T_{sec}} + (1 - \gamma T_{sec})^{\sigma T_{sec}} \cdot PDD_{sec}^{1-\sigma T_{sec}}]^{\frac{\sigma I_{sec}}{1-\sigma T_{sec}}} \cdot \left(\frac{XD_{sec}}{aT_{sec}}\right)$$

Domestic supply of domestic goods

25.

$$XDD_{sec} = (1 - \gamma T_{sec})^{\sigma T_{sec}} \cdot PDD_{sec}^{-\sigma T_{sec}} \cdot [\gamma T_{sec}^{\sigma T_{sec}} \cdot PE_{sec}^{1-\sigma T_{sec}} + (1 - \gamma T_{sec})^{\sigma T_{sec}} \cdot PDD_{sec}^{1-\sigma T_{sec}}]^{\frac{\sigma I_{sec}}{1-\sigma T_{sec}}} \cdot \left(\frac{XD_{sec}}{aT_{sec}}\right)$$

CET zero profit condition

$$26. PD_{sec} \cdot XD_{sec} = PE_{sec} \cdot E_{sec} + PDD_{sec} \cdot XDD_{sec}$$

Import demand

$$27. M_{sec} = \left(\frac{X_{sec}}{aA_{sec}}\right) \cdot \gamma A_{sec}^{\sigma A_{sec}} \cdot PM_{sec}^{-\sigma A_{sec}} \cdot [\gamma A_{sec}^{\sigma A_{sec}} \cdot PM_{sec}^{1-\sigma A_{sec}} + (1 - \gamma A_{sec})^{\sigma A_{sec}} \cdot PDD_{sec}^{1-\sigma A_{sec}}]^{\sigma A_{sec}/(1-\sigma A_{sec})}$$

Demand for domestic goods

28.

$$XDD_{sec} = (X_{sec}/aA_{sec}) \cdot (1 - \gamma A_{sec})^{\sigma A_{sec}} \cdot PDD_{sec}^{-\sigma A_{sec}} \cdot [\gamma A_{sec}^{\sigma A_{sec}} \cdot PM_{sec}^{1-\sigma A_{sec}} + (1 - \gamma A_{sec})^{\sigma A_{sec}} \cdot PDD_{sec}^{1-\sigma A_{sec}}]^{\sigma A_{sec}/(1-\sigma A_{sec})}$$

Armington zero profit condition

$$29. P_{sec} \cdot X_{sec} = PM_{sec} \cdot M_{sec} + PDD_{sec} \cdot XDD_{sec}$$

F. Equilibrium, Market Clearing and Model Closures

In this model, we ensure equilibrium in the factor markets for labour and capital, product markets for the commodities as well as balance of payments equilibrium of the foreign sector. Equations 30 to 33 describe these conditions. Equations 30 and 31 define equilibrium in the factor market for labour and capital respectively. In equation 30, market clearing requires that total labour demand equals the supply of labour. Similarly, total capital demand, in equation 31, equals capital supply plus total capital dividends paid to government and foreigners. The second market clearing condition (equation 32) imposes equality between composite supply and the sum of final demand

for commodities. Finally, equation 33 assures balance of payment equilibrium by equating total foreign receipts to payments. This condition equalizes the sum of imports plus the payments to foreign capital with sum of total exports, total foreign transfers to the government and households and foreign savings.

We assume, in traditional fashion, that the economy has no impact on international markets, and so takes the world prices as given. Thus, world prices of imports and exports and dividends paid to the rest of the world are exogenously fixed. The next closure condition is that the supply of labour and capital are also exogenous to the model. Also pre-determined outside of the model are the nominal exchange rate and foreign savings, as well as, government savings and transfers to households.

Essentially, the study adopts the classical macro closure, where investment is savings-driven; implying that total investment value adjusts to available level of savings. This was used because with endogenous investment, total savings are determined by applying exogenous saving rates to income of each institution in the economy, hence total investment is then determined by savings behaviour and consequently by the distribution of income among different households, firms and the government (see, Cockburn *et al*, 2008).

Market clearing for labour

$$30. \quad \sum_{sec} L_{sec} = LS$$

Market clearing for capital

$$31. \quad \sum_{sec} K_{sec} = KS + TPC$$

Market clearing for commodities

$$32. \quad \sum_h C_{sec,h} + I_{sec} + \sum_{sccc} i_{0_{sec,sccc}} \cdot XD_{sccc} + CG_{sec} - TRC_{sec} = X_{sec}$$

Balance of payments

$$33. \quad \sum_{sec} M_{sec} \cdot PWM_{sec} + PFC = \sum_{sec} E_{sec} \cdot PWE_{sec} + TFT + SF$$

Equation 34 is used to verify Walras' law, and the variable Walras is thus a check variable, which should be zero, if every equation in the model is satisfied and a general equilibrium solution, found. Lastly, equation 35 specifies the objective function that is to be optimized since we specify the model as a system of non-linear programming (NLP) equations, which are solved simultaneously.

Verification of Walras Law

$$34. \quad Walras = \sum_{sec} L_{sec} - LS$$

Objective Function

35. $OMEGA = 1$

4.3.1.1.3 Calibration of the CGE Model

In order that the CGE model replicates the data represented in the base year equilibrium, it has to be calibrated on the basis of such data. In the current study, the 2006 social accounting matrix for Nigeria provides the database for the calibration of the CGE model for Nigeria, since the model is built around the said SAM. Thus, calibration of the model consists in determining the numerical values of the various parameters of the functions (production, consumption, import, export function, etc.) compatible with the equilibrium of the initial SAM (Annabi, Cockburn and Decaluwe, 2009 and Adenikinji, 2009). These parameters, which are mostly elasticities, propensities, ratios, etc., are assigned to equations of the CGE model in order to guarantee that the benchmark dataset (the 2006 SAM, in our case) is the equilibrium solution to the model. This condition, among others, has to be met, necessarily, for simulation experiments to be carried out on the model. Apart from calculating the elasticities from the various functions in the CGE model, the calibration exercise also involves the calculation of tax rates, saving rates and other parameters that are needed for the benchmark equilibrium solution to be attained.

In the current study, the “free” parameters (those that cannot be calibrated from the underlying SAM) were chosen from the literature (see, for instance Dorosh, 1996; Yusuf, 1999; Nwafor *et al*, 2005; Annabi *et al*, 2009; etc). They include CES capital-labour substitution elasticities, substitution elasticities of Armington function, elasticities of transformation in the CET function as well as income elasticities of demand for commodities. Some of the elasticities for production, consumption and trade were the best guesstimates based on similar studies and also defined to ensure overall model consistency (Busari, 2009). The Frisch parameter was also obtain outside the SAM (see, Dervis, *et al*, 1983; Savard, 2003; Adenikinju, *et al*, 2009; among many). On the basis of the obtained free parameters, we proceed to calibrate/calculate the parameters as shown below:

Parameters of the LES utility function: $\alpha HLES$ and μH ;

36. $\alpha HLES_{SEC,h} = elasY_{SEC,h} \cdot (1 + tc_{SEC}) \cdot P_{SEC} \cdot C_{SEC,h} / CBUD_h$

$$37. \quad \mu H_{sec,h} = C_{sec,h} + \alpha HLES_{sec,h} \cdot CBUD_h / (1 + tc_{sec}) \cdot P_{sec} \cdot Frisch_h$$

Parameters of the CES production function: gammaF and aF;

$$38. \quad \gamma F_{sec} = 1 / \left(1 + \frac{PL}{PK} \cdot \left(\frac{K_{sec}}{L_{sec}} \right)^{\left(\frac{-1}{\sigma F_{sec}} \right)} \right)$$

$$39. \quad a F_{sec} = XD_{sec} / \left[\gamma F_{sec} \cdot K_{sec}^{\left(\frac{\sigma F_{sec}-1}{\sigma F_{sec}} \right)} + (1 - \gamma F_{sec}) \cdot L_{sec}^{\left(\frac{\sigma F_{sec}-1}{\sigma F_{sec}} \right)} \right]^{\left(\frac{\sigma F_{sec}}{\sigma F_{sec}-1} \right)}$$

Parameters of the Armington function: gammaA and aA;

$$40. \quad \gamma A_{sec} = 1 / \left[1 + \left(\frac{PDD_{sec}}{PM_{sec}} \right) \cdot \left(\frac{M_{sec}}{XDD_{sec}} \right)^{\left(\frac{-1}{\sigma A_{sec}} \right)} \right]$$

$$41. \quad a A_{sec} = X_{sec} / \left[\gamma A_{sec} \cdot M_{sec}^{\left(\frac{\sigma A_{sec}-1}{\sigma A_{sec}} \right)} + (1 - \gamma A_{sec}) \cdot XDD_{sec}^{\left(\frac{\sigma A_{sec}-1}{\sigma A_{sec}} \right)} \right]^{\left(\frac{\sigma A_{sec}}{\sigma A_{sec}-1} \right)}$$

Parameters of the CET function: gammaT and aT;

$$42. \quad \gamma T_{sec} = 1 / \left[1 + \left(\frac{PDD_{sec}}{PE_{sec}} \right) \cdot \left(\frac{E_{sec}}{XDD_{sec}} \right)^{\left(\frac{-1}{\sigma T_{sec}} \right)} \right]$$

$$43. \quad a T_{sec} = XD_{sec} / \left[\gamma T_{sec} \cdot E_{sec}^{\left(\frac{\sigma T_{sec}-1}{\sigma T_{sec}} \right)} + (1 - \gamma T_{sec}) \cdot XDD_{sec}^{\left(\frac{\sigma T_{sec}-1}{\sigma T_{sec}} \right)} \right]^{\left(\frac{\sigma T_{sec}}{\sigma T_{sec}-1} \right)}$$

Parameter of the Cobb-Douglas investment function: alphaI;

$$44. \quad \alpha I_{sec} = I_{sec} \cdot P_{sec} / S$$

Parameter of the Cobb-Douglas utility function of government: alphaCG

$$45. \quad \alpha CG_{sec} = P_{sec} \cdot CG_{sec} / (TAXR - \sum_h GTH_h - PCINDEX.SG)$$

Tax rates:

$$46. \quad tc_{sec} = TRC_{sec} / \sum_h C_{sec,h} \cdot P_{sec}$$

$$47. \quad tm_{sec} = TRM_{sec} / (M_{sec} \cdot PWM_{sec} \cdot ER)$$

$$48. \quad ta_{sec} = TRA_{sec} / XD_{sec}$$

$$49. \quad ty_h = TRY_h / Y_h$$

Other Parameters

$$50. \quad mps_h = SH_h / (Y_h - TRY_h)$$

$$51. \quad XD_{sec} = \sum_{sec} io_{sec,sec} + K_{sec} + L_{sec} + TRA_{sec}$$

$$52. \quad XDD_{sec} = XD_{sec} - E_{sec}$$

$$53. \quad X_{sec} = XDD_{sec} + M_{sec} + TRM_{sec}$$

The parameters and other variables calibrated and calculated using the expressions listed in 36 to 53, above, alongside other benchmark data from the SAM, allowed the

model to be computable, of which solution replicated the initial data represented in the SAM.

4.3.1.2 Poverty and Inequality Analyses in the Study

In this module, we link the macroeconomic CGE model to microeconomic behaviour of the households, as captured in the household survey. This was done, as mentioned earlier, by using the results (average income/expenditure values) obtained from the base equilibrium as well as the simulations of the macro model on the household groups in the model, to change the values of the income/expenditure data in the household survey before carrying out poverty and inequality analyses.

The theoretical basis for this exercise is that value-added is channelled from the production process into the income of different types of households and other institutions through the return to factors of production owned by the households. Each factor of production generates different amounts of value-added depending on the return to that factor and the quantity used in the economy. Thus, differences in ownership, types, and the value-added generated by the different factors of production determine the distribution of income across household groups, following an economic shock, as a result of changes in the return to factors of production or adjustments in the quantity of the factors used in the economy or both (see, Damuri and Perdana (2003); Boccanfuso and Savard, 2003 & 2005).

Subsequently, we describe how the estimations were carried using the results obtained from both the base solution and scenario experiments from the CGE model to estimate poverty measures and analyse inequality, with a view of assessing the impact of the various shocks on these indexes, as part of the specific objectives of the study.

4.3.1.2.1 Poverty Analysis

In this study, we adopted the Foster, Greer and Thorbecke (1984) class of poverty measures for the analysis of poverty, as in most of the CGE studies cited in section 4.3 and others including Damuri and Perdana (2003); Boccanfuso and Savard (2003) and (2005). The choice of this measure is informed by the fact that it is additively decomposable, and thus it allows the decomposability of the overall population into sub-groups which helps us to making useful poverty comparisons.

The Foster-Greer-Thorbecke (FGT) index allows us to measure the proportion of the poor in the population (the headcount ratio). Furthermore, it provides a measure of the

depth of poverty (poverty gap), which provides information regarding how far households are from the poverty line, as well as a measure of the severity of poverty (squared poverty gap), which takes into account not only the distance separating the poor from the poverty line, but also the inequality among the poor. The poverty depth and severity indices provide a measure of the mean of the individual poverty gaps raised to a power that reflects the social-valuation of different degrees of poverty. This implies that the FGT class of measures treats poverty as dependent on the poverty gap ratio, the parameter α entering as a power of that ratio (Anyanwu, 1997). The FGT measure for the i^{th} sub-group is given as:

$$54. \quad P_{\alpha_i} = \frac{1}{n_i} \sum_{j=1}^{q_i} \left[\frac{Z - y_{ji}}{Z} \right]^\alpha$$

Where:

α = degree of concern for the depth of the poverty line; for this study $\alpha = 0, 1, 2$

n_i = total population in the i^{th} sub – group

q_i = number of the poor in the i^{th} sub – group

Z = poverty line

y_{ji} = expenditure of the i^{th} sub-group

$\frac{Z - y_{ji}}{Z}$ = poverty gap ratio

An α value of zero gives the poverty incidence, defined as the proportion of the population that is poor in the sub-group. This is the share of the population whose income or consumption is below the poverty line, that is, the share of the population that cannot afford to buy a basic basket of goods (World Bank, 2011). The poverty incidence or headcount ratio is not sensitive to the changes in the welfare among the poor.

On the other hand, an α value of one gives the depth of poverty, which is the ratio of the poverty line that is required to lift a poor person out of poverty. This measure captures the mean aggregate income or consumption shortfall relative to the poverty line across the whole population. It is obtained by adding up all the shortfalls of the poor (considering the non-poor as having a shortfall of zero) and dividing the total by the population. Put differently, it gives the total resources needed to bring all the poor to the level of the poverty line (divided by the number of individuals in the population). Unlike the headcount ratio, this measure is sensitive to the welfare among the poor. Lastly, the severity of poverty takes on an α value of two. This measure takes into

account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor. That is, a higher weight is placed on those households who are further away from the poverty line. As for the poverty gap measure, limitations apply to some non-monetary indicators. As α increases, more importance is given to the shortfalls of the poorest households and the measure becomes more distributionally sensitive.

In implementing this approach in the context of a CGE model, two points need be resounded. First, the endogenized poverty line in the LES demand function in the CGE model provides the poverty lines for poverty analyses in the pre- and post-shock scenarios, as earlier indicated, thus sidestepping the arbitrariness that the construction of a poverty line is usually fraught with (see for instance, Decaluwe *et al.*, 1999; Decaluwe *et al.*, 2005; Boccanfuso and Savard, 2005; Damuri & Perdana, 2003). Second, from the simulations of the general equilibrium model, new values with respect to average income or expenditure levels of each of the household groups are obtained, and the average variations are thus applied to the household distributions from the survey, this hence allows us to calculate the indicators of poverty following an exogenous shock (Decaluwe *et al.*, 2005).

4.3.1.2.2 Inequality Analysis

Here, we analyse the changes in inequality in income distribution, nationally and for the various household groups in the base year, and nationally for the post-shock scenarios. The reason for the latter is intuitive in the sense that the simulations affect only the average income or expenditure of each household group, and not the variance of the income or expenditure distribution within the group. Thus, the distributional aspects of the simulations come from the fact that the overall distribution of income or expenditure of the entire population will change because the change of average income and expenditure varies between one household group and another (see for example, Damuri and Perdana, 2003).

We measure income inequality using the Gini coefficient. The Gini index was chosen because it satisfies most of the desirable axioms of a good inequality measure, as stated in section 2.4.1, and it is the most frequently used index to assess the rate of overall inequality (see Decaluwe, Dumont and Savard, 1999; Abdelkrim and Awoyemi, 2006; Boccanfuso and Savard, 2005 & 2009; Aigbokahn, 2008; among others) . The index is given as:

$$55. \quad GR = 1 - \sum_i^n f_i(F_i + F_{i-1})$$

Where:

f = the frequency of population in the i^{th} class

F = the cumulative frequency of the particular class

The value of the Gini coefficient lies between 0 and 1, and the larger its value, the greater the level of inequality in the distribution of income, whereas a value of zero indicates an egalitarian income distribution or perfect equality, a value of 1 indicates extreme inequality.

4.3.2 Model Implementation Procedures

As indicated earlier, two sets of analyses (CGE and poverty and inequality) were carried out in order to meet the objectives of this study. The computable general equilibrium analysis was carried out with the aid of the General Algebraic Modelling System (GAMS) software package, by GAMS Development Corporation (2009), while the poverty and inequality analysis was conducted using the Software for Distributive Analysis (DAD) developed by Duclos, Araar and Fortin (2008). Next we briefly explain how both software packages were deployed.

4.3.2.1 CGE Analysis (GAMS)

General Algebraic Modelling System (GAMS) provides high-level language for the compact presentation of large and complex models and allows changes to be made in model specification simply and safely. It also allows unambiguous statement of algebraic relations and permits model descriptions that are independent of solution algorithms (see, Oyeranti, 2005). This makes GAMS one of the best-suited packages for the implementation of CGE models, given their high data demands and computational complexities. Other packages include, but not limited to, GEMPACK, EVIEWS and EXCEL.

Generally, every GAMS model follows a basic structure, which is divided into three broad headings namely, *Data*, *Model* and *Solution*.

Under *Data*, the following tasks are performed:

- i. sets declarations and definitions

- ii. parameter declarations and definitions
- iii. assignment of initial values; and
- iv. displays (basically intermediate displays).

The *Model* comprises:

- i. variable declarations
- ii. equations declarations
- iii. equations definitions; and
- iv. model definition.

Finally, the *Solution* algorithm is made up of

- i. solve statement; and
- ii. display statements.

Following the above structure, the data for the implementation of the CGE model from our SAM were entered after declaring sets and parameters (both scalars and variables (exogenous and endogenous)). After this stage, the initial values from the SAM and from the calibration process were assigned to the declared parameters so as to enable GAMS to solve the model and replicate the base solution represented in the SAM, then we display the assignments to ensure that the values are consistent with those in the SAM and/or provided by calculations outside of the SAM based on the specified expressions.

Next, we set up the model by first declaring the variables, followed by equations declaration and specification (it should be noted that the number of endogenous variables must be equal the number of equations to ensure that the model is a square system, which is a requirement that assures a solution), the model was then defined (for the current study, the model was named: “Macroeconomic Shocks and Poverty” and GAMS was asked to solve the equations listed inside the two slashes (“//”) after the model name in GAMS syntax).

The last part of the model structure is the Solution. Here, we specified the solve statement, which reads: “Solve Macroeconomic Shocks and Poverty using NLP maximizing OMEGA”. NLP here stands for Non-Linear Programming. So, we used an NLP Solver called CONOPT3 (the most recent version of CONOPT solver at the time) to solve the system of equations since the model was specified as a system of non-linear equations with an objective function OMEGA (see equation 35) to be optimized, in this case by maximization. Finally, we ask GAMS to display the results, which must exactly

replicate the benchmark data provided to GAMS. This can only be obtained if all the model equations are satisfied, system is square, the calibration was successful, and in which case GAMS would return a “normal completion” and “locally optimal” solution for an NLP problem, like in the current one. The interested reader can request for the GAMS code for details on the model structure.

The model was specified and solved in a comparative static mode. Upon solving for the benchmark equilibrium, it provided a simulation laboratory, which allowed us to carry out ‘controlled’ experiments, changing the exogenous conditions (using the shocks pursued in this study), and then measuring the impact against the baseline conditions. Each solution provides a full set of economic indicators, including household incomes, expenditures; prices, supplies, and demands for factors and commodities, etc as well as macroeconomic results.

4.3.2.2 Poverty and Inequality Analysis (DAD)

The software for Distributive Analysis, DAD is one of the widely used packages for poverty and inequality analyses in recent times, particularly because of its user-friendly interface and the fact that it is freely available. We deployed it in the analysis of poverty indexes before and after shocks to the CGE model and to analyse pre- and post-shock inequality of the four household categories and Nigeria as a whole (see Savard, 2003).

For poverty analysis, we used the household expenditure data from the NLSS, for Nigeria as a whole, and for the four household categories in addition to the poverty lines obtained from the CGE model, to estimate poverty incidence, depth and severity using the FGT class of poverty measures. Similarly, we used the same expenditure data to analyse inequality for the four household groups and Nigeria as whole.

4.3.3 Description of and Rationale for Model Simulation Experiments

The policy scenarios in the study were chosen to, as much as possible mimic the macroeconomic shocks that impacted the economy in the wake of the global economic crisis, variously and in combination, with a view to capturing their effects on poverty and household inequality. Apart from other shocks, rise in world prices of food imports, fall in world price of oil exports, and exchange rate depreciation were prominent and so, we simulated the model under the following alternative scenarios, having successfully replicated the benchmark equilibrium:

- i. 50% rise in the world price of food imports

- ii. 50% fall in the world price of oil exports
- iii. 25% depreciation of the real exchange rate
- iv. Combination of scenarios i, ii and iii above.

Although the focus of the discussion in this study is on the simulation experiments, which were based on the negative shocks outlined above, but in order to appreciate the impact of the above-named simulations in terms of a broader picture, we also simulated the reverse scenarios, which represent positive shocks, to see what would be the case if the opposite had occurred. Thus, the second set of simulations (which were only highlighted but not discussed, since they were not the focus of the study) includes:

- a. 50% fall in the world price of food imports
- b. 50% rise in the world price of oil exports
- c. 25% appreciation of the real exchange rate
- d. Combination of scenarios a, b and c above.

Furthermore, the levels of the experiments were taken to represent as close as possible the levels of the shocks that impacted the economy. For example, the Food and Agriculture Organisation (FAO), reports in its food price index that food prices had risen about 53 percent in the peak of the crisis in 2008. For the oil price, simulations, data from the Central Bank of Nigeria (CBN) for monthly oil prices between July 2008, which recorded the highest oil price and June, 2009 showed a total percentage price fall in oil prices for the one-year period of 50.3 percent. Lastly, as indicated earlier, the exchange rate had risen about 25 percent by February 2009 from its fairly stable level in early to toward the end of 2008.

The results of the experiments and associated analyses are presented and discussed next.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 Introduction

In this chapter the results of the empirical exercise are presented followed in each case by a discussion of the results. In section 5.2, we present the results of the descriptive analysis of the economy at the reference period. This is followed by the base equilibrium solution of the CGE model in section 5.3. In the next section (5.4), we present and discuss the simulation results, which then leads us to an assessment of the poverty status of household groups vis-à-vis the nation in the base year, in section 5.5. In section 5.6, the impact of the various simulations on poverty is presented and finally section 5.7 concludes with the impact of the simulations on inequality.

5.2 Descriptive Analysis of the Structure of the Economy in the Base Year

We begin with the presentation and discussion of the results describing the basic structure of the Nigeria economy in the base year before the shocks. This is necessary because the structure of the economy has important poverty and distributional ramifications. It also allows us to have an understanding of how and what sectors or households would be affected by the various shocks applied to the model.

5.2.1 Sources of Household Income

Table 5.1 shows the sources from which households derived their incomes, as well as the population of each household group and the average amount of income earned per person in a year. From the table, urban-south households, which represent almost 25 percent of the population, earned the highest amount of income of N154,000.433 per head while rural-north households that make up almost 34 percent of the population, earned the lowest income of N77,062.578 per capita. Urban-north and rural-south households, which represented about 19.5 and 22 percent earned N141,371.992 and N85,421.051 per head per annum, respectively. Clearly, the average incomes were found to be very low: N85,421.051 for rural-south households and N77,062.578 for rural-north households, per person per year. These average incomes translate into N234.03 (or US\$1.56) and N211.13 (or US\$1.41) per day for rural-south and rural-north households respectively, which are less than all the endogenous poverty lines used in the study.

Table 5.1: Sources of Household Income

	Rural		Urban	
	South	North	South	North
Average Income (Naira p.a.)	85,421.051	77,062.578	154,042.433	141,371.992
Population (persons)	30940000	47314400	34332200	27413400
Income sources	Percentages			
Wage income	57.572	49.265	59.732	67.675
Capital income	31.850	40.252	31.327	22.096
Public transfers	0.000	0.000	1.634	2.203
Foreign transfers	10.580	10.482	7.307	8.025
Total	100	100	100	100

Source: Nigeria SAM, 2006 and NLSS, 2004

Over 57 percent of the income earned by all the households is wage income, except for rural-north households that earn about 50 percent of their income from wages. The proportion of wage income was highest among urban-north households and lowest among rural-north households. This result may have been different if the households were classified along occupational lines, in which case the proportion of wage earner households would be clearly demarcated from capitalist households.

Rural-north and rural-south households earned a higher proportion of capital income than urban-south and urban-north households, most of which came from land rent and a small proportion from dividends paid by enterprises, as returns from land have been aggregated as part of capital income in the SAM. The rural households did not receive any direct transfers from government, while urban-south and urban-north households received very little, making up 1.634 and 2.203 percent respectively, thus a fall in government transfers is not likely to affect rural households at all, but might affect urban households by a very small degree. Finally, rural households received a little more than urban households as far as foreign transfers, in the form of remittances from abroad were concerned in the model. It can be observed that households' income from abroad contributed a sizeable portion of their total income, thus making it an important income source.

As the sources of households' income vary among household types, their distributive and poverty consequences would also vary, as these affect the general equilibrium properties of the model and in turn, determine how the effects of shocks in the simulations would distribute among different types of households (Damuri and Perdana, 2003).

5.2.2 Uses of Household Income

Table 5.2 is a summary of how the households spent their income. Just like in the sources of households' income, the four households also differ in their uses of income. Clearly rural households spend over 60 percent of their income on food, while urban households spend less than 30 percent of their incomes on food. This makes sense when we note that poverty in Nigeria is said to be predominant in the rural areas (see, Omonona, 2001 & 2009; Olaniyan and Bankole, 2005), and that the poor spend a greater proportion of their income on food. While all households spent between 33 and about 37 percent of their income on manufactures and services, except urban-north households, which spent 47 percent, none of the four households in the economy spent on crude oil, thus changes in crude oil prices would not be expected to have a direct impact on household expenditures but could have indirect impacts through changes in macro variables such as government expenditure, inflation, terms of trade, etc.

Table 5.2: Uses of Household Income

	Rural		Urban	
	South	North	South	North
Food	61.042	61.184	29.347	27.419
Other Agriculture	4.952	2.453	1.893	1.678
Manufactures and Services	33.568	35.065	36.792	47.277
Direct Taxes	0.000	0.000	1.555	1.114
Savings	0.438	1.298	30.413	22.512
Total	100	100	100	100

Source: Nigeria SAM, 2006

Urban households spent less than 2 percent of their incomes on direct taxes, while rural households in the model did not pay direct taxes at all. This implies that if direct taxes were to be increased to boost government revenue using the same direct tax structure, it would affect the rural households less. Lastly, urban-south households saved over 30 percent of their income, while their northern counterparts saved roughly 23 percent of their total earnings. Rural household saved the least, with rural-south saving less than half a percent and rural-north saving just about 1.3 percent of their income.

5.2.3 Sectoral Factor Remunerations and Factor Market Shares

Table 5.3 serves two purposes: the upper part depicts factor remunerations by sector while the lower portion of the table shows the share of each factor in each sector. The remuneration of factors was highest in the manufactures and services sector, with a total of about 36 percent of total value-added. Of this proportion, labour accounted for 61 percent whereas, capital accounted for about 14 percent. Although the crude oil sector accounted for about 34 percent of total value-added, labour accounted for a paltry 0.2 percent while capital accounted for 63.30 percent. This again reinforces the enclave nature of the crude oil sector, with little if any direct linkages to the rest of the Nigerian economy (see, Akpan, 2009). The food sector accounted for about 28 percent of total factor remunerations out of which it accounted for 36 percent of total value-added by labour and about 21 percent of total value-added by capital.

The second part of the table shows the relative importance of each factor in each sector. While both labour and capital were almost equally important in the food and other agriculture sectors, the picture for the crude oil sector was remarkably different, as almost 100 percent of value added in this sector came from capital. This indicates that the crude oil sector is highly capital intensive, as existing capital determines the level of output (Adenikinju and Falobi, 2006).

Table 5.3: Sectoral Factor Remunerations and Factor Market Shares

	Food	Other Agriculture	Crude Oil	Manufactures/ Services	Total
Labour (N'million)	3280392.135	231495.880	18713.492	5569053.713	9099655.219
Percent	36.050	2.544	0.206	61.201	100
Capital (N'million)	2235632.742	166128.653	6841676.961	1565438.952	10808877.31
Percent	20.683	1.537	63.300	14.483	100
Total Value Added	5516024.877	397624.533	6860390.453	7134492.665	19908532.529
Percent	27.707	1.997	34.459	35.836	100
Labour	59.470	58.220	0.272	78.058	45.707
Capital	40.530	41.780	99.730	21.942	54.293
Total Value Added	100	100	100	100	100

Source: Nigeria SAM, 2006

A contrasting picture is seen in the manufactures and services sector, where 78 percent of value-added came from labour while 22 percent came from capital. In this model, it can be observed that labour is remunerated mostly by the manufactures/services and food sectors, while capital is mainly derived from crude oil sector. Thus, if the shocks, for example, favour the expansion of the food sector the return to labour in this sector is expected to increase (see Cockburn *et al*, 2008).

5.2.4 Household Consumption and Import Intensity

Table 5.4 shows the shares of household consumption from each sector as well as the share of import consumed by households by sector. Food accounts for over 61 percent of rural households' consumption, while urban households consume mainly manufactures/services. The table also reveals that the share of imports in total household consumption is almost 39 percent. Of this proportion, about 6 percent of households' consumption of food is imported while the share of imports consumed in Other Agriculture and manufactures/services stand at 25.74 and 75.55 percent, respectively. The impact of the simulations on poverty and inequality would also depend on household consumption shares in each sector and the amount of imports in which they consume from each sector. For example, which households are mostly affected by consumer price changes depends on their respective consumption patterns, also reflected in how much imported or domestically produced commodities that they consume. Thus, changes in food prices are expected to affect rural households more than urban households, while changes in the consumer prices of manufactures/services should affect urban households more. Differences in sectoral consumption shares imply that changes in consumer prices of goods as a result of economic shocks would impact household categories differently (see, Cockburn *et al*, 2008).

Table 5.4: Household Consumption Shares and Import Intensity

Sectors	Rural		Urban		Sectoral Import Shares
	South	North	South	North	
Food	61.311	61.989	43.137	35.901	5.82
Other Agriculture	4.974	2.485	2.782	2.200	25.74
Manufactures/Services	33.715	35.526	54.081	61.902	75.55
Total	100	100	100	100	38.83

Source: Nigeria SAM, 2006

5.2.5 Government Revenue and Expenditure

Table 5.5 above indicates that government earns over 86 percent of its income from capital paid as dividend income by enterprises while smallest amount of government income of less than 1 percent of total, is earned from indirect sales tax. Government revenue, hence its expenditure can impact households through transfers and indirectly through investment expenditure, which can impact earnings ability of households in the long-run (see, Nwafor *et al*, 2007).

Table 5.5: Government Revenues

	Value (N'million)	Income Shares
Import Tariffs	245199.963	4.251
Indirect taxes (sales)	51599.994	0.895
Activity taxes	145087.67	2.515
Direct taxes on household	125405.171	2.174
Dividend income	4994250.392	86.587
Foreign Transfers	206333.822	3.577
Total	5767877.013	100

Source: Nigeria SAM, 2006

In table 5.6, government spends about 64 percent of its income on consumption of services, while the least expenditure, of about 3 percent, by government was made on transfers to urban households. Thus, a fall in government income would impact government expenditure on basic services which may benefit poor households. It would also have a small impact on urban household based on the direct transfers government makes to them.

Table 5.6: Government Expenditure

	Value (N'million)	Expenditure Shares
Consumption(Services/Manufactures)	3716689.71	64.438
Transfers (Urban households)	171781.099	2.978
Savings	1879406.204	32.584
Total	5767877.013	100

Source: Nigeria SAM, 2006

5.3 Base Equilibrium Solution of the CGE Model

Table 5.7 shows the equilibrium solution of the CGE model for Nigeria based on the 2006 SAM used in the study.

One of the basic requirements for carrying out simulations with a CGE model is that the base or equilibrium solution of the model replicates the benchmark data in the SAM from which the model was calibrated to a given level of tolerance. Under this section, and based on table 5.7, we show the results for the base or equilibrium solution of the model alongside the benchmark data as well as the change between them.

Clearly, our results meet the requirement for the model to be used in simulation experiments, since the base solution replicates the economy that was represented in the SAM. Consequently, we proceed to present the results and discussion on the various simulation scenarios considered in the study, followed by their impacts on poverty and inequality.

Table 5.7: Replicated Benchmark Data

Variable	Benchmark Data	Replicated Data	Change
Households			
<i>Household income Level</i>			
Rural south	2642927.340	2642927.340	0.000
Rural north	3646169.671	3646169.671	0.000
Urban south	5288615.606	5288615.606	0.000
Urban north	3875486.962	3875486.962	0.000
<i>Household consumption expenditure</i>			
Rural south	2631340.864	2631340.864	0.000
Rural north	3598827.408	3598827.408	0.000
Urban south	3597972.672	3597972.672	0.000
Urban north	2959873.227	2959873.227	0.000
<i>Household Savings</i>			
Rural south	11586.476	11586.476	0.000
Rural north	47342.263	47342.263	0.000
Urban south	1608424.335	1608424.335	0.000
Urban north	872427.164	872427.164	0.000
<i>Gross Domestic Output</i>			
Food	6456533.767	6456533.765	0.001
Other Agriculture	549607.182	549607.186	-0.004
Crude Oil	745559.843	745559.863	-0.020
Manufactures/Services	13083842.85	13083842.85	0.000
<i>Domestic Production to Home market</i>			
Food	6451123.411	6451123.349	0.006
Other Agriculture	520779.202	520779.206	-0.004
Crude Oil	118662.779	118662.781	-0.002
Manufactures/Services	12618307.4	12618307.4	0.000
<i>Domestic Sales of Composite commodity</i>			
Food	7019982.273	7019982.205	0.006
Other Agriculture	629509.359	629509.364	-0.005
Crude Oil	120016.423	120016.425	-0.002
Manufactures/Services	17151628.25	17151628.25	0.000
<i>Imports</i>			
Food	375861.244	375861.240	0.004
Other Agriculture	99233.416	99233.417	-0.001
Crude Oil	1353.644	1353.644	0.000
Manufactures/Services	4490615.253	4490615.278	-0.002
<i>Exports</i>			
Food	5410.356	5410.356	0.000
Other Agriculture	28827.980	28827.980	0.000
Crude Oil	7336897.064	7336897.083	-0.001
Manufactures/Services	465535.452	465535.454	-0.002

Source: CGE Model Solution

Table 5.7: Replicated Benchmark Data Continued

Variable	Benchmark Data	Replicated Data	Change
<i>Factor Demand (Capital)</i>			
Food	2235632.742	2235632.720	0.002
Other Agriculture	166128.653	166128.654	-0.001
Crude Oil	6841676.961	6841676.980	-0.001
Manufactures/Services	1565438.952	1565438.960	-0.008
<i>Factor Demand (Labour)</i>			
Food	3280392.135	3280392.103	0.003
Other Agriculture	231495.880	231495.882	-0.002
Crude Oil	18713.492	18713.492	0.000
Manufactures/Services	5569053.713	5569053.743	-0.003
<i>Price of Domestic Output</i>			
Food	1.000	1.000	0.000
Other Agriculture	1.000	1.000	0.000
Crude Oil	1.000	1.000	0.000
Manufactures/Services	1.000	1.000	0.000
<i>Price of Domestic Output to Home Market</i>			
Food	1.000	1.000	0.000
Other Agriculture	1.000	1.000	0.000
Crude Oil	1.000	1.000	0.000
Manufactures/Services	1.000	1.000	0.000
<i>Price of Composite Commodities</i>			
Food	1.000	1.000	0.000
Other Agriculture	1.000	1.000	0.000
Crude Oil	1.000	1.000	0.000
Manufactures/Services	1.000	1.000	0.000
<i>Domestic Price of Imports</i>			
Food	1.513	1.513	0.000
Other Agriculture	1.096	1.096	0.000
Crude Oil	1.000	1.000	0.000
Manufactures/Services	1.010	1.010	0.000
<i>Domestic Price of Exports</i>			
Food	1.000	1.000	0.000
Other Agriculture	1.000	1.000	0.000
Crude Oil	1.000	1.000	0.000
Manufactures/Services	1.000	1.000	0.000
<i>Return to Capital</i>			
Food	1.000	1.000	0.000
Other Agriculture	1.000	1.000	0.000
Crude Oil	1.000	1.000	0.000
Manufactures/Services	1.000	1.000	0.000

Source: CGE Model Solution

5.4 Simulation Results

In a CGE model, a simulation experiment involves changing the value of an exogenous variable of interest, with the aim of observing the changes in the set of equilibrium endogenous variables of interest. The resulting values of the endogenous variables after the simulation are then compared with those in the base or equilibrium solution of the model, and the magnitude and direction of the percentage deviations of the simulated values from the benchmark values indicate the economy's response or sensitivity to the shock or policy change. This is essentially the reasoning behind counterfactual policy analysis (Oyeranti, 2005; Aredo, Fekadu and Workneh, 2008). Due to space constraint, we report only the results for changes in household disposable income, consumption expenditure and minimum consumption representing the monetary poverty line from the LES demand function. Other results are shown in the appendix 2.

5.4.1 Rise in World Price of Food Imports

To determine the effect of food price shocks on the variables of interest, we experimented with a 50 percent rise in world food prices.

Table 5.8: Simulation Results of Food Price Shocks

Variable	Base Solution	Percentage Change from Base Level	
		50% Rise in Food Prices	50% Fall in Food Prices
<i>Household Disposable income</i>	N'million		
Rural south	2642927.340	-1.590	5.085
Rural north	3646169.671	-1.343	4.299
Urban south	5288615.606	-1.678	5.366
Urban north	3875486.962	-1.912	6.108
<i>Household consumption expenditure</i>			
Rural south	2631340.864	-1.590	5.085
Rural north	3598827.408	-1.343	4.299
Urban south	3597972.672	-1.652	5.283
Urban north	2959873.227	-1.891	6.040
Society's Minimum Consumption	12581493.448	2.001	-5.646
Poverty Line	N89867.81	N91665.166	N84793.873

Source: CGE Simulation Results

From the results in table 5.8, a 50 percent rise in the world price of food imports causes households disposable incomes and consumption expenditures to fall. This is as expected and indicates that all household categories are net consumers and not net producers of food, as this increase in price forces the price of food composites to increase thus reducing real disposable incomes and accordingly lowering their consumption of food. This action however, raises the minimum consumption (defined as the nominal value of the basic needs commodity basket or the monetary poverty line) nationally by about 2 percent due to an increase in relative prices of commodities that constitute the basic needs basket of households. It can be noticed that the overall increase in the national poverty line is induced by the increase in the poverty line for rural households, who spend over 61 percent of their incomes on food compared with less than 30 percent spent by urban households (see table 5.2). Expectedly, the impact of this shock on poverty would be higher on rural households but this also depends on the distributional impact of the shock. Generally, this shock is expected to increase the poverty situation of all the households since there is both a rise in commodity prices following the shock, and a fall in the incomes of all the households, all things being equal.

On the other hand, a 50 percent fall in food price had the opposite effect of lowering the poverty line by over 5 percent, a margin which is higher than the 2 percent increase when a 50 percent rise in food price was simulated. This result indicates that lower food prices are likely to reduce poverty by a larger margin than higher food prices would increase it, given the margin at which the poverty line dropped when food prices were reduced.

5.4.2 Fall in World Price of Oil Exports

In this simulation experiment, we explore the effect of a 50 percent fall in the world price of oil exports on household parameters. Conceptually, an oil price shock, in the Nigerian case is not supposed to have direct effects on households, particularly, as a net exporter of oil and the enclave nature of the Nigerian oil economy.

Table 5.9: Simulation Results of Oil Price Shocks

Variable	Base Solution	Percentage Change from Base Level	
		50% Fall in Oil Prices	50% Rise in Oil Prices
<i>Household Disposable income</i>			
Rural south	2642927.340	-1.401	6.756
Rural north	3646169.671	-6.543	10.103
Urban south	5288615.606	-0.759	6.540
Urban north	3875486.962	4.715	2.871
<i>Household consumption expenditure</i>			
Rural south	2631340.864	-1.401	6.756
Rural north	3598827.408	-6.543	10.103
Urban south	3597972.672	-0.747	6.438
Urban north	2959873.227	4.662	2.839
Society's Minimum Consumption	12581493.448	-1.912	10.333
Poverty Line	N89867.81	N88149.53	N99159.13

Source: CGE Simulation Results

The effects are generally indirect, trickling down from the macroeconomic repercussions of such a shock, as well as, from government spending channel, given that crude oil constitutes more than 90 percent of Nigeria's export earnings and on average about 70 percent of government revenues in annual budgets (see Akpan, 2009). The indirect channels that a fall in oil prices can affect households include their effect via government expenditure (inflation, transfers, spending on services, employment, etc) and their impact through attempts to restore balance of payment equilibrium, for example, via exchange rate depreciation. Given the above background, the impact of a fall in the price of oil will be determined by various factors acting together. From the results in table 5.9, a 50 percent fall in oil price reduces the disposable income of all households, except that of urban-north households, which actually increase by almost 5 percent. Rural-north households suffer the highest reduction in incomes of over 6 percent.

A similar picture can be observed for household consumption expenditures, with accompanying fiscal implications. In the model, this shock reduces government income, savings and expenditure. This causes a chain of adjustments that culminate in the above results. For instance, a fall in government revenue from oil exports due to depressed prices leads to unfavourable terms of trade, which induces a real depreciation of the exchange rate with attendant consequences for households that are net importers as a result of changes in relative prices. Moreover, from the results, expenditure on services

which accounted for over 64 percent of government expenditure (see table 5.6) is reduced by over 11 percent, while total savings which government savings constitutes 2 percent is reduced by 86 percent. The effect of these would distribute differently among households. With our main interest being the poverty and distributional impacts, we observed from the model that the poverty lines for rural households decreased while that of urban households increased. Overall, the national poverty line dropped almost 2 percent, because of the drop in the prices of most composite goods in the economy, which means that we might expect a reduction in poverty levels in the analysis of poverty impacts which follows in section 5.4. These results are appealing because the fall in government income by over 15 percent as a result of this shock is accompanied by a reduction in government spending, which has a potential of reducing inflationary pressures, which indirectly raises real incomes (see, Nwafor *et al*, 2005).

Conversely, a rise in oil price by 50 percent, which can be considered a positive shock for a net oil exporting country like Nigeria, increases the national poverty line by over 10 percent compared with about a 1.9 percent decrease in the case of a 50 percent fall in oil price. This indicates that increases in oil price, as explained earlier, have the tendency to increase the general level of prices, thus making it possible for more people to fall below the poverty line, and thus likely to increase poverty.

5.4.3 Depreciation of the Exchange Rate

To determine the effect of exchange rate shocks on the variables of interest, we experimented with a 25% rise in the nominal exchange rate. As noted in chapter 2, the effect of exchange rate changes can be very significant in the economy because of its impact on the relative prices of commodities. A real depreciation increases producer prices for exports, with a larger impact in relatively export-oriented sectors, and demand-side prices for imports, which boost prices of domestically produced import substitutes. This has the effect of making exports cheaper and imports, expensive. From the simulation results in table 5.10, exchange rate depreciation remarkably increases households' disposable incomes and consumption expenditures. This is theoretically plausible as noted by Oyeranti (2005), as Rural-north households' incomes increased highest by about 17 percent, followed by urban-north (with 16 percent), rural-south (15.7 percent) and urban-north (14 percent). A similar picture is observed for consumption expenditures. However, the results indicate an increase in the monetary poverty lines of rural households but a fall in the monetary poverty line of urban

households. Overall, the national poverty line increased by approximately 18 percent, indicating that the price effect of exchange rate depreciation was stronger than the observed income effect.

Table 5.10: Simulation Results of Exchange Rate Shocks

Variable	Base Solution	Percentage Change from Base Level	
		25% Increase in Exchange Rate	25% Decrease in Exchange Rate
<i>Household Disposable income</i>			
Rural south	2642927.340	15.710	-9.049
Rural north	3646169.671	17.203	-11.435
Urban south	5288615.606	16.052	-9.041
Urban north	3875486.962	14.186	-6.348
<i>Household consumption expenditure</i>			
Rural south	2631340.864	15.710	-9.049
Rural north	3598827.408	17.203	-11.435
Urban south	3597972.672	15.802	-8.900
Urban north	2959873.227	14.028	-6.277
Society's Minimum Consumption	12581493.448	17.832	-9.823
Poverty Line	N89867.81	N105893.038	81039.21

Source: CGE Simulation Results

While prices increased for rural households, they actually fell for urban households but taken as a whole the country faced higher commodity prices with the depreciation of the exchange rate. This is in line with received wisdom, in that domestic output price increased by 13.6, 9.3, 25.3 and 3.2 percent for food, other agriculture, crude oil and manufactures/services, respectively while domestic price for imports increased by 25 percent for all sectors. The increase in domestic price increases the domestic sales of composite goods by 14.5, 10.9, 40.2 percent for food, other agriculture and crude oil sectors respectively while domestic sales of manufactures drops by 16 percent since most of it is now exported. Conversely, import demand in food, other agriculture and manufactures/services fell by 14.5, 22.5 and 59 percent, respectively, as result of an increase in the domestic price of imports by 25 percent. Thus, it is clear that net producers stand to gain more from a real depreciation than net consumers. More of the effects of this simulation on poverty and inequality will be seen in due course.

Be that as it may, it was also found that a 25 percent decrease in the exchange rate decreased the poverty line by roughly 9.8 percent, a margin that is much lower than 17.832 percent by which a 25 percent increase caused the poverty line to increase.

5.4.4 Combination of the Three Scenarios

In this section, we combined the previous scenarios in attempt to mimic the real world situation that prevailed in the country during the period in which these shocks occurred and to measure their combined effects on poverty and inequality of the four household categories in the model. To achieve this, we simulate a scenario where there is a 50 percent rise in world price of food imports, a 50 percent fall in world price of oil exports and a 25 percent increase in the exchange rate.

Table 5.11: Combinations: Food Price, Oil Price and Exchange Rate Shocks

Variable	Base Solution	Percentage Change from Base Level	
		All (1)	All(2)
<i>Household Disposable income</i>			
Rural south	2642927.340	-2.535	26.808
Rural north	3646169.671	-7.514	24.710
Urban south	5288615.606	-1.955	28.015
Urban north	3875486.962	3.367	29.753
<i>Household consumption expenditure</i>			
Rural south	2631340.864	-2.535	26.808
Rural north	3598827.408	-7.514	24.710
Urban south	3597972.672	-1.924	27.579
Urban north	2959873.227	3.329	29.421
Society's Minimum Consumption	12581493.448	3.709	-5.218
Poverty Line	N89867.81	N93193.818	N85180.305

Source: CGE Simulation Results

Table 5.11 shows the combined impact of the three shocks on household disposable incomes, expenditures and subsistence consumption. It can be observed that there was a fall in incomes and consumption for all households except urban-north households. Rural-north households registered the highest income fall of 7.5 percent followed by rural-south households which recorded a fall in income of about 2.5 percent, just a little above urban-south households with about a 2 percent drop in their incomes. However, urban-north households enjoyed an increase of about 3.3 percent in their incomes. A similar trend was observed for household expenditures.

Turning to households' subsistence consumption, we observed that there was a fall in the average consumption of rural households, while there was an increase in the average minimum consumption of urban households. On the whole, the average minimum national consumption (the monetary poverty line) increased for this scenario. However, the combined scenario for positive shocks indicated a drop in the poverty line by a little above 5 percent compared with the 3.7 percent increase in the poverty line when all the negative shocks were combined. Based on these results and also depending on the initial distribution of households' incomes/expenditures in the household survey, that is how skewed they might have been, we expect that more households would be consigned to poverty compared with the base case scenario. These issues are addressed in the following subsections.

5.5 Poverty Status of Households in the Base Year

Before determining the impact of the simulations on poverty it is necessary to have an understanding of the poverty status of the households in the base year. This allows us to have a basis for calculating the change in poverty or impact of the shock on poverty after the simulations.

Table 5.12 shows the poverty status of the four household categories in the model plus, the poverty status for all households taken together, based on the FGT poverty measures, namely incidence, depth and severity of poverty. In the base year, 55 percent of Nigerians were consigned to poverty in terms of headcount. Rural-north households showed the highest poverty incidence, with 75 percent of its population living in poverty; this is followed by rural-south and urban-north households both with about 47 percent of their populations in poverty. Urban-south households are the least poor, with a poverty headcount of about 40 percent. These results are quite in line with existing evidence (see, for instance, NBS, 2005). Although poverty is generally very high among household groups in both urban and rural areas in Nigeria, it has been found to be more concentrated in the rural areas, especially the rural-north.

Table 5.12: Poverty Status of Households in the Base Year

Poverty Index	All	Rural South	Rural North	Urban South	Urban North
$P_0(\alpha = 0)$	0.5500	0.4729	0.7514	0.4038	0.4724
$P_1(\alpha = 1)$	0.2259	0.1738	0.3318	0.1650	0.1780
Equally Distributed Equivalent Income (EDE) (Naira/Head)	20300.91	15621.57	29822.94	14830.46	15999.04
$P_2(\alpha = 2)$	0.1227	0.08712	0.1854	0.0922	0.0928
Poverty Line (Naira/Year)	89867.81	89867.81	89867.81	89867.81	89867.81

Source: Poverty Analysis Results

The above results also indicate that the poverty level of rural-south households is not much different from that of urban-north households, 47.29 and 47.24 percent, in that order.

Further insights can be gained when we analyse the data in terms of absolute number of poor persons in each household category as well as relative contribution of each household group to national poverty incidence. In terms of absolute numbers, 25.4 percent of poor Nigerians in the base year were found in rural-north households alone, while the remaining 29.6 percent of the poor were found in rural-south households (10.45 percent), urban-south households (9.90 percent) and urban-north households (9.25 percent). However, the relative contribution of the household groups to total national poverty incidence shows that rural-north households contribute 46.18 percent, while the remainder of 53.82 percent is shared among rural-south households (19 percent), urban-south households (18 percent) and urban-north households (16.82 percent). Clearly, the challenge of poverty reduction in Nigeria is more evident in the rural-north.

The results for poverty depth follow a similar pattern. However, the poverty depth indicates the ratio or proportion of the poverty line that is required to lift a poor person out of poverty. This thus results in the equally distributed equivalent income; EDE, defined as the average amount of money or resources that would be needed to make a poor person non-poor based on the poverty threshold that was used to classify him as poor (see, Duclos and Araar, 2006; World Bank, 2011). From table 5.12, the poverty depth for Nigeria is about 22 percent. Disaggregating by household group shows that rural-north households have the highest poverty depth of 33 percent followed by 17.8, 17.4 and 16.5 percent for urban-north, rural-south and urban-south, respectively. Thus, on an annual basis, it would require ₦20,300.91 (that is 22.59

percent, which is the poverty gap, multiplied by N89867.81, which is the poverty line) on average, to lift a poor person out of poverty nationally, while it requires N29,822.94, N15,999.04, N15,621.57 and N14,830.46 to lift a poor person out of poverty in rural-north, urban-north, rural-south and urban-south, accordingly. Clearly, fighting poverty in the north would require more resources than combating poverty in the south.

Lastly, poverty is most severe within the rural-north households (18.54 percent) and least severe among the rural-south households (8.71 percent). The severity of poverty among urban-north and urban-south households is 9.28 and 9.22 percent respectively. These results are further highlighted in figure 5.1 below:

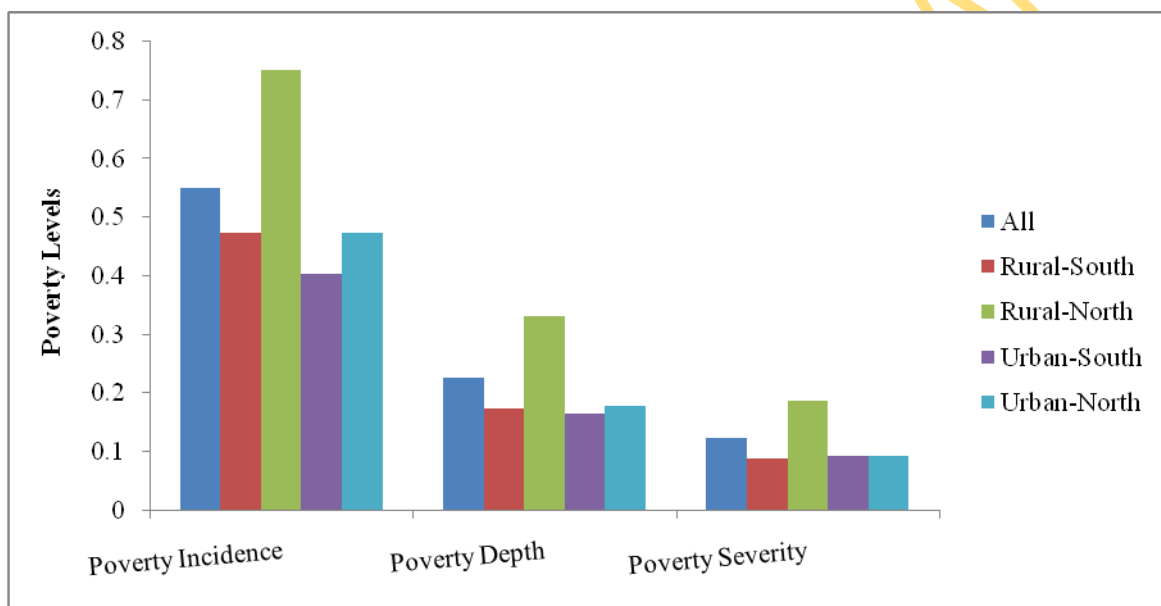


Fig. 5.1 Poverty status of households in the base year

The results for poverty depth and severity perhaps underscore the need for other measures apart from the headcount measure to be used in assessing poverty. For example, in Nigeria, where the poverty headcount is over 50%, it may be practically difficult to target all the poor at once, but with the poverty gap and squared poverty gap measures, it is easier to target those whose poverty depth and severity is higher before others or at least give them higher priority in the allocation of resources and poverty interventions. Next, we discuss the impact of the various simulation experiments on the poverty status of households in the base scenario.

5.6 Impact of Simulations on Poverty

In this section, the results of the impact of the scenario experiments on poverty using the FGT class of poverty measures are presented and discussed. Second we present the results and discussion by the type of shock across household groups and the three FGT poverty measures. Finally, we compare the impacts of the shocks on household groups by the poverty gap measure and the equally distributed equivalent income. The poverty impacts are reported as percentage changes from the base levels following a shock.

5.6.1 Impact of Food Price Shocks on Poverty

Table 5.13 shows the impact of food price shock on poverty, reported as percentage change from the reference period. From the table, a 50 percent rise in the world price of food imports increased the incidence of poverty nationally, and in all the household categories albeit by varying degrees. National poverty headcount increased by 3.254 percent. This increase in poverty headcount is as expected (since Nigeria is a net food importer and is yet to be self-sufficient in food production), although the figure is higher than 2.42 and 0.96 percent increase in poverty recorded by Boccanfuso and Savard (2009) for Senegal and Mali, respectively as a result of a 70 percent increase in the import price of food.

Rural-south households record the highest increase in poverty incidence of almost 5 percent, followed by urban-north households, which registered a rise in poverty headcount of a little above 4 percent. This shock increases the poverty incidence of urban-south households by 3.86 percent, whereas rural-north households experience the least increase in poverty headcount of 2 percent. It is worthy to notice that the impact of this shock is higher for each household group than the national average, except for rural-north households. These results are informative as they clearly indicate that the impact of increased food prices was least felt by rural-north households, perhaps due to the fact that the bulk of the staple food grains are produced by the rural-north households. Thus, the increase in the price of food imports like rice, maize, guinea corn, cowpeas, millet, etc, is not wont to affect rural-north households as much as others. This suggests that this region could be harnessed to assure food security in Nigeria.

The results also imply that although rural areas in Nigeria are mostly agrarian, which preoccupation is subsistence production, food production in rural-south

households is poor as it negates this thesis, and hence the high impact of the shock on this household category. Several reasons may account for this, which include quest for formal education, penchant for engaging in commerce or trading (especially in the south-east) instead of agriculture, poor agricultural conditions and output (especially in Niger-Delta or south-south) due to oil spills and environmental degradation. For example, a recent UNEP report indicates that it will take 30 years to clean-up oil spills in the Niger-Delta region to make room for cultivating crops and revamping aquatic life (see, The Guardian, 4 Aug, 2011).

For the poverty depth measure, we observe that rural-south and urban-north households recorded the largest increase, with urban-north households recording the highest increase in poverty gap of 6.5 percent, whereas rural-south poverty depth increased by 6.2 percent. Urban-south and rural-north households record an increase of 5.3 and 4.2 percent respectively. These results are not surprising as the headcount measure discussed above does not capture the extent to which individual income or expenditure falls below the poverty line, the poverty depth measure, does. Jha and Sharma (2003) have noted that certain policy changes or shocks favour one group of the poor and adversely affect another group, and that in such cases, the headcount may not register any change but the poverty gap index may get around it to some extent, thus the need to use all three measures in analysis.

Table 5.13: Impact of Food Price Shock on Poverty (Percent)

Poverty Index	All	Rural South	Rural North	Urban South	Urban North
$P_0(\alpha = 0)$	3.254	4.863	2.022	3.863	4.149
$P_1(\alpha = 1)$	0.579	6.271	4.219	5.394	6.504
$P_2(\alpha = 2)$	0.652	7.323	5.383	5.901	7.424

Source: Poverty Analysis Results

The results for poverty depth measure imply that it would require N20,823.78 on average nationally to take a poor person out of poverty on an annual basis. If we consider the quantum of resources required on the basis of households groupings, rural-north households would require the greatest level of intervention; specifically, each poor person in this household category would need N31,702.14 on average per year to become non-poor. Urban-north households come next, requiring N17,381.33 on average per person annually, to step out of poverty. This is then followed by rural-south (N16,936.76) and urban-south (N15,940.84) households. This result implies that in

terms of targeting, rural-north households require more urgent attention than all other households groups as far as this shock is concerned, in spite of the fact that it recorded the lowest poverty incidence and the lowest increase in poverty gap. Clearly, the poverty depth in the reference year based on the distribution for rural-north households is very high, and hence the results.

In terms of poverty severity, urban-north households record an increase of 7.4 percent from the base, followed closely by rural-south households, with an increase of 7.3 percent from the base year. Also, rural-north households record the least increase in poverty severity, as far as food price shocks are concerned. Figure 5.2 is a graphical representation of the effect of this shock on the various household groups

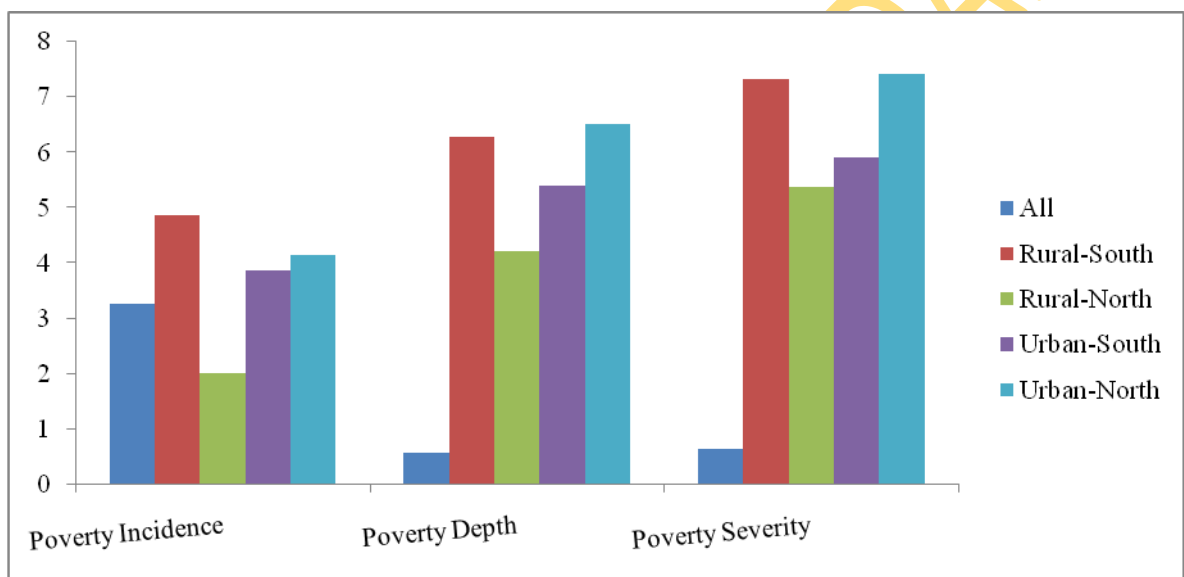


Fig. 5.2 Impact of Food Price Shock on Poverty

5.6.2 Impacts of Oil Price shocks on Poverty

From the model simulation results in table 5.14, the impact of a fall in oil price on households is mostly poverty-reducing. A 50 percent fall in the world price of oil exports reduces the incidence of poverty nationally by approximately 1 percent. Urban-north households experience the highest reduction in poverty incidence of 8.7 percent, whereas rural-south households recorded the least reduction in the headcount measure of 0.76 percent. Similarly, urban-south households experienced a 1.78 percent reduction in poverty incidence. However, unlike other households, rural-north households actually experienced an increase in poverty incidence of almost 3 percent, following this shock. These results are quite plausible in terms of theory. According to Olomola and Adejemo

(2006), many studies have shown that rising oil prices reduced output and increased inflation in the 1970s and early 1980s oil shocks, while falling oil prices boosted output and lowered the general price (inflation). Also, Dorosh (1996), found that reductions in the world price of oil hurt the poor less if real exchange rate was allowed to depreciate than if foreign exchange restrictions prevented a real exchange rate adjustment. We observe this pattern in the current study, as a 50 percent fall in oil price causes an increase in sectoral output substantially and forces down domestic prices in all sectors except manufactures/services.

In the Nigerian situation, this can further be explained from the government expenditure point of view. This shock brings about fiscal austerity unlike an oil price hike which earns the government windfall income. Thus, it is accompanied by reduced government spending, which reduces the general price level, and so households experience a reduction in the prices they face, which in the simulation were much lower than the reduction in their incomes and consumption. Recall also that in the description of the basic structure of the economy government spent over 64 percent of its income on services and infrastructure and only about 3 percent on direct transfers to households. Thus, a fall in government income would affect households more through public consumption than transfers.

Table 5.14: Impact of Oil Price Shock on Poverty (Percent)

Poverty Index	All	Rural South	Rural North	Urban South	Urban North
$P_0(\alpha = 0)$	-1.127	-0.761	2.981	-1.783	-8.721
$P_1(\alpha = 1)$	-1.328	-0.921	6.139	-1.679	-10.224
$P_2(\alpha = 2)$	-1.508	-1.033	7.821	-1.844	-11.315

Source: Poverty Analysis Results

In terms of poverty depth and severity, a similar pattern like the one observed for poverty incidence is observed for all households (see figure 5.3). Specifically, the national poverty depth falls by 1.3 percent, whereas rural-south, urban-south and urban-north record a reduction in poverty depth of 0.92, 1.67 and 10.22 percent, respectively. Conversely, rural-north households experienced an increase in poverty depth of 6.14 percent. However, compared with the base scenario, it takes a lower amount of money, on average, N19,637.72, nationally to lift a poor person out of poverty. Considering each household category, rural-north, rural-south, urban-north and urban-south households require N31,043.79, N15,186.45, N14,301.09 and N14,091.42, respectively

to lift a poor person out of poverty. Clearly, as far as this shock is concerned, rural-north households need to be paid most attention in poverty alleviation efforts, followed perhaps by rural-south households which experienced the lowest reduction in poverty.

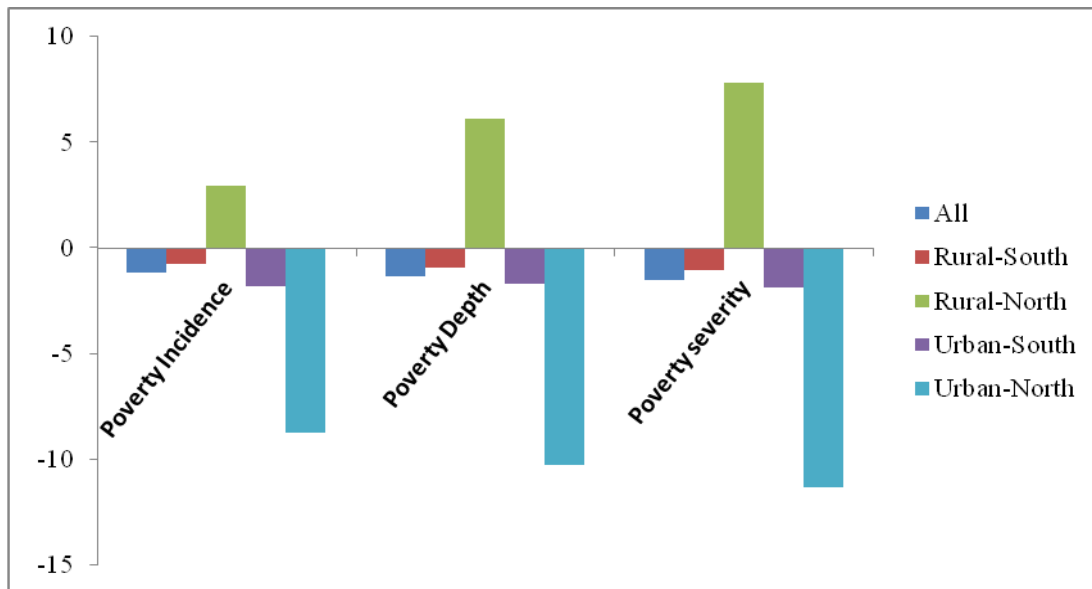


Fig. 5.3. Impact of Oil price Shock on Poverty

5.6.3 Impacts of Exchange Rate shocks on Poverty

The impact of exchange rate depreciation in the model exacerbates national and household poverty; the extent of which depended greatly on the consumption (of local or imported goods) and production (for domestic or export market) patterns of the households and to some extent the proportion of their income that is obtained from foreign transfers. Table 5.15 points out that this shock increased national poverty incidence by about 1.7 percent. Urban-north households suffer the highest increase in poverty headcount of 3.3 percent, while rural-north households suffer the least impact, with less than 0.5 percent increase in poverty incidence. Rural-south and urban-south households experience an increase of about 2.5 and 2 percent in poverty headcount, respectively. These results may imply that urban-north households are the largest culprits in the consumption of imported products. Although the results indicate that rural-south households come next in terms of poverty incidence, it may be that they are implicated more than urban-south households because the latter might have been exporting a good quantity of products as they consume imports, compared with rural-south households. For rural-north households which are the least affected by this shock, it may be that they consumed less of imported commodities while they produced much

in terms of primary agricultural commodities that may likely be import substitutes, for example, rice, maize, sorghum, wheat, livestock, etc.

Table 5.15: Impact of Exchange Rate Shock on Poverty (Percent)

Poverty Index	All	Rural South	Rural North	Urban South	Urban North
P ₀ (alpha = 0)	1.696	2.529	0.331	2.172	3.315
P ₁ (alpha = 1)	2.651	3.164	0.690	2.562	5.494
P ₂ (alpha = 2)	3.154	3.670	0.895	2.755	6.250

Source: Poverty Analysis Results

These results make sense even further when the proportion of total expenditure of households' expenditure on items that are most likely to be imported (namely beverages, processed food, textiles, furniture, transport/other equipment, other manufactures) is compared among the households groups. It is interesting to see that 17.5 percent of urban-north households' expenditure went to imported products, compared with 12.8 percent from urban-south. Rural-north households spent the least (9.3 percent) on imported commodities, whereas rural-south households took the second position (13.7 percent) as indicated by the simulation results.

The results for changes in poverty depth and severity in the table show a similar pattern (see Fig. 5.4). Nationally, the poverty depth increased by 2.65 percent. Among the household categories, urban-north households experienced the highest increase in the depth of poverty of 5.5 percent followed by 3.2 percent for rural-south households, 2.6 percent for urban-south households and lastly, 0.7 percent for rural-north households. This same order is repeated for poverty severity: 3.15 percent nationally, and 6.25, 3.67, 3.15 and 0.89 correspondingly for urban-north, rural-south, urban-south and rural-north households.

However, rural-north households need more money (N35,378.605) on average for a person to be taken out of poverty compared with the national average (N24,555.57) and urban-north households (N19,885.15), which experienced the highest impact of exchange rate depreciation. The least effort to lift individuals out of poverty is required in urban-south households (N17,920.12) after households in the rural-south category (N18,989.01). These results draw attention to the importance of the poverty gap measure, even though this shock did not affect rural-north households as much as the others, this measure still indicates that that household group needs the most help as far as this shock is concerned.

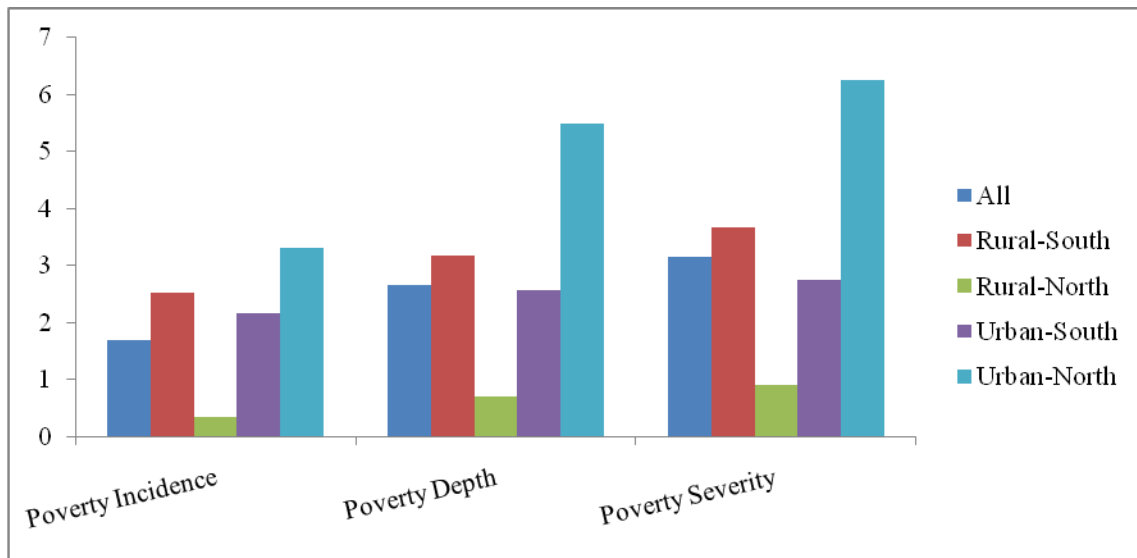


Fig. 5.4. Impact of Exchange Rate Shock on Poverty

5.6.4 Impacts of All shocks Combined Poverty

The last simulation, which combines the first three scenarios, has a remarkable effect on poverty with some interesting results. The resulting direction and perhaps, the magnitude of the effects underscore the overarching impact of some external shocks on household poverty and distributional outcomes. They further highlight the conception advanced earlier in section two, that the impact of positive shocks are easily over-swamped by those of negative ones, especially when they occur simultaneously. Of the three macroeconomic shocks explored in this study, increase in food prices and exchange rate depreciation caused a worsening of household poverty while a fall in oil price was, in the main, poverty-reducing. However, the combined scenario clearly showed that the impact of the three shocks, which occasioned the global economic crisis, taken together, exacerbated poverty in Nigeria, with some appealing implications.

From the macro results, this simulation led to a fall in household incomes/expenditures except those of urban-north households. Domestic output increased (except for the crude oil due to depressed export price). Imports volume dropped remarkably, while there was an increase in exports except crude oil exports for the same reason stated earlier. Prices of domestic output dropped except in manufactures/services. Overall, household income had fallen more than domestic prices thus leading to a rise in the poverty line as earlier noted. Thus, under this scenario, as shown in table 5.15, national poverty incidence increased by about 5.7 percent, while increase in household poverty showed rural-south households recording an 8.56 percent

increase, followed by rural-north and urban-south households, with roughly a 7 percent increase poverty headcount each. However, there was no change in the poverty incidence of urban-north households as a result of this combined shock. As far as the headcount measure is concerned, rural-south households were the worst hit by the global economic meltdown as it affected Nigeria, whereas, urban-north households were not affected at all, considering the combined effects of the shocks. This is intuitively appealing in that, the urban-north households experienced the highest reduction in poverty as a result of the oil price shock, and it was only possible for the effect of the other two shocks to knock off that gain, without aggravating their poverty status.

Table 5.16: Impact of All Shocks Combined on Poverty (Percent)

Poverty Index	All	Rural South	Rural North	Urban South	Urban North
$P_0(\alpha = 0)$	5.727	8.562	7.061	6.922	0.000
$P_1(\alpha = 1)$	8.490	11.064	14.578	8.315	0.617
$P_2(\alpha = 2)$	10.130	12.913	18.964	9.11	0.743

Source: Poverty Analysis Results

However, in terms of poverty depth measure, rural-north households recorded the deepest plunge into poverty of about 14.5 percent, whereas rural-south and urban-south households went deeper by 11 and about 8.5 percent, respectively. Urban-north households only showed a marginal increase of less than 1 percent in poverty depth. This is not surprising as the poverty gap measure is able to highlight an important aspect of poverty that is usually masked by the headcount measure. Under this scenario, it takes an average of N22,840.361 nationally to make an individual non-poor per annum. This is actually higher than the amount needed to take an individual out of poverty in rural-south (N17,989.89), urban-south(N16,656.41) and urban-north (N16,689.609) households, while it is much lower than the N35,429.87 that it takes to lift a poor person out of poverty in rural-north households, per annum on average. This implies that the task of reducing the poverty gap would be greatest in rural-north households.

Further results indicate that poverty severity increased by about 10 percent nationally. Breaking this down by household groups, rural-north households recorded the highest increase in poverty severity from base level, of almost 19 percent, followed by almost 13 percent experienced by rural-south households. Urban-south households recorded an increase in poverty severity of 9 percent, whereas the least increase in

poverty severity of 0.74 was recorded by urban-north households. One striking feature of rural-north households is that in all the simulations, including one that reduced poverty in other household groups, their poverty situation based on all the measures, worsened. Figure 5.4 depicts the response of the households' poverty to this simulation.

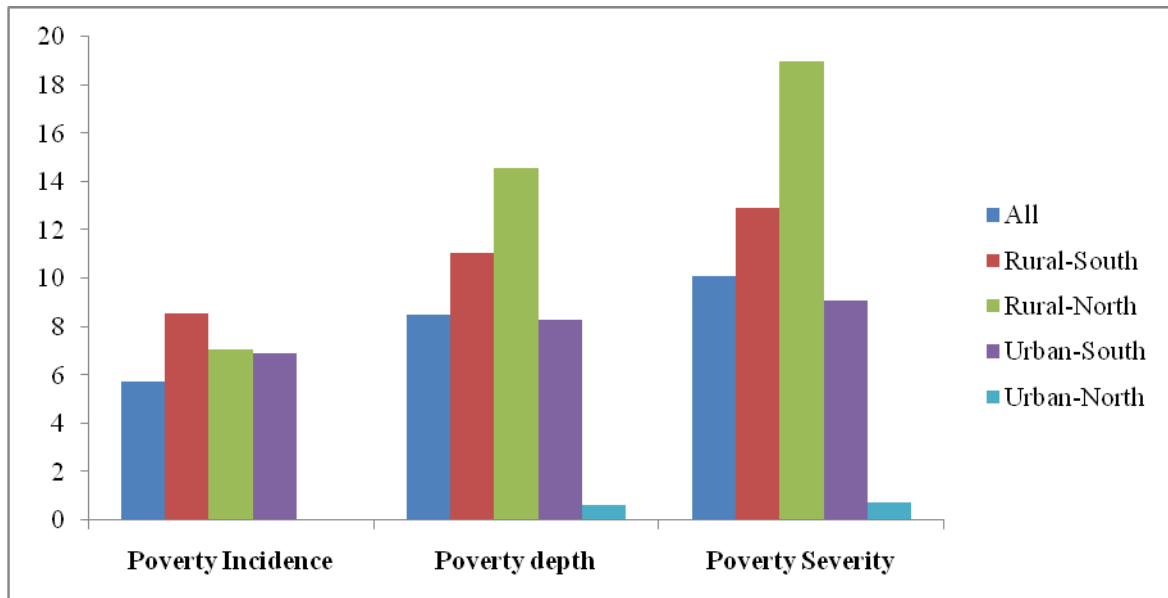


Fig. 5.5 Impact of the Combined Shock on Poverty

On the whole, the simulations experiments indicate that while food price shocks and exchange rate shocks increased poverty, falling oil price shocks were mostly poverty-reducing (this result makes sense in that, as indicated earlier, rise in oil prices may lead to an increase in the general price level which then reduces consumers purchasing power thus exacerbating poverty and *vice versa*). But the combine effects of the three shocks indicate an increase in poverty, as implicated by the effects of exchange rate and food price shocks. These results have dire implications for policy.

5.6.5 Comparison of the Impacts of Simulations on Household Groups by Poverty Gap Measure and Equally Distributed Equivalent Income

Table 5.16 shows the poverty depth impact of the simulations alongside the equally distributed equivalent income (EDE), which shows the average amount of money required to bring a poor person out of poverty; in other words, the average distance between the income of each of the household members and the poverty line. Figure 5.5 on the other hand is a graphical representation of the EDE income. From the

table, we find that even where the change in poverty gap registered by other households is higher for a given simulation than in rural-north households, this household group still registers the highest EDE income. This implies that there was widespread poverty in the original distribution of incomes/expenditure of this household group compared with the others. The graph indicates that the resources required tackling poverty in rural-north households are almost double those required by the other household categories in almost all the scenarios.

Table 5.17 Poverty Gap Impact and Equally Distributed Equivalent Income of Household Groups

		All	Rural South	Rural North	Urban South	Urban North
Food Price	P ₁	0.579	6.271	4.219	5.394	6.504
	EDE (Naira)	20832.78	16936.76	31702.14	15940.84	17381.30
Oil Price	P ₁	-1.328	-0.921	6.139	-1.679	-10.224
	EDE (Naira)	19637.72	15186.45	31043.79	14091.42	14301.09
Exc. Rate	P ₁	2.651	3.164	0.690	2.562	5.494
	EDE (Naira)	24555.57	18989.01	35378.605	17920.12	19885.15
All	P ₁	8.490	11.064	14.578	8.315	0.617
	EDE (Naira)	22840.36	17989.89	35429.87	16656.41	16689.609

Source: Poverty Analysis Results

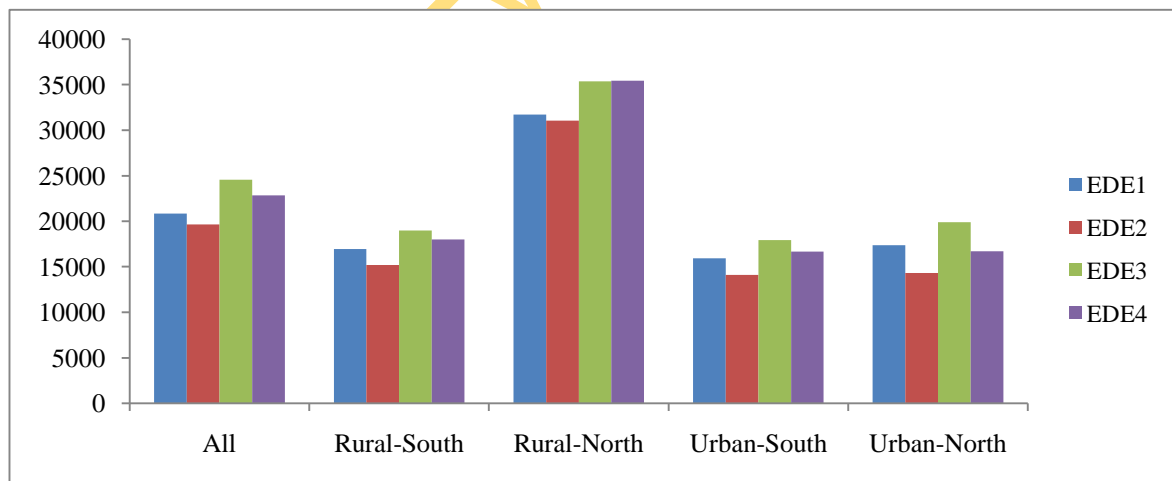


Fig. 5.6: Equally Distributed Equivalent Income by Household Groups Following the Shocks

5.7 Impact of Simulations on Income Inequality

In this section we present and discuss the results of the analysis of the impact of the shocks on income inequality nationally and at the socioeconomic group level in the base year, followed by the post-shock impacts at the national level for all shocks. This

analysis is important because inequalities in income distribution, access to productive resources and basic social services have been cited as causing and exacerbating poverty (see, for instance, Naschold, 2002; United Nations, 2005).

In the base year, national Gini coefficient is 0.4176 (table 5.18). This implies that the average distance between the incomes of the households in the distribution is in the order of 83.52%. Put in terms of difference in income, the value represents the expected difference in incomes of two individuals or households randomly selected from the population as a whole. Looking at the household groupings, we find that urban-north households have the highest Gini coefficient of 0.422, followed by urban-south households, with an index of 0.4197. Rural-north households record the least inequality (0.3637) in their income distribution, before rural-south households with a Gini index of 0.3781. It can be noticed that inequality is higher among urban households than among their rural counterparts. This implies the extent of relative deprivation is higher in urban areas than in rural areas, which quite in line with literature (see, Aredo, Fekadu, and Workneh, 2008).

Table 5.18: Inequality Levels in the Base Year

Gini Index	All	Rural South	Rural North	Urban South	Urban North
<i>Base</i>	0.4176	0.3781	0.3637	0.4197	0.4244

Source: Inequality Analysis Results

Table 5.19 shows the impact of the simulation experiments on inequality. From the table although slightly, food price shocks and exchange rate shocks reduced inequality nationally by 0.0478 and 0.2586 percent, respectively, whereas oil price shocks increased inequality, by about 1.4 percent. This may be due to the fact that the changes in relative prices following food price and exchange rate shocks shift resources in favour of the poor segment of the income distributions; however, since oil price shocks do not have direct effects on the prices faced by these households, the impact tends to worsen inequality. These results show that poverty can decrease even when inequality is rising.

It can be observed that the magnitudes of the inequality changes are quite small when compared to the magnitude of the simulations. This is common in CGE literature, as they have been known to produce small distributional impacts (see, Nwafor *et al*, 2005; Adenikinju and Falobi, 2006; Annabi, Cisse, Cockburn and Decaluwe, 2007).

In the last simulation, that is combination of the three previous ones, inequality increased by 1.37 percent. Clearly, these results indicate that income was much less equitably distributed during the global economic crisis, which was occasioned by the analysed simulation scenarios. Thus, inequality would have contributed to cause and exacerbate poverty during the crisis given its implicit linkage between the two concepts, based on what they measure and the indirect link with poverty through growth (see, for instance, Naschold, 2002; Bourguignon, 2004).

Table 5.19: Impact of Simulation on Base Inequality Level

	Gini Index	All	Change from base
	Base	0.4176	
Food Price	Simulation 1	0.4174	-0.0478
Oil Price	Simulation 2	0.4234	1.4056
Exc. Rate	Simulation 3	0.4165	-0.2586
Combination	Simulation 4	0.4233	1.3721

Source: Inequality Analysis Results

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This study examined the impact of macroeconomic shocks on household poverty and income inequality in Nigeria, motivated by the recent global economic crisis. Specifically, the study investigated the impact of three different shocks, namely food price shock, oil price shock and exchange rate shock as well as their combination, experienced in Nigeria in the wake of the economic crisis, on household poverty and income inequality.

Secondary data, collected in the main, from the National Bureau of Statistics (NBS) and the International Food Policy Research Institute (IFPRI) were relied upon in meeting the specific objectives and arriving at the results of the study. The data were analysed using a macro-micro framework, which comprised a computable general equilibrium model (which provided the economy-wide general equilibrium results on changes in prices, households' incomes and demand) and a module that involved poverty and inequality measurement, using the FGT and Gini indexes, respectively. The summary of major findings of the study is subsequently discussed.

6.2 Summary of Major Findings

Beginning with the descriptive of the structure of the Nigerian economy in the base year, we find that the average incomes of incomes of rural households are very low. Precisely, the estimated average income of rural-south and rural-north households were N85,421.051 and N77,062.578 per person per annum, respectively. These translate into N234.03 (or US\$1.56) and N211.13 (or US\$1.41) per day for rural-south and rural-north households accordingly, which are less than all the endogenous poverty lines used in the study and also less than the recommended minimum income of US\$2 per day for most developing countries by the World Bank (2008).

Another key finding in this section hinges on the consumption pattern of the households in Nigeria. Rural households spent over 61 percent of their income on food, while urban household spent between 54 and 62 percent of their incomes on manufactures/services. Furthermore, the share of imports in total household consumption was roughly 39 percent, which calls for serious concern. Of this proportion, about 6 percent of households' consumption of food was accounted for by

imports, while the share of imports consumed in other agriculture and manufactures/services stood at approximately 26 and 76 percent, respectively.

In the reference year, we find that poverty incidence was already very endemic in Nigeria and among the four household groups considered in the study. Thus, before the shocks, 55 percent of Nigerians were poor in terms of headcount, while the incidence of poverty in rural-north, rural-south, urban-north and urban-south households stood at 75, 47, 47 and 40 percent, respectively. These results indicate that rural-north households were the poorest socioeconomic group in the country and also that the poverty status of rural-south and urban-north household was the same. One interesting feature of this finding is that in terms of absolute numbers, 25.4 percent of poor Nigerians in the base year were found in rural-north households alone, while the remaining 29.6 percent of the poor were in the other household groups, taken together. Thus, in relative terms, rural-north households alone accounted for about 46 percent of poverty in Nigeria.

The food price shock increased poverty nationally and among all the households. A 50 percent increase in the price of food imports increased poverty in rural-south households by 5 percent followed by a 4 and 3.8 percent increase in poverty of urban-north and urban-south households, in that order. Rural-north households were the least affected by this shock as their poverty incidence increased by just 2 percent.

The impact of the oil price shock was mostly poverty-reducing. From the model simulation results, a 50 percent fall in export price of crude oil led to an 8.7 percent reduction in poverty incidence of urban-north households, followed by a 1.78 and 0.76 percent reduction in the headcount measure of poverty in rural-south and urban-south households respectively. However, a fall in the price of crude failed to reduce poverty in rural-north households, but actually increased poverty in this socioeconomic group by almost 3 percent.

The impact of exchange rate depreciation aggravated the poverty situation across board with substantial effects on all household categories. The individual effects on all but one household group were higher than the national average impact. A 25 percent increase in the exchange rate increased national poverty incidence by about 1.7 percent. Urban-north households suffered the highest increase in poverty headcount of 3.3 percent, while rural-north households suffered the least impact, with less than 0.5 percent increase in poverty incidence. Rural-south and urban-south households experienced an increase of about 2.5 and 2 percent in poverty headcount, respectively.

The results of the combination scenario were quite remarkable, as they actually produced the strongest impacts that we have seen in this study. Thus, under this scenario, we found an increase in national poverty incidence of about 5.7 percent. Regarding the household categories, rural-south household's poverty situation worsened the most as they recorded an 8.56 percent increase, followed by rural-north and urban-south households, with roughly a 7 percent increase poverty headcount each. Interestingly, however, there was no change in the poverty incidence of urban-north households as a result of this combined shock. These results are very informative as we find that in combination, the negative impacts of food price and exchange rate shocks over-swamped the poverty-reducing effect of oil price shocks and even worsened the poverty situation of all the household groups except one (urban-north households), which situation in terms of poverty incidence did not change.

One finding that need be viewed seriously as far as this study is concerned is the impact of the poverty gap measure and the equally distributed equivalent (EDE) incomes, as it provides a depiction of what the amount of resources that would be required to move all poor people to the poverty threshold. We find that for the combination scenario (which mirrors the crisis period), the equally distributed equivalent income nationally was N22,840.36, implying that on average, at the national level, if each poor individual receives N22,840.36, they would become non-poor based on the endogenous poverty lines used in this study. But even more informative is that of the four household categories, three, namely, rural-south (N17,989.89), urban-south (N16,656.41) and urban-north (16689.609) households have EDE incomes that are lower than the national average while rural-north households have the highest EDE income of N35,429.87. This trend was observed across all the simulations. Thus, we find that in reducing poverty in Nigeria, rural-north households would require almost twice as much resource as would be needed to tackle poverty in any of the other three household groups.

Finally, in the base year, we find that inequality was higher in urban households (0.4197 for urban-south and 0.4244 for urban-north) than in rural households (0.3781 for rural-south and 0.3637 for rural-north), and that urban household inequality levels were higher than the national inequality index (0.4176). The impact of the simulations on inequality for the individual shocks were rather mixed in the sense that although marginally, food price and exchange rate shocks potentially reduced inequality by 0.0478 and 0.2586 percent, respectively, oil price shock increased inequality, by about

1.4 percent, which was quite in contrast to their effects on poverty. However, the expected picture showed up in the combination scenario, as inequality increased by 1.37 percent, in line with poverty increases in the poverty analysis of the impact of this simulation. These results show that poverty can decrease even when inequality is rising.

6.3 Conclusions

This study investigated the impact of macroeconomic shocks on household poverty and income inequality in Nigeria. Based on the results, the study has shown that the global economic crisis occasioned by the simulated shocks impacted the Nigerian economy and households in Nigeria negatively (as national poverty incidence increased by 5.7 percent and even by a higher proportion in rural-south (8.56 percent), and 7 percent in rural-north and urban-south households), thus affirming the notion that the country is not insulated to external shocks. The magnitude and direction of the impact, however, varied by individual shocks and household groups, but importantly, increases in food price as well as increase in the naira/dollar exchange rate were the major perpetrators of the negative impacts on poverty, as they increased national poverty by 3.25 and 1.7 percent, respectively, while they turned out to show potential for reducing inequality, as they reduced national inequality levels by 0.048 and 0.26 percent respectively. In contrast, fall in oil price mostly reduced poverty (nationally by 1.13 percent), while at the same time exacerbated inequality by about 1.41 percent.

Consequent upon the above results, we assert that there could be an increase in poverty even when inequality remains unchanged or falls marginally, especially if the reduction in incomes is even across households. This seems to be in conflict with the thesis that poverty and inequality reinforce each other (McKay, 2002; Naschold, 2002), as we found that it may not apply in all cases. The impact of oil price on poverty and inequality further negates the notion about the acclaimed implicit relationship between poverty and inequality, as stated earlier, and leads us to the conclusion that shocks that may reduce poverty may not necessarily be egalitarian in their impact, thus calling for attention to be paid to the fact that pursuing poverty reduction policies with the implied aim of tackling both poverty and inequality may actually worsen income distributions and *vice versa*.

One new insight gained from this study is that shocks which have the potential of increasing poverty but redistributing wealth are those whose effect are mostly direct, for example, food price and exchange rate shocks, transmitted through income,

employment and price changes, while those that might have the opposite effect of reducing poverty but worsening income distribution belong to the group which effects might be basically indirect, for example, oil price shock in the Nigerian situation, which major transmission channel is via government fiscal stance through its spending, before affecting prices.

Another important lesson from this study is that overall, when all the shocks were allowed to act simultaneously, the resulting impact was negative: poverty increased and inequality also worsened. This conforms to the theory that inequality is bad for or fuels poverty (see, Killick, 2002). However, some of the results in this study have indicated that it may not always be so, unless perhaps when both direct and indirect mechanisms act together. Thus, we conclude on this score that the relationship between poverty and inequality can be very fluid, both in terms of signal and causality.

Another important conclusion drawn from the study is that the impact of shocks would depend more on the economic fundamentals of the nation and its households or socioeconomic groups than on policy response mechanisms to such shocks, based on the recurring strong impacts of the shocks on rural-north households, which in the study had the worst poverty status in the reference year and which required the most intervention after the shocks than any other household group. This household group has shown how strong the negative impact of shocks can be when the initial economic structure was poor. It has also shown how the impact of some shocks can be minimal depending on the households' income sources and consumption structure in the sense, for example that it was the least affected in terms of headcount measure, by food price shock for reasons perhaps of producing more food than other household groups and consuming less of imported food and manufactures/services.

6.4 Policy Recommendations

Although poverty reduction and income equity issues require actions on broad fronts, the results of the study point to some specific implications that require specific interventions, which may be targeted at some socioeconomic groups, as well as broad-based policy actions, which might necessarily have a national outlook. An important message from the current analysis is that the initial economic structure or fundamentals determine, to a great extent, the impact of the various shocks on the various sectors as well as household groups in the model. Thus, the recommendations proffered here to

guide or inform public policy interventions implicitly address this concern amongst the implication(s) that arise from the simulation experiments.

A. **Food Price Shock:** The results have shown that households, particularly rural households spend a substantial portion of their incomes on food, which means that an increase in the price of food would lower their real income, reduce their consumption and hence welfare. This therefore suggests that if abundant or more food is produced, to the extent that we would no longer have to rely much on imported food, any increase in the price of imported food would have very minimal impact on the price of food that is produced and sold domestically. Furthermore, the impact of food price shock was least in rural-north households, and as was stated earlier, a plausible explanation could be that they relied much less on imported grains as they produce a good quantity of grains. Thus it is recommended that:

- i. In the long-term, boosting food production especially in rural-south households and stepping up same in rural-north households is key, as increased agricultural productivity in rural areas would assure availability of affordable food and enhance the already very low per capita rural incomes.
- ii. In the short-term, however, palliative measures, as response to food price increase would, include measures to bring down food price and/or measures that can increase the purchasing power of households. For the first intervention strategy, staple food grains can be released from strategic reserves into the markets in the rural-south, particularly, as well as other regions most affected by the shock. Safety-net programmes, such as school feeding in the most affected areas are another short-term measure.

B. **Oil Price Shock:** As it concerns oil price shock, the study recommends that:

- i. In the interim, hedging against future price volatility can help in reducing the impact of world oil price shocks on the Nigerian economy. Another short-term recommendation is that rural-north households that have suffered the most impact from the shock should be directly targeted with safety-net programmes like food-based programmes to help in cushioning the adverse effect of the shock.
- ii. In the long-run, diversification of the economy through investments in production sectors using oil windfall incomes and developing alternative

sources of government revenue will reduce over-dependence on oil revenue, as well as the impact of its price shock on the economy.

C. **Exchange Rate Shock:** Since the impact of exchange rate shock is mostly felt by households through the goods they consume and/or produce and we found in the study that the import of manufactured goods (which include processed foods like dairy product, canned meat/fish, sugar, beverages, etc) had the highest proportion in the list of imports. It is therefore important to change the production and trade structure of the economy. Thus it is recommended that:

- i. An effective and efficient infrastructural system that supports manufacturing, agro-processing and efficient service delivery should be pursued so that foreign companies that use raw materials from Nigeria can be encouraged to open factories and manufacture those good here in the country, as this would have a broad impact of reducing the adverse effect of exchange rate shocks on households that consume imported products.
- ii. Moreover, diversification of the export base and export promotion as well as import-substitution is crucial. Agricultural exports should be boosted by encouraging the production of say, cassava for export by rural-south households. But in the case of northern households, the poverty impact of exchange rate shocks can be reduced by providing an incentive for the unskilled and low education urban-north households who constitute the bulk of the urban poor to migrate back to the rural-north areas by developing the rural-north areas in terms of infrastructure. This is bearing in mind that the rural-north households were the least affected by this shock.
- iii. In the long-term, apart from, interventions to change the production and trade structure in terms of broad-based diversification of production to include import substitutes and the promotion of exports, proper management of the external reserves is important. It is recommended that increasing the external reserves when there is economic boom can help stabilized the exchange rate during economic busts.

D. On the issue of inequality, it is recommended that both broad-based and targeted interventions be pursued in the areas of education, healthcare, improving social capital, as well as, expanding and improving access to basic infrastructural

services. One way of achieving this would be taxing the richer segment of society, which is a means of ensuring income redistribution and equity.

6.5 Limitations of the Study and Suggestions for Further Research

As in any empirical research endeavour, this study has its limitations, stemming mainly from data and model development issues rather than the question that was investigated. The data requirements of CGE models are very demanding, thus to capture the nuances in the behaviour of the economy, sectors and agents requires highly detailed databases, which in most cases are lacking in developing countries, especially given that the data sources for assembling the database (or SAM) are very numerous. Consequently, since the equations of CGE model derive from the SAM underlying the state of the economy which is being modelled at equilibrium, it follows that the SAM would determine the working of the model. Beyond this, carrying out poverty analysis in a general equilibrium framework has its added data as well as modelling challenges. As it concerns the data, it is difficult for the SAM and household survey data to both be available for the same year at the time of analysis. Thus, aside the inherent shortcomings of the household surveys themselves, the assumption that the economic structure does not change significantly within a band of a certain number of years may not hold, as results might be affected by structural changes. Consequently, the following suggestions are made for future research.

- (i) Future studies on poverty analysis using the current representative household CGE approach should use a different classification of household groups based along the lines of not just geographic locations but also along occupational and educational dimensions. This way some more detailed effects can be observed that might help policy actions to be more focussed, given that the dimensions of poverty are quite diverse. This of course depends on the availability of a detailed and consistent household survey and SAM data.
- (ii) Since the simulations in the current study were carried out in comparative static mode, the dynamic effects of the simulations were not captured, although some analysts argue that the manner in which the CGE model is closed might indicate whether the results should be interpreted as short- or

long-run impacts. Thus, there is need for further studies to model dynamics so as to predict the steady-state and dynamic growth path of the shocks.

- (iii) Future research should also be carried on the basis of CGE micro-simulation analysis which is more complex in terms of computational demands, using all the households in a survey and fed into the CGE model through a micro-simulation module in order to capture the intra-group variances which are ignored in the current representative household model. This way the analysis of both poverty and inequality for each household in the survey rather than household group can be carried out.

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