Technical Research Report on

Poverty and Social Impact Assessment of Flexible Exchange Rate on Segments of the Nigerian Population

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Abbreviations

Acronym	Meaning
CBN	Central Bank Nigeria
SUBSIM	Subsidy Simulation
IFPRI	International Food Policy Research Institute
HBS	Household Budget Survey
NISER	Nigeria Institute for Social and Economic Research
BDC	Bureau De Change
SFEM	Second Tier Foreign Exchange Market
AFEM	Autonomous Foreign Exchange Market
RDAS	Retail Dutch Auction System
GHS	General Household Survey
SAM	Social Accounting Matrix
NBS	National Bureau of Statistics
I-O	Input-Output
RDAS	Retail Dutch Auction System
WDAS	Wholesale Dutch Auction System
Q1	Lower Quintile
Q3	Middle Quintile
Q5	Upper Quintile
ENEP	Endogenous Export Price
EXEP	Exogenous Export Price
PPP	Purchasing Power Parity

Executive Summary

Nigeria's transition from oil revenue windfalls to shortfalls because of the slump in global price of oil since July 2014 means an inevitable end to unsustainable general subsidy programmes that the government had pursued for decades. Nigeria had used commodity price windfalls to maintain a regime of general subsidies. Subsidies on the pump prices of petrol, electricity tariffs, and an overvalued exchange rate were the most common. Weak commodity prices in the two years since July 2014 and a bleak outlook for the near future clearly meant that the windfalls required to back the subsidy regimes are gone, revenue shortfalls are now a grim reality, general subsidies have become fiscally unsustainable.

Consequently, the government embarked on the following:

- 45 percent increase in *electricity tariff* from February 1 2016
- 67.6 percent increase in the *pump price of petrol* on May 11 2016
- 40 percent *downward adjustment of the exchange rate* of the Naira on June 20 2016.

It is important to note that the above generalised subsidy removal measures were taken because the income required to maintain them are no longer available to the government, as such no fiscal savings will result from an end to the general subsidy programmes. Had the government ended the regressive subsidy programmes while the windfalls lasted, it would have been possible to use part of the resulting savings to fund policies that would enhance the welfare of the poor. Since downward adjustment of the exchange rate however enhances the Naira value of the proceeds of oil exports, part of the naira gain could still be applied to protect losses of the poor who will suffer more than average welfare losses from the impact of exchange rate adjustment.

Necessary adjustments had been delayed by concerns about the vulnerability of the poor. But now that the adjustments have become inevitable and have indeed occurred, there is a need to identify those who might be negatively impacted and estimate the magnitudes of the harm they are likely to suffer. This study presents new empirical evidence on the sizes of the distributional effects of the exchange rate flexibility on the different income groups in the country, across rural and urban areas, and across the six geopolitical zones.

The study used the Subsidy Simulation (SUBSIM) tool to estimate data from the 2006 International Food Policy Research Institute's (IFPRI) social accounting matrix, an updated 2011 Input-Output table produced by the Nigeria Institute for Social and Economic Research (NISER) and a 2011 Household Budget Survey (HBS) produced by the National Bureau of

Statistics (NBS). The study finds that while all income groups will suffer net welfare losses from the transition to flexible exchange rate, with upper income groups losing more in absolute terms, but the smaller absolute losses of the poor constitute larger percentages of their lower incomes, making the relative losses larger for the poorer population, and resulting in a slight increase in inequality. This holds true by expenditure groups, rural-urban divide, and geopolitical zones. The poor are likely to suffer larger than average welfare losses.

- The main channel through which a downward exchange rate adjustment erodes welfare across income groups is the *purchasing power losses* inflicted by increases in consumer prices because of the adjustment. Upper income groups suffer bigger absolute welfare losses than lower income groups because they spend more on non-food items that have more imported components than on food items with little lower imported components.
- A downward exchange rate adjustment however also enhances *incomes of households* who earn part of their incomes in foreign currency, providing opportunities to mitigate some of the purchasing power losses on the spending side. Non-oil export income earners and recipients of remittances enjoy a boost in the Naira values of their receipts after the adjustment. Upper income groups receive most of the non-oil export earnings and remittances, while middle income groups receive very little, and low income groups receive nothing. As such, upper income groups can mitigate a fraction of their purchasing power losses though the enhanced Naira value of the portions of their incomes denominated in foreign currency, while the lower income groups are unable to do so.
- While the net impact of exchange rate flexibility remains negative for all income groups, it is much less so for the upper income groups, who could mitigate a significant fraction of their welfare losses by increased Naira value of their foreign currency incomes, than it is for the lower income groups, who have little or no foreign currency incomes.

Thus, while lower income groups will lose between 4 and 7 percent of their incomes in the aftermath of the downward adjustment of the exchange rate, upper income groups will only lose about 2.5 percent. Rural dwellers will similarly lose between 4 and 6 percent of their incomes in the aftermath of the adjustment; urban dwellers will only lose about 3 percent. The incidence of poverty will thus increase the most in rural areas. Consequently, the incidence of poverty will increase the most in the North West and North-East of the country, which already have the highest poverty incidents in the country, while the incidence of poverty will increase the least in the South West and the South-South, which already enjoy the lowest incidents of poverty in the country.

Since it has been found that a downward exchange rate adjustment did make the poor poorer in all above cases, there is a need for introducing intervention programmes to protect the

poor from adverse welfare effects of economic policy shocks. The report discusses motives and methods for doing so, with references to similar measures in Nigeria and other countries.

1. Introduction

1.1. Background and context

1.1.1 The Nigerian foreign exchange market: Historical and conceptual issues

The major participants in Nigeria's foreign exchange market are commercial banks, public sector, bureau de change (BDC), and private sector. While the Central Bank of Nigeria is the major supplier of foreign currency in the foreign exchange market, the commercial banks constitute the most important institutions involved in the operations of the foreign exchange market. This is because they are the major authorized dealers empowered to buy and sell foreign currency on behalf of their customers as well as holding exchange deposits with correspondent banks abroad to meet the foreign currency demand of their customers.

The commercial banks operate in the formal and autonomous segments of the Nigerian foreign exchange market. Another important participant in the market are the BDC operators. They are registered foreign exchange dealers who engage in over the counter transactions to meet retail foreign currency demand. The BDCs bridge the gap between the official (formal) and parallel (informal) markets in terms of access and documentation.

In the formal exchange rate auction market where authorized dealers are the main participants, the CBN determines not only how and when currencies are sold, but ascertains those that qualify to bid and stipulates required documentation for the authorized dealers. These guidelines are reviewed in line with prevailing and emerging economic conditions by the CBN which, is saddled with the responsibility of supervising and monitoring the foreign exchange market operations as well as issues guidelines that regulate the sale of foreign currency in the official and autonomous markets.

Obadan (2012) identifies three major segments of the Nigerian foreign exchange market and they are; (i) the official (formal) market; (ii) the autonomous market (interbank and BDC); and (iii) the parallel market. He notes that the first two are part of the formal foreign currency market while the parallel market is the major component of the informal foreign exchange market. These segments have evolved overtime in line with developments in the economy. This has often led to the view of the formal market being driven by the CBN and the informal market by the BDC.

The official or formal market is the predominant segment in Nigeria's foreign exchange market. The evolution of the market in Nigeria to its present state was influenced by many factors, including the changing pattern of international trade, institutional changes in the economy and structural shifts in the structure of production. Prior to 1986, informal foreign exchange market transactions existed; it was largely ignored by the CBN. Further, the autonomous segment of the formal exchange rate market which, is dependent on privately sourced foreign exchange was dormant between 1962 and 1986. This changed by September 1986 with the introduction of the Second-Tier Foreign Exchange Market (SFEM) as the institutional framework for foreign exchange trading and market determination of the exchange rate.

The SFEM was established in the context of a dual foreign exchange rate market made up of an official first tier market and a second-tier market. The former featured a fixed but adjustable exchange rate that was applied to a few official transactions (such as debt servicing and multilateral obligations). The second-tier market on the other hand featured all other international transactions as well as transfer of funds. Under this system, market forces determined the price of the currency within the framework of the auction system.

The BDCs were introduced in 1989 with a view to dealing in privately sourced foreign exchange. By 1995, the foreign exchange market was liberalised again with the introduction of an Autonomous Foreign Exchange Market (AFEM) for the sale of foreign exchange to end users by the CBN through selected authorised dealers at the market determined rate. The foreign exchange rate market was further liberalised in October 1999 with the introduction of an Interbank Foreign Exchange Market (IFEM).

The instability and sharp practices that characterised the autonomous markets prompted its merger with the official foreign exchange market in January 1989 to produce an enlarged Inter-bank Foreign Exchange Market (IFEM). This sought to harmonize the exchange rate in the official and autonomous segments of the markets to reduce distortions. IFEM came to an end in December 1990 but was reintroduced in October 1999 consequent upon speculative tendencies that destabilized the exchange rate and resulted in a significant depreciation of the naira. The reintroduction was meant to deepen the foreign exchange market through active participation of other market players such as banks, oil firms, BDCs, etc. Under this system, the CBN was not the dominant supplier but operated as a participant that intervenes in buying and selling of foreign exchange depending on market conditions.

The *Informal foreign exchange market* has two segments: the free funds and parallel market. It is the latter's activities that has attracted significant attention and concern. The free funds basically consist of the balances held by banks in private individual domiciliary accounts and dealings in proceeds of non-oil exports remitted to the receiving bank. The *parallel market*, otherwise known as *black market* for foreign exchange has been in existence since the era of exchange control. The existence of the parallel market is linked to the inability of the formal/official market to efficiently meet foreign exchange needs of end users. Thus, scarcity in the official sector and bureaucratic procedures necessitated the growth and development of the parallel market. An important attraction of the market is the absence of documentation which, makes transactions easier.

There has always been a disparity in the formal and parallel market rates with the latter exhibiting higher market-driven rates. The goal of reducing the parallel market premium has been at the forefront of government's macroeconomic policy agenda given its existence alongside the formal market. In view of the linkage between the markets, the divergence of one rate from the other implies that resources are not efficiently priced. Thus, a high parallel market premium is an indication of the extent of misalignment of the exchange rate. It is therefore expected that the difference between the official and parallel rate should be as small as possible, reflecting only transaction costs and not speculative bubbles (Olisadebe, 1991).

1.1.2 Mitigating the socioeconomic effects of exchange rate adjustment

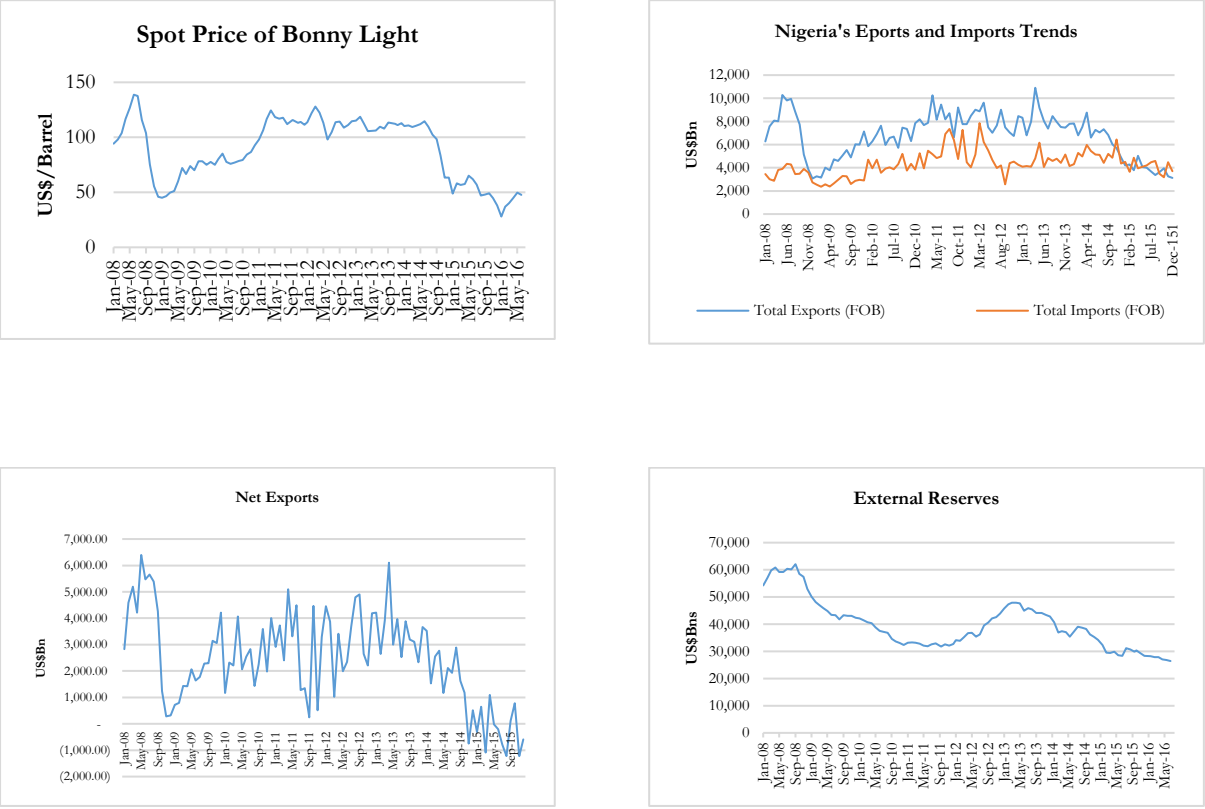
Nigeria had used commodity price windfalls to maintain a regime of subsidies on electricity, petrol and exchange rate. Weak commodity prices in the last two years and a bleak outlook for the near future mean the windfalls are gone for now and Nigeria will inevitably have to let the subsidies go. Nigeria's export receipts that were twice as large as import commitments have now dropped significantly. Subsidies on the pump prices of petrol, electricity tariffs, and maintaining the official exchange rate well below the market determined rate are the most ubiquitous subsidies whose removal have defined economic reform discussions in recent years. Subsequently, the government effected upward adjustments to electricity tariff, pump prices of petroleum products, and allowed more flexibility in the exchange rate, immediately triggering a 40 percent depreciation. Nigeria now needs to focus on how to protect the poor from any possible adverse effects of this exchange rate policy change.

1.1.3 Oil price shocks and foreign exchange crisis

After staying above US$100 per barrel since January 2011, Nigeria's reference *oil price*, the spot price of a barrel of Bonny Light crude oil, dropped steeply from US$114.6 to US$48.81 in June

2014. It recovered slightly over the next five months to US$62.06 by June 2015, before sliding steeply over the next seven months to US$28, the lowest since July 2003. It has hovered around US$50, recording US$49.84 as at August 2016.

Figure 1: Trend of selected external sector variables



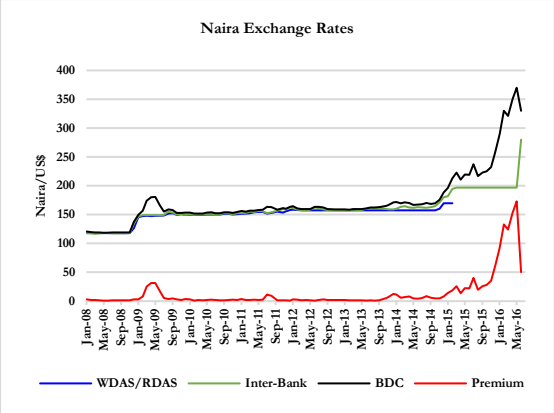
With oil and gas exports typically accounting for 92 percent of total export earnings in Nigeria, monthly export receipts have dropped from an average of US$8 billion before July 2014 to less than US$4 billion in the months after. Observably, monthly import bills remain marginally above US$4 billion while surplus *net exports* have fallen from a monthly average of about US$4 billion to deficits. Nigeria faces a stark reality in which export receipts do not cover import commitment for the first time in over a decade. The CBN drew from its foreign exchange *reserves* to make up for the shortfalls in export receipts which, exceeded its import commitments. Notably, external reserves fell below US$30 billion in February 2015, just above six months' cover for prospective import bills, from about US$40 billion in 2014, suggesting that the CBN could no longer meet the shortfalls.

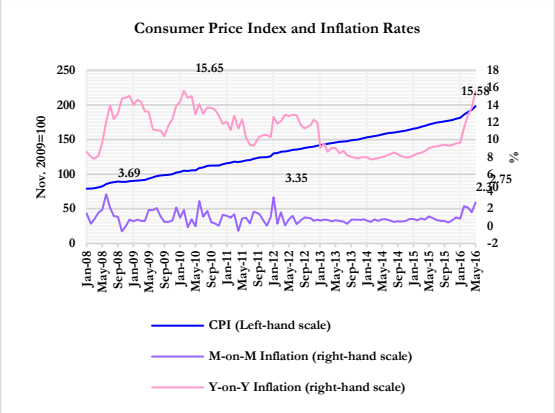
1.1.4 Exchange rate movement and policy developments

The Naira exchange rate has come under pressure in the face of dwindling export earnings. The CBN closed its weekly subsidized auction window, known as the Retail Dutch Auction System (RDAS), in February 2015, leaving the Inter-Bank Market and the BDC[1] as the two outlets through which foreign exchange can be traded. Both the inter-bank rate and the BDC rate depreciated in November 2014 and February 2015, but the CBN subsequently held the interbank rate by fiat to bring a situation in which a large and widening premium emerged between the BDC rate and inter-bank rate. Besides fixing the interbank rate by fiat, the CBN also came up with a prohibition list of 41 items whose imports cannot be funded with foreign exchange procured from the inter-bank market. This inadvertently added to the excess demand pressures on the autonomous BDCs and widened the parallel market premium.

Figure 2: Exchange rate and price movement

[1] The BDC is also often referred to as the autonomous market by CBN officials or parallel market by the public. To the extent that BDCs are licenced by the CBN and received direct supply of forex from the CBN, until CBN directed them to source from the open market early 2016, it may not be right to refer to them as 'black market'. Although BDC transactions are less formal, mostly spontaneous, anonymous, includes street hawking, and largely undocumented.





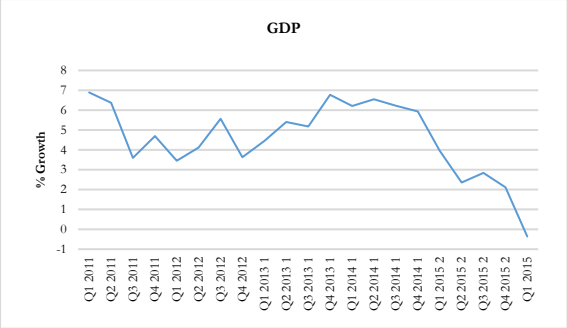
The widening *parallel market premium* became a conspicuous indicator of the overvaluation of the inter-bank rate and precipitated pressures on the CBN to allow more flexibility in the determination of the inter-bank rate. Some potential suppliers of foreign exchange expressed worries about a situation in which they were being forced to sell foreign exchange at N198/US$ at the interbank market when they have a surplus only to end up buying at 370/US$ at the BDCs when they have a shortfall. Since both banks and BDCs are licensed by the CBN, allowing such premium to persist between the two windows merely perpetuated market-distorting arbitrage opportunities. The CBN eventually allowed market determination of the inter-bank rate from June 2016, bringing about a 40 percent depreciation in the interbank rate, and a 10 percent appreciation in the autonomous rate.

A key policy and empirical issue is how best to capture the impact of a flexible exchange rate regime on the poor. Consumer price *inflation* figures reveal that depreciation of the autonomous rate passed through to consumer goods even when the interbank rate was fixed. This suggests that the parallel market premium, a measure of the spread between the two exchange rates, could be vital for understanding the impact of a depreciation on consumer prices in a dual exchange rate regime and hence formed the basis of the policy simulations carried out.

1.1.5 Economic activity

Economic activity has contracted because of the global *commodity price weaknesses* as well as *reduced access of businesses to foreign exchange*. Quarterly *real GDP growth* slowed from 6.77 percent in the first quarter of 2014 to -2.24 percent in the third quarter of 2016 while *stock market capitalization* fell from a historic peak of N14 trillion in June 2014 to N8.2 trillion in January 2016; before recovering to N10.1 trillion in June 2016.

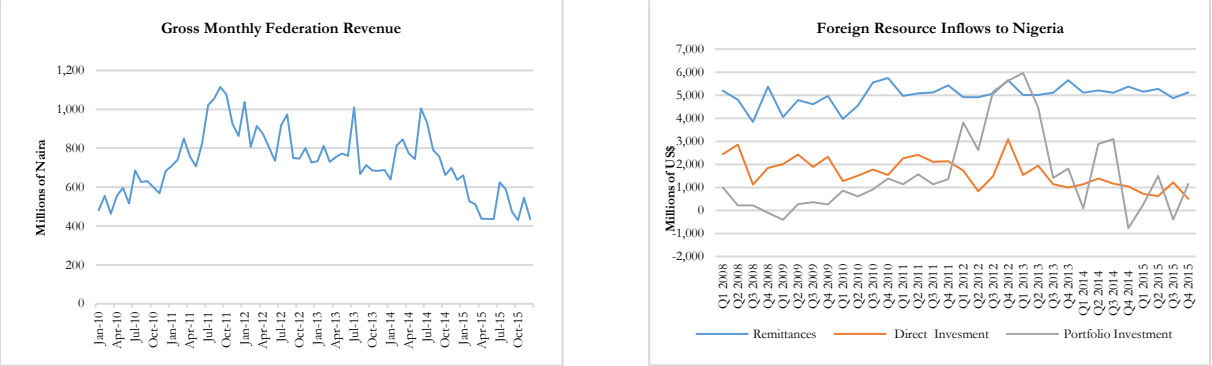
Figure 3: Trend of GDP and Stock Market Capitalization



1.1.6 Foreign resource inflows

The bulk of *US dollar proceeds from oil export* flow directly into the federation account, supplying 80 percent of total revenue into the account as at 2013, 75 percent in 2014, and 72 percent in 2015. Since oil export earnings are denominated in US dollars, government revenue in the domestic currency will be boosted by a depreciation of the inter-bank rate, but will remain unaffected by the autonomous rate, because dollar receipts into the federation account are converted at the inter-bank rate. The *US dollar proceeds from non-oil exports* mostly accrue to private exporters' domiciliary accounts which have remained accessible in US dollars. This means that unlike the government, private oil and non-oil exporters enjoy Naira income gains from the depreciation of the autonomous exchange rate.

Figure 4: Gross monthly Federation revenue and foreign resource inflows



Migrants' remittances or *diaspora funds* is another significant and stable source of foreign exchange inflow to Nigeria, but these accrue entirely to the private sector. Over the last decade, a stable inflow of about US$5 billion per quarter, or US$20 billion per year into the country has been recorded, regardless of what is happening to commodity prices or economic activity in Nigeria. The Naira value of remittances are also boosted by depreciation of inter-bank or autonomous exchange rate prior to February 2015, when recipients could receive remittances in US dollars, giving them the liberty of changing into Naira at the BDCs. This always gives higher Naira value compared with the inter-bank rate. Since February 2015 however, the CBN directed that remittances are only paid in Naira, based on conversion at the inter-bank rate. Thus, private sector recipients of remittances now only gain in Naira value of their receipts when the inter-bank rate is devalued.

1.1.7 Protecting the Poor

According to Casero and Seshan (2006),[2] subsidy removal and currency adjustment could indeed generate fiscal savings in the short-term, but it would have adverse effects on poverty and income distribution. While the adoption of flexible exchange rate could generate fiscal savings, it could cause the poorest households to fall below the extreme poverty line and pull the lower middle-income households below the national poverty line. However, the absence of formal social safety nets limits the government's readiness to provide well-targeted and timely social transfers to the poor.

This study evaluated the impact of adopting a flexible exchange rate regime on Nigerian households. The sample cuts across rural and urban locations in the 36 states (and the Federal Capital Territory) grouped into six geopolitical zones. The data inputs are drawn from the

[2] Casero, P. A. and Seshan, G. (2006), Fiscal and Social Impact of a Nominal Exchange Rate Devaluation in Djibouti. World Bank Policy Research Working Paper 4028, October 2006.

General Household Survey (GHS) and Social Accounting Matrix (SAM) provided by the National Bureau of Statistics (NBS).

The GHS and SAM provide the detailed structure of goods and services that are mostly consumed by the poor, thereby making it possible to investigate the extent to which their prices have been affected. This provides ample opportunity to evaluate the likely impacts of the Naira exchange rate adjustment on the poor.

1.2. Objectives and scope of the study

This study examines the impact of flexible exchange rates on various segments of society, and in particular, on the poor. Specifically, it focuses on the following:

i. An analysis of the current economic challenges (including foreign exchange rationing and inflation), and their impacts on various economic agents (including manufacturing companies that provide jobs, remittances from abroad that can be beneficial for the poor). The impact was analysed with regards to the net impact of inter-temporal (short-term) hardships vis-à-vis medium to long-term benefits such as increased revenues that can be used for provision of social protection programs and basic social services.
ii. A clear determination and articulation of various pathways (both macro and micro) through which a higher naira exchange rate can affect domestic inflation. An assessment of lessons from international evidence on exchange rate adjustment and pass through effect to inflation.
iii. To analyse the impact of flexible exchange rates on inflation.
iv. Considering the various transmission mechanisms above and other factors likely to have been at play, an analysis of the structure of goods and services that are mostly consumed by the poor and the extent to which their prices could be affected.
v. Assess the impact of previous increases in Naira exchange rate, including the 22 percent increase between November 2014 and February 2015, on domestic inflation, and more specifically, on the poor in Nigeria
vi. Assess the extent to which high exchange rates currently on the parallel market are already having an impact on prices, and hence on the poor
vii. To assess the supply side responses that can be put in place to alleviate the impacts.
viii. Assess other countries that have tried to mitigate the negative impact of a higher exchange rate on the poor, and the extent to which such mitigating measures have been successful.

2. Methodology

2.1 Method of analysis

To ascertain the distributional impact of adopting a flexible exchange rate regime, the empirical analysis is carried out in three phases. First we ascertain the household per capita expenditure shares across various commodities as well as their income from the household budget survey. The second phase entails the implementation of exchange rate adjustment simulations to analyse the impact on households through the spending channel. Finally, we estimate the potential fiscal cost in form of social transfers needed by government to compensate for the losses by households due to the resultant currency depreciation.

The primary channel through which the impact of adjustment is transmitted is through prices. The SUBSIM model accounts for an endogenous and exogenous price model based on the sectors considered. The endogenous assumption allows for price adjustment through a shocked sector after the shock period while the exogenous assumption assumes that the price of the shocked sector does not change after the introduction of the price shock (See section A2 on analytical Framework and transmission channel in the appendix for more details on the mechanics of the model).

2.2 The data

The data requirement for executing SUBSIM is a household budget survey (HBS) and an I-O matrix that is re-aggregated based on the most recent shares provided by the Social Accounting Matrix (SAM). All the datasets are expressed in the domestic currency (naira). The analysis starts with preparing the HBS consumption aggregates such that it conforms to the I-O sectors prior to estimations. Since the HBS is made up of numerous sectors relative to the I-O table, the product categories in the HBS were reorganised/matched with the corresponding I-O sectors.

2.3 The SUBSIM tool: An overview and motivation

SUBSIM, meaning Subsidy Simulation, is an automated tool used to evaluate the potency of policies in terms of their distributional impact. Although its primary policy focus is on subsidy reforms, it is also applicable to an array of policies. It is a potent tool for conducting economy-wide analysis with emphasis on poverty, welfare and inequality as well as computation of cash transfers. It provides ample opportunity to conduct counterfactuals such as the impact of a policy when social safety nets are put in place.

An important advantage of the model is that it independently and/or simultaneously assesses direct and indirect effects. While the former focuses on the impact of a price change on household through the price channel, the indirect effect considers the impact of the price change on welfare through the consumption of products that are affected indirectly by the change in the price of subsidized products.

Thus, the tool aids the computation of both partial and general equilibrium effects. The primary transmission of policy changes to households is through the prices of primary, intermediate and final products. This invariably affects household spending on consumables.

Araar and Verme (2012) identify three important phases through which the SUBSIM tool is executed (See Table 11 in appendix). The first is the incidence analysis of policy on household welfare. Second is the price shock simulation while the final stage is the impact analysis phase and it involves comparing the outcome of alternative policy scenarios.

3. Analysis and Discussion of Findings

3.1 The policy simulations

The Nigerian government embarked on a significant change in the exchange rate management on February 18, 2015 during which the Retail Dutch Auction (RDAS)-the subsidized foreign exchange window- was closed;[3] and then floated the exchange rate on June 20, 2016. This resulted in a change in the value of the currency in the formal (interbank) and informal market (BDC). It is expected that flexibility in the foreign exchange market will lead to a quasi-instantaneous convergence of the rate in both markets. This was not the case during the first month as the formal and informal market rates remain significantly different, despite the new regime.

Illustratively, a week into the June 20, 2016 floating of the currency, the formal-informal price gap decreased from 171 to 50 naira; and to about 10 naira at the end of July, but has since drifted wide apart again. . Therefore, the impact on household welfare will depend on changes in the formal and informal market. Unfortunately, it is not easy to estimate the importance of each market with available information.[4] Therefore, the simulations of the exchange rate adjustment were approximated to changes in the official market rate. Precisely, in equilibrium, the exchange rate is projected to depreciate from the free floating of the currency by between 30% and 50%. Hence the simulation is based on these two lower and upper band scenarios.

Two sets of exchange rate policy simulations are conducted with a view to ascertaining the impact on households. The first scenario is an upper band simulation of 50% that was arrived at based on the premium between the formal interbank and informal BDC rate as at June 20, 2016 and this is expected to decrease further as they tend towards convergence between the short to medium term.[5] Furthermore evidence suggest that the formal exchange rate market accounts for a significant share of total foreign exchange supplied to end users such as importers and producers. This means that its impact on import prices is expected to be relatively higher because this is the price at which agents access foreign exchange.

[3] The CBN, in scrapping its window of direct sale of foreign exchange to end users on February 17, 2015 said all foreign exchange needs are to be sourced from the inter-bank market whose rate ranges between N197-N198 to a dollar.
[4] This because it is difficult to get the exact share of the total supply of foreign exchange from both the formal and informal market to end users.
[5] This will in turn eliminate arbitrage opportunities and speculative activities that have dominated the fixed foreign exchange market regime.

The second simulation is a lower band scenario that focuses on the 30% exchange rate depreciation. Under this scenario, the assumption that total foreign trade in Nigeria is financed by foreign exchange supplied through the formal market channel is dropped. In other words, importers and exporters also source for foreign exchange through the informal market as well. This in turn is expected to reduce the impact of the change relative to the upper bound scenario. The value is computed based on the difference between the pre-floating and post-floating exchange rate and depicts the contemporaneous impact of adopting a flexible exchange rate system.

3.2 Baseline scenario

The analysis carried out in this study is based on the 2010/2011 Nigerian household budget survey and the 2006 social accounting matrix.[6] Although we acknowledge the availability of the more recent household budget survey, we rely on the 2011 version because it matches the 2011 I-O which, is a primary requirement for calibrating the SUBSIM model. The use of the SAM is predicated on the fact that it is the most recent available and provides the requisite shares for disaggregating the 2011 Input-Output that was linked to the household budget survey. Results of the distributional analysis are estimated using 2010 base year prices.

Table 1 presents the expenditure shares by household quintiles. Notably, aggregate household spending is dominated by food which constitutes about 77% of total expenditure. This is followed by education which takes up about 9.1% while footwear and clothing items record about 3.5%. A similar pattern is observed in terms of household spending on other items. Although the food component out rightly dominates spending; however, expenditure on clothing and footwear as well as communication make up a significant share of non-food expenditure. Observably, the lower quintiles spend more on the various food commodities (excluding other food items) compared with the higher quintiles. However, the higher quintiles tend to spend more on non-food items (excluding footwear). This suggests that the impact of exchange rate adjustment will be relatively higher on upper income households relative to the middle and low income quintiles due to the relatively higher import intensity of non-food products. This however will depend on whether the commodities in each category are imported or produced in domestic markets.

[6] A SAM 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, farms, households, investors, and the external sector (rest of the world). The Nigerian SAM was developed by the International Food Policy Research Institute and is disaggregated by 61 sectors.

Table 1: Household expenditure share on commodities by quintiles (%)

Commodity	Quintile_1	Quintile_2	Quintile_3	Quintile_4	Quintile_5	Average
Cereals & tubers	37.22	35.07	31.39	28.82	23.41	28.42
Meat & fish	11.16	13.11	13.93	14.29	13.38	13.48
Vegetable & fruits	22.14	19.60	18.01	15.98	12.71	15.88
Other food	12.75	14.81	16.77	18.95	23.70	19.56
Tobacco	0.10	0.23	0.11	0.15	0.10	0.13
Cloth & Footwear	4.66	4.10	3.89	3.40	2.87	3.45
Water & Electric.	0.90	0.95	1.45	1.52	1.62	1.43
House & Energy	2.28	2.29	2.39	2.58	2.32	2.39
Transport	0.89	1.19	1.69	2.05	3.41	2.36
Education	5.36	5.76	6.84	8.36	12.01	9.06
Health	0.78	0.89	1.11	1.18	1.05	1.05
Communication	1.75	1.99	2.43	2.69	3.37	2.77
Insurance	0.00	0.00	0.00	0.00	0.05	0.02
Total	100.00	100.00	100.00	100.00	100.00	100.00

3.3 Discussion of findings

The effect of an exchange rate adjustment can manifest through the price channels (change in proceeds of exports and change in cost of imports). The change in import prices affect final and intermediate products. The impact of the intermediate product price channel on household well-being is transmitted through the induced final product price change because of the increase in cost of production. This is in turn transmitted to the final product prices.

The second channel is linked to final imported good. From Table 2, it was observed that a 30% upward adjustment of the exchange rate will lead to a relatively small increase in the price of commodities relative to the 50% exchange rate adjusted price effect. This is explained by the magnitude of the transmission to domestic prices, which will vary with the extent to which the naira increases *vis-a-vis* the US dollar. The adjustment will have different impact on the various products depending on whether the commodity is mainly imported or produced in the country.

Evidently, the adoption of flexible exchange rate policy leads to a large increase in prices; especially imported commodities. Table 2 also reveals that the impact is relatively higher on manufactures and services compared to agriculture produce. This suggests that the effect of the exchange rate policy adjustment will be higher on middle and high income households since they rely more on imported food and non-food items. Another important finding is that the exchange rate pass-through effect

is primarily more pronounced via the intermediate product price channel.[7] This increases the cost of production which, is then transmitted to final product prices, and then to consumers. In view of the household spending shares on commodities presented in Table 1, the price changes are expected to affect high income households significantly more than their low-income counterparts. This is because households that fall in the lower quintile tend to spend more on food relative to non-food products than high income households.

The price of transport and energy products increased significantly under the upper and lower bound flexible exchange rate scenarios considered. The increase in the price of energy products and transport may be partly explained by the fact that a depreciation of the currency implies that the import of motor vehicles, other equipment and machines become more expensive in naira terms. In addition, about 75% of refined petroleum products are imported and therefore, the decrease in value of the naira will make these products more expensive. The significant price change observed especially for manufactured products may be traced to the fact that a significant portion of non-food items are imported and the exchange rate pass-through effect is further magnified by the exchange rate adjustment.[8]

Table 2: Commodity price effect of exchange rate adjustment

Commodity	Scenario 1 (30%)	Scenario 2 (50%)
Vegetable and fruits	1.460	2.434
Cereals and tubers	3.543	5.905
Water and electricity	3.654	6.090
Meat and fish	5.183	8.639
Communication (postal and telephone)	5.511	9.184
Other food products	6.060	10.100
Education	7.090	11.817
Health	7.793	12.988
Tobacco and narcotics	11.356	18.926
Clothing and footwear	15.007	25.012
Other insurance excluding education	18.973	31.621
Transportation and energy products	22.766	37.943

Household well-being is primarily affected by the change in commodity prices. The welfare effect by expenditure for the lower (Q1), middle (Q3) and upper quintiles (Q5) is presented in Table 3. The

[7] This implies that the transmission of an exchange rate adjustment is not through the final price channel per say but through the price of imported inputs.

[8] According to Nwafor et al. (2010) a bulk of Nigeria's import are manufactured goods that make up about 66% of total import compared with the 22% and 6% of services and crops.

total impact of a 30% depreciation is relatively regressive for all the household groups with the low-income households (Q1) recording a 3.88% decline in terms of per capita spending while the middle and high income households recorded declines of 3.85% and 2.23%, respectively. However, it is interesting to note that the high estimates observed for the low-income households should be viewed with caution as the model only accounted for first order price effects and did not account for short run supply side responses. That is, it did not take into consideration the compensatory effect of higher income that may arise from contemporaneous sales of agriculture produce at higher prices locally and to neighbouring countries as anecdotal evidence suggests. However, the impact is progressive in absolute terms. This was the case in the exogenous price model (EXEP) where Nigeria is assumed to be a world price taker and the global price of exported commodities is not affected by the exchange rate adjustment.[9]

To assess the robustness of our estimates, another scenario where Nigeria's exports are large enough to affect the global price is considered. In this case, it is assumed that a flexible exchange rate system leads to a depreciation and this may in turn boost the country's export earnings in naira. Observably, simulations under the endogenous price model (ENEP) assumption, although recorded a similar price decline; the magnitude of the price decrease was relatively larger using the upper bound elasticity value of -0.5 compared with the lower bound elasticity of -1.5. The results are *robust* based on the ENEP model as the results were not significantly different when the elasticity value was almost doubled. This implies that the policy implications drawn from the findings are not sensitive to changes in the elasticity. For the EXEP model, the upper bound 50% exchange rate adjustment led to a significantly larger increase in the welfare effect of the lower (Q1) and middle (Q3) quintiles, recording 6.36% and 6.14%, respectively. This means that their already low purchasing power is eroded by the exchange rate-induced price change. This effect may be traced to the intermediate commodity price changes and not the final product price because the final product price is transmitted through imports and the consumption share of low income household groups in total import is generally quite low.

The high-income household (Q5) recorded a relatively lower fall of 2.19% consequent upon adopting a flexible exchange rate regime in Nigeria. In the case of the endogenous price (ENEP) model, the prices recorded were also significantly larger as the effect almost doubled for both the

[9] In other words, the country's export is not large enough to influence the global price.

low and middle income households. An important observation from Table 3 is the positive remittance effect recorded for the middle and high income quintiles. This is expected because the depreciation of the exchange rate transcends to more naira holding for households because more dollars received from the diaspora funds will more than double when converted to naira. However, the increase is clearly higher for the fifth quintile (Q5) compared with the middle quintile (Q3) and this may be explained by the fact that emigration is more associated with higher quintiles relative to lower income households given the inconsequential impact recorded by the lowest quintiles (Q1 and Q3) under the various policy simulations considered. Another plausible explanation is because it is expensive for members of poor households to emigrate and hence reduces the ability for poor households to receive remittances.

Table 3: Welfare effect by expenditure groups (naira)

	30% depreciation			50% depreciation		
Quintile	**Q1**	**Q3**	**Q5**	**Q1**	**Q3**	**Q5**
A- Per capita	29,514.83	65,190.20	176,294.22	29,514.83	65,190.20	176,294.22
B- Impact by imports	-1,191.82	-2,797.30	-8,002.23	-1,986.36	-4,662.15	-13,337.01
C- Impact by remittances	0.00	92.71	3445.30	0.00	216.33	8039.04
D- Impact by exports (EXEP)	46.45	189.66	617.39	108.38	442.54	1440.58
E- Impact by exports (elas.= -0.5)*	-23.23	-94.83	-308.70	-54.19	-221.27	-720.29
F- Impact by exports (elas.= -1.5)*	23.23	94.83	308.70	54.19	221.27	720.29
Net impact (B+C+D)	-1145.37	-2514.93	-3939.53	-1877.97	-4003.29	-3857.39
Net impact (B+C+D) in %	-3.88	-3.86	-2.23	-6.36	-6.14	-2.19
Net impact (B+C+E)	-1215.04	-2799.42	-4865.62	-2040.55	-4667.10	-6018.26
Net impact (B+C+E) in %	-4.12	-4.29	-2.76	-6.91	-7.16	-3.41
Net impact (B+C+F)	-1168.59	-2609.76	-4248.23	-1932.17	-4224.56	-4577.68
Net impact (B+C+F) in %	-3.96	-4.00	-2.41	-6.55	-6.48	-2.60

Source: (*) ENEP Model.

Next we examine the welfare impact of flexible exchange rate by rural and urban areas. As expected, the impact is dissimilar and presented in Table 4. The welfare impact of adopting a market-based exchange rate regime on rural areas is significantly larger under both scenarios. This is due to the relatively low income of rural households compared with the higher impact on urban household due to the high consumption spending especially on imported products. The net welfare impact normalised by the remittances is significantly larger for urban households and in terms of magnitude when the upper bound scenario was considered.

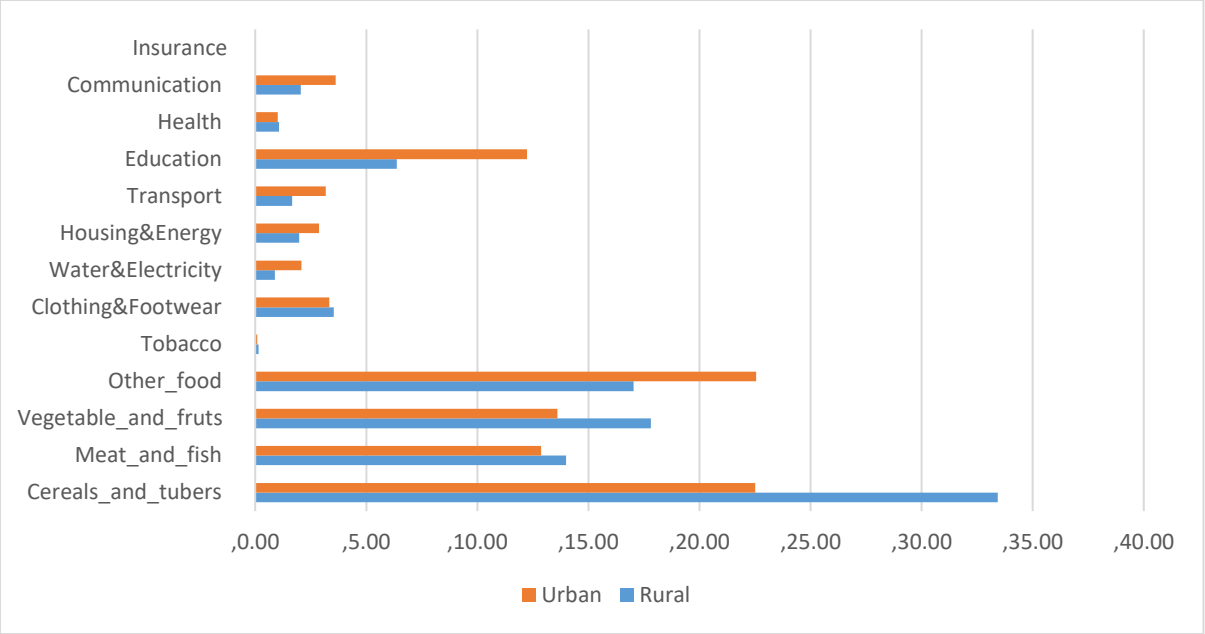
Table 4: Welfare effect by rural and urban areas (naira)

Variable	30%			50%		
	Rural	Urban	Average	Rural	Urban	Average
A- Per capita	67,591.58	108,402.16	82,369.14	67,591.58	108,402.16	82,369.14
B- Impact by imports	-2,875.41	-4,888.48	-3,604.34	-4,792.33	-8,147.44	-6,007.22
C- Impact by remittances	151.02	1,788.38	744.22	352.39	4,172.88	1,736.52
D- Impact by exports (EXEP)	176.75	429.28	268.24	412.41	1,001.66	625.89
E- Impact by exports (elas.= -0.5)*	-88.37	-214.64	-134.12	-206.20	-500.83	-312.95
F- Impact by exports (elas.= -1.0)*	88.37	214.64	134.12	206.20	500.83	312.95
Net impact (B+C+D+G)	-2,547.64	-2,670.81	-2,591.88	-4,027.54	-2,972.90	-3,644.80
Net impact (B+C+D+G) in %	-3.77	-2.46	-3.15	-5.96	-2.74	-4.42
Net impact (B+C+E+G)	-2,812.76	-3,314.74	-2,994.24	-4,646.15	-4,475.39	-4,583.64
Net impact (B+C+E+G) in %	-4.16	-3.06	-3.64	-6.87	-4.13	-5.56
Net impact (B+C+F+G)	-2,636.01	-2,885.46	-2,726.00	-4,233.74	-3,473.73	-3,957.75
Net impact (B+C+F+G) in %	-3.90	-2.66	-3.31	-6.26	-3.20	-4.80

The household expenditure shares in rural and urban areas represented in Figure 5 helps in explaining the difference in welfare impact between the two areas. For instance, we see that rural households spend higher than urban households on food items while the share of urban spending on non-food items is relatively higher.

Poverty in Nigeria is estimated based on the national poverty line (N51,482.14). Table 5 shows that the impact of the flexible exchange rate regime is large in absolute terms in urban (N2,670.81) compared with the N2,547.64 decline recorded by rural. However, in relative terms, the welfare impact on rural is higher (3.77%) compared with the urban area's 2.46%. This will lead to a worsening of poverty and inequality levels as shown in Table 5. The high intensity of price changes for non-food items such as transport, energy products, clothing, etc. also contribute to the high welfare impact on urban compared with rural in absolute terms. This is explained by the spending pattern, and where expenditure on energy products and transportation are higher in high income urban households, as well as, the observed high non-food price increments, as shown in Table 1.

Figure 5: Expenditure shares by rural and urban areas



The exchange rate adjustment exerted a significant impact on poverty and inequality and this is presented in Table 5. Further inspection of the Table shows that a 30% downward adjustment of the exchange rate leads to a change in poverty from an initial level of 19% to about 21% while the 50% upper bound policy adjustment will increase poverty by 4 percentage points. The fall in household expenditure and per capita spending is explained by the eroded purchasing power in addition to the relatively low household expenditure that may have contributed to the worsening incidence of poverty.[10]

Concurrently, the increase in poverty also led to a worsening of the inequality gap as more middle income quintile households fell into the lower quintile. The 30% and 50% exchange rate policy scenarios considered led to an increase of about 1.5 and 1.4 percentage basis point of the Gini coefficient (measure of inequality), respectively. This tends to worsen the very low inequality index in Nigeria which stands at about 36.5%. The impact on inequality is quite small but the increase observed is explained by the relatively high impact on wellbeing of the poorer segment of the society. A puzzling observation at a first glance is the higher national inequality, relative to urban and rural inequalities (compare Table 5 with Tables 6 and 7). This is explained by the high "between" rural and urban inequality disparity not observed by the "within" rural and urban inequalities.

[10] The increase in poverty headcount and inequality after the simulations are traced to the negative welfare impact of constrained household spending on various commodities (See Table 12 and 13 in appendix).

Table 5: Impact of exchange rate adjustment on poverty and inequality

	30%	50%
Poverty rate		
A- Pre-simulation	19.385	19.385
B- Post-simulation	21.189	22.971
Inequality (Gini)		
A- Pre-simulation	36.541	36.541
B- Post-simulation	37.090	37.908

A further assessment of the impact of adopting flexible exchange rate adjustment on well-being by rural-urban as well as by regional dimension is presented in Tables 6, 7 and 8. The show that poverty is predominantly a rural phenomenon and relatively more pronounced in the northern region. Table 6 shows that the 30% policy scenario led to an increase in poverty by 2.39% while the upper bound scenario led to a 4.83% worsening of the poverty incidence.[11] Table 7 shows that the impact of the lower and upper bound exchange rate adjustment scenarios on urban households is relatively lesser for both measures of well-being. The reason for this difference is the lower initial poverty rate in the urban centres compared with the high poverty incidence in rural areas. Observably, initial inequality was almost the same for both rural and urban and thus, the aftershock impact was almost the same 34.49 (rural) and 34.3 (urban). In terms of the geopolitical zones, Table 8 reveals that poverty is higher in the Northern regions because the initial poverty headcount in the north almost quadruples the values recorded in the southern regions. Therefore, the impact of the exchange rate adjustment is relatively larger in the north under both scenarios.

Table 6: Impact on poverty and inequality in rural areas

	30%		50%	
	EXEP	ENEP (-1.5)	EXEP	ENEP (-1.5)
Poverty rate				
A- Initial state	26.72	26.72	26.72	26.72
B- After the impact of imports	29.27	29.27	31.73	31.73
C- After the impact of imports, exports and remittances	29.11	29.27	31.55	31.57
Inequality (Gini)				
A- Initial state	34.32	34.32	34.32	34.32
B- After the impact of imports	34.32	34.32	34.33	34.33
C- After the impact of imports, exports and remittances	34.49	34.47	34.78	34.7

[11] This may be traced to the high food expenditure share of the household which was significantly affected by the adjustment in addition to the low income in rural relative to urban households.

Table 7: Impact on poverty and inequality in urban areas

	30%		50%	
	EXEP	ENEP (-1.5)	EXEP	ENEP (-1.5)
Poverty rate				
A- Initial state	6.46	6.46	6.46	6.46
B- After the impact of imports	7.29	7.29	8.5	8.5
C- After the impact of imports, exports and remittances	7.24	7.24	7.86	8.42
Inequality (Gini)				
A- Initial state	33.37	33.37	33.37	33.37
B- After the impact of imports	33.32	33.32	33.3	33.3
C- After the impact of imports, exports and remittances	34.3	34.28	35.66	35.59

Table 8: Impact on poverty by geopolitical zones

	Initial Poverty	**Change in poverty**			
		30%		50%	
Geopolitical zones		EXEP	ENEP (-1.5)	EXEP	ENEP (-1.5)
North Central	23.17	1.96	1.96	3.55	3.55
North East	31.17	3.83	3.83	6	6
North West	32.14	2.46	2.63	5.49	6.13
South East	9.79	1.28	1.28	2.16	2.16
South-South	5.58	-0.1	0.27	2.04	2.04
South West	6.74	1.05	1.05	1.25	1.51

Figures 6 and 7 show the poverty impact of a targeted cash transfer programme where we assume a perfect targeting system. This is quite different from targeting the entire population since everyone is affected by the exchange rate adjustment. However, it is expected that the focus of government efforts in terms of mitigating the impact of the shocks will be on the most vulnerable groups. It is pertinent to note that the assumption of perfect targeting may not be realistic given the potential leakages in the system due to the unavailability of an existing targeting system that can efficiently target vulnerable households.

In terms of government response, Figure 6 shows that a cash transfer of about N2,069.96 per capita *targeted* at the lower income quintile will be enough to keep poverty unchanged consequent upon exchange rate adjustment. This is based on the change (increase) in poverty head count by about 2.7%; recording on average, an increase from about 35.9% to 38.5%. This implies that poverty remains dominant in the lower quintile, suggesting that targeting the low-income quintile affected by the reform would be sufficient to maintain poverty at the pre-adjustment level. Under the second

scenario of a 50% exchange rate adjustment the cash transfer required to keep poverty constant is higher due to the relatively larger magnitude of the change in poverty recorded consequent upon the upper bound adjustment. The findings suggest that any cash transfer programme that exceeds N3,413.70 will buffer the exchange rate adjustment induced shock given an initial poverty state of about 35.9%.

The Figures can also provide a useful planning guide for government in terms of the per capita transfers required to obtain a given poverty rate. For instance, Figure 6 shows that an increase in per capita government transfer by N3,000.00 will lead to a decline in the poverty headcount by about 1.5 percentage basis point while an increase in transfer to N4000.00 will lead to a decline in poverty by about 2.5%. A similar scenario is discernible from Figure 7.

Figure 6: Poverty impact of cash transfer to the lower quintile (Scenario 1: 30%)

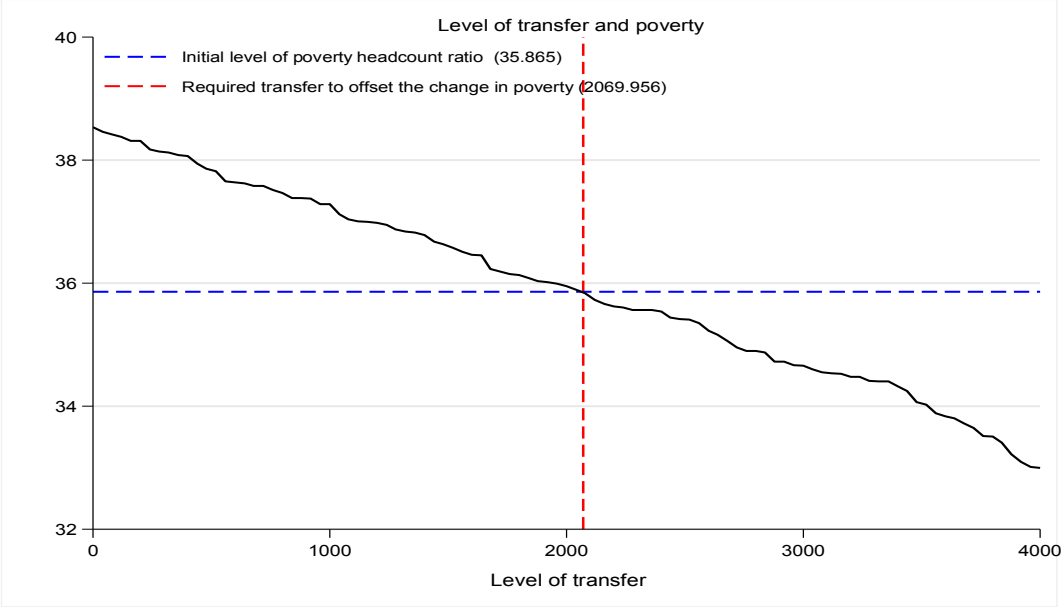
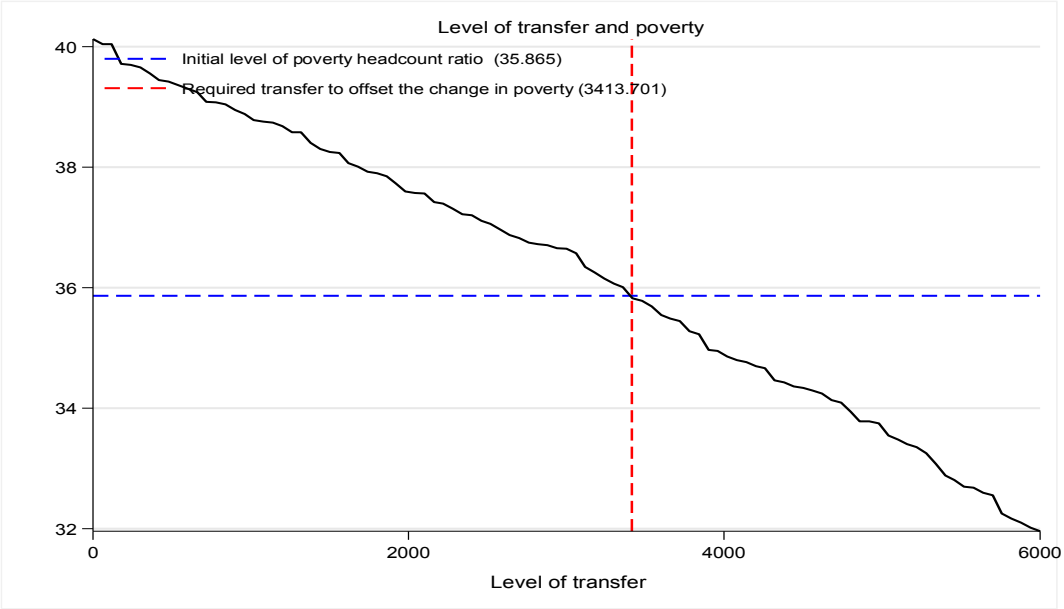


Figure 7: Poverty impact of cash transfer to the lower quintile (Scenario 2: 50%)



Notably, any kind of compensation in form of cash transfer programmes embarked upon by the government to mitigate the impact of the exchange rate adjustment will have an impact on its short term fiscal profile. In this case a review of the medium term expenditure framework may be required to account for the extra-budgetary expenditure. Table 11 shows that the universal transfer system will cost the government about N283 billion. This leads to a per capita cash transfer of about N2,069.95 for the exogenous price model while the lower and upper bound elasticity values of the endogenous price model fall within the range of N2,091.54 and N2,142.47. If we assume that government's targeting programme will focus mainly on the lower quintile, then the per capita cash transfer required will be around N2,162.01. These values should be viewed with caution as the prevailing macroeconomic fundamentals may dampen or even negate the efficacy of the intervention.

In the second scenario, where the exchange rate was adjusted downward by 50%, the equivalent cash transfer required to offset the increase in poverty is relatively higher. For instance, the poor would require between N3,763.02 to N4,144.42 to absorb the exchange rate adjustment shock through the expenditure channel. The relatively higher cash requirement is based on the high household losses due to constrained budgets and its consequent impact on household spending. In this case, the government's total absorption requirement will fall between approximately N500 to

N600 billion. These estimates are based on the post-flexible exchange rate regime poverty increase of 2.5% recorded.

Table 9: Equivalent transfers necessary to offset changes in poverty

	EXEP	ENEP (-0.5)	ENEP (-1.5)
Scenario_1: 30%			
Pre-flexible regime level of poverty	0.359	0.359	0.359
Post-flexible regime level of poverty	0.385	0.387	0.386
Change in headcount	0.027	0.029	0.027
Per capita transfer	2,069.956	2,142.471	2,091.538
Total budget of transfers (in millions)	328,956.542	340,480.539	332,386.272
Scenario_2: 50%			
Pre-flexible regime level of poverty	0.359	0.359	0.359
Post-=flexible regime level of poverty	0.401	0.406	0.402
Change in headcount	0.043	0.047	0.044
Per capita transfer	3,413.701	3,780.654	3,549.030
Total budget of transfers (in millions)	542,503.987	600,819.945	564,010.275

Another important impact of the currency adjustment is the effect on government budget should a decision to embark on compensation arise. In this case a significant short term fiscal expansion for a transfer programme of about 61% will be required should the exchange rate adjustment increase to 50% beyond the lower bound scenario (30%). This based on the percentage change in total budget transfers following an increase in the exchange rate adjustment (second scenario). However, in the case of the endogenous price (ENEP) models, an estimated 56% and 58% budgetary expansion towards a cash transfer will be required to buffer the shock on the most vulnerable groups.

It was also observed that targeted transfers to the poor are relatively smaller than transfers targeted at the entire population. This is because government spending to mitigate the impact of a shock to the relatively higher income households is larger than the income buffer required to protect vulnerable household groups.[12] Therefore, targeted transfers to mitigate the impact of exchange rate adjustment solely on the poor will constitute a relatively lower fiscal burden on the government than if they targeted the general population (See. Table 10).

[12] This is because the poor are less exposed to shocks that arise primarily through the consumption of imported commodities.

Table 10: Budget transfers to the poor and targeted group

	EXEP		ENEP (-0.5)		ENEP (-1.5)	
	Population	**Poor**	**Population**	**Poor**	**Population**	**Poor**
Scenario_1: 30%						
Per capita targeted group	2,069.96	829.34	2,142.47	866.22	2,091.54	837.99
Total budget of transfers (in millions)	328,956.54	131,798.56	340,480.54	137,659.74	332,386.27	133,172.70
Scenario_2: 50%						
Per capita targeted group	3,413.70	1,507.68	3,780.65	1,660.49	3,549.03	1,554.60
Total budget of transfers (in millions)	542,503.99	239,599.82	600,819.95	263,883.98	564,010.28	247,055.79

The effect of household well-being through spending on various commodities are reported in Table 12 and 13 in the appendix. It shows that the household effect of a currency depreciation negatively affects spending on cereals and tubers with the magnitude of the effect ascending from the lowest to the highest quintile, recording an average impact of 0.86% while other food items recorded a significant fall of 1.01%. This is not surprising since low and middle income households in Nigeria tend to spend more on food items compared with their high income counterparts. Other commodities with a similar spending effects are education, transport and communication as well as clothing and footwear. The welfare effect of exchange rate adjustment through expenditure on non-food items such as transportation, communication, and insurance have relatively larger impacts for the higher income quintile.

Interestingly, the upper bound policy adjustment scenario exhibits a similar pattern but with markedly higher magnitudes across commodities. While spending on cereals and tubers exert a significant negative impact on well-being recording a 0.86% decline, other foods fell by 1.01%. Likewise transport and education fell by approximately 0.50% whereas clothing and footwear increased by 0.44%. Again the dominance of the food component for the lower quintile and non-food components for the higher quintile is apparent. An important impact of the upper bound scenario is the substantial decline in aggregate education spending especially for the higher income quintile.[13]

[13] This may be attributed to the fact that the higher quintile requires a significant amount of foreign exchange to finance the education of their wards abroad (payment of tuition and upkeep). The depreciation makes it difficult to keep up with this component of spending.

3.4 Robustness Checks

The depreciation that arises due the adoption of flexible exchange rate was estimated to be between 30% and 50% (lower and upper bound values, respectively). The values are based on actual increase in the naira vis-a-vis the US dollar. An important observation is that further increments of the upper bound scenario will exacerbate the impact of the adjustment on welfare while a reduction of the simulation value below the lower bound will tend to underestimate the impact of the flexible exchange rate policy simulations on households.

Several alternative assumptions to test the robustness of the results were conducted. First we use the endogenous and exogenous price assumptions in the model and observed that the effect of exchange rate simulations in terms of the sign of the estimated household impact coefficients did not change in terms of the negative sign recorded but increased marginally in terms of magnitude. Notably, the impact of the endogenous price model was relatively larger in all the policy scenarios considered.

Second, we use upper and lower bound elasticity values of -0.5 and -1.5 based on estimated elasticity values for Nigeria. Specifically, the magnitude of the price decrease was relatively larger using the upper bound elasticity value of -0.5 compared with the lower bound elasticity of -1.5. The results are robust based on the endogenous price model as the results were not significantly different when the elasticity value was almost doubled. For the exogenous price model, the upper bound 50% exchange rate adjustment led to a significantly larger increase in the welfare effect of the lower (Q1) and middle (Q3) quintiles, recording 6.36% and 6.14%, respectively. The results from changing the elasticity values in the endogenous price model support the finding from the exogenous price assumption.

In sum, our findings are robust in terms of the lower and upper bound elasticity values as well as with respect to the endogenous and exogenous price assumptions used. In terms of the exchange rate adjustment scenarios considered, it was observed that further reduction of the lower bound benchmark scenario (<30) will reduce the impact of the adjustment while an increase of the upper bound scenario (>50) will worsen the welfare impact of exchange rate adjustment on households.

4. Social Security Programmes in Nigeria and International Experiences

4.1 General social transfers to support the poor

Apart from the Nigerian government's hesitation to end subsidy regime, also well-known is their welfare intentions to *improve the lot of Nigeria's poor* through social transfer programmes such as free feeding programmes for school children, and cash transfers to unemployed graduates (500,000 of which would be employed as school teachers across the country) in spite of growing doubts on the availability of resources to fund such interventions.

Nigeria has two historical examples of social transfer schemes that were meant to enhance the welfare of the citizens, especially the *poor*:

(a.) the Federal Government supplied 'Essential Commodities' in 1984, by rationing selected food items and toiletries at highly subsidised prices; and

(b.) the Federal Government has also implemented a National Poverty Eradication Programme (NAPEP) since 2001, training youths in vocational trades, supporting internship and micro-credit, creating employment, and helping VVF patients; even though the beneficiaries of both schemes have included the non-poor. It is unclear if the current government wants to continue with NAPEP or create a new agency.

Barrientos (2010) provide a discussion of general social protection policies, while Barrientos, Niño-Zarazúa and Maitrot (2010) provide a database of general social assistance across countries.

i. Specific Social Transfers to Protect the Poor

The sudden adoption of a flexible exchange rate system and subsidy removal made the poor poorer and middle income households worse off as more people have been pushed below the poverty line. This underscores the urgent need for immediate targeted social transfers to protect the poor from the losses inflicted by a depreciation of the currency. Perhaps this may be pursued by using some of the government revenue gains from the depreciation to fund such transfer programmes.

Nigeria also has two previous policy schemes that were meant to compensate the populace for welfare losses from market determined exchange rate, especially, the new poor:

(a.) in 1989, SAP-Relief Package made cash transfers to junior government employees for only six months to cushion the adverse welfare effects of exchange rate flexibility and commercialization on the populace; and,

(b.) from 1994, the Petroleum Trust Fund (PTF) gave back part of the savings from 'appropriate pricing of petroleum products' to the populace through road projects, education support and medical supplies. The beneficiaries of the PTF also included the non-poor. PTF was scrapped shortly after the return to democratic rule in 1999, as it was largely perceived as duplicating the functions of regular government ministries and agencies. (See Ahmad, 1991; Casero and Seshan, 2006; Friedman and Levinsohn, 2002; Habib, Narayan, Olivieri, and Sanchez-Paramo, 2010; Glewwe and Hall, 1998; IMF, 2016; who have all analysed specific policy responses to the adverse distributive effects of economic shocks).

4.2. Protecting the poor from adverse policy shocks

This subsection draws on McCord (2013), which provides a lucid discussion of the motives and measures for social protection in times of adverse economic shocks and in tranquil times (See also OECD, 2009 and Ferreira, Prennushi and Ravallion, 2000)).

To mitigate the negative effects of income losses, targeted transfers of cash or food would be provided to specific sub-groups of the poor. The range of objectives that can be addressed through targeted compensations for income loss may include a, b, or c below, or any combination of the three:

a. *Social stabilisation*: consumption smoothing to ensure social cohesion
    1. a mechanism to address the needs of the poorest people
    2. a mechanism to compensate for increases in poverty as a result of shocks
    3. a temporary safety net to support those falling into poverty as the result of a shock
b. *Economic stabilisation*: Protecting demand (automatic stabilisers)
    - a mechanism to protect aggregate demand to stimulate economic activity
c. *Political stabilisation*: Defusing popular dissent
    - a mechanism to promote political stability by quelling latent social unrest while, potentially, promoting government legitimacy

These issues however provoke tension in terms of 'who is the most vulnerable?', 'whose vulnerability is most important', and whether vulnerability should be measured in terms of absolute or relative deterioration. Programmes could also be designed to meet the needs of groups who are objectively 'less vulnerable' but subjectively more important in terms of government support, given their potential role as political 'spoilers' or agents of civil unrest, most notably urban youth.

Government must also ensure that fiscal adjustment protects the items of spending most important for the poor. Fiscal policies that protect spending on basic education and health can prevent cuts in services which the poor use, and protect their ability to build up human capital. In education, expenditures on primary schools, and on non-salary items, which are essential for quality, should be maintained; targeted subsidies to reduce school drop-out rates among the poor (for example, feeding programs or scholarships tied to attendance) should also be increased.

In health, spending for activities with high externalities, such as vaccinations and vector control, as well as spending for health care provision at the lower levels of the health system should be maintained. Beyond health and education, other public investments that affect the productivity of the poor most notably, investments in infrastructure, sanitation, and the provision of microfinance should also be protected (Ferreira, Prennushi, and Ravallion, 2000).

4.3 Lessons from Other Countries

Indonesia[14]

Over the past decade, the Indonesian government has increased the price of fuel on several occasions. At every increase, a range of compensation programs targeted the poorer segments of the population to help them cope with the adverse effects by introducing a number of poverty alleviation programs. Although far from perfect, the programs represent the building blocks of a comprehensive social welfare system.

The Indonesian government's strategy to achieve its target led to a division of its poverty reduction programs into three clusters, based on the major group targeted by each one (TNP2K, 2011):

i. Cluster 1: *Programs targeting households*. This cluster consists of several social assistance programs such as rice subsidy; conditional cash transfer; educational assistance for poor students; and subsidized health care.
ii. Cluster 2: *Programs targeting communities*. Consists of several community-driven development programs.
iii. Cluster 3: *Programs targeting micro, small- and medium-sized enterprise (MSME)*. The government is offering a guarantee scheme for bank credit.

[14] Perdana (2014).

Indonesia's experiences show strong two-way linkage between energy subsidies and social welfare policy reforms. To start with, energy subsidy reform—reducing subsidies and increasing domestic prices—has created the need to deliver compensation programs. The government is under pressure to show that price increments will not unfairly hurt the poor. In practice, the resulting welfare programs have created real change: the government has used fuel subsidy cuts and the associated mitigation policies as instruments to reduce inequality, ensuring a more progressive distribution of benefits concentrated on the poor.

Jordan[15]

Electricity tariff reform in Jordan has been implemented in a socially acceptable way. All poor households were exempted from the tariff increase implemented in mid-August 2013, and the increases in January 2014 and January 2015 affected only wealthier households. Access to finance for small and medium-sized enterprises and low-income individuals is being improved. Cash transfers were introduced in November 2012 to mitigate the social impact of the removal of general fuel subsidies. These transfers, which are paid when the oil prices exceed $100 per barrel, amount to about US$100 per person per year; they are capped at a maximum of six family members. Initially, all families with an annual income below JD 10,000 (US$14,700) (70 percent of the population) were eligible for the transfers, but eligibility criteria were extended to include assets (land, car and real estate ownership), in order to better target the poor segments of the population.

Brazil[16]

Brazil experienced a sharp, but relatively short-lived recession. As part of an overall national stimulus package, the Brazilian government increased the value of cash benefits paid by 10% under the country's conditional cash transfer, *the Bolsa Familia*, a high profile programme reaching around 44 million low-income people. The programme received 1.5% from the Brazilian stimulus package. The explicit aim of the increase was to enable poor households to better cope with the additional hardship engendered by the crisis. Moreover, the eligibility criteria for the programme were relaxed. Eligibility for benefits was increased from a monthly income of US$ 71 to US$ 82. This resulted in the programme covering an additional 1.8 million families so that today 12. 8 million families are now covered.

[15] IMF (2016).
[16] See Box 2 pp 17 in McCord (2013).

According to a study by the International Policy Centre for Inclusive Growth (Soares, 2009), the transfer lessened the impact of the crisis in a number of ways, demonstrating how social security can fulfil its role as an economic and social buffer during crisis periods. These effects include: (a.) Generating reliable income flows, sustained household consumption levels and avoiding a decline in overall economic activity; (b.) Reducing negative impacts of the crisis on the nutrition intake of children; (c.) Maintaining school attendance and keeping children out of the workforce; and, (d.) Potentially reducing the risks of increased levels of informal employment. The existence of this important programme in Brazil prior to the crisis, and its subsequent expansion during the crisis, might help explain why Brazil is thought to have coped well with the crisis. Clearly, having the institutional framework and capacity to ratchet up coverage and adequacy facilitates effective crisis responses when and where required.

5. Conclusion and Policy Considerations

This study examined the impact of adopting a flexible exchange rate regime on various segments of the population in Nigeria. Empirical findings show that a 30 percent downward adjustment of the exchange rate leads to an increase in poverty by 2 percentage points and by 4 percentage points, following a 50 percent upper band exchange rate adjustment. This estimation was based on the N51,482.14 national poverty line. This suggests that government may consider augmenting its proposed conditional cash transfer programme by about N3,500.00 monthly in order to help the poor segments absorb the impact of flexible exchange rate regime over the short to medium term. This would require a phased budget transfer of about N564 billion.

The sudden adjustment of the exchange rate without any safety cushion nets resulted in an increase in poverty and inequality; with the impact being more pronounced on middle and high income households. The study provides important information regarding various product categories with a view to reducing the negative price impact on households. For instance, import duties may be reduced for essential consumable products and intermediates based on their importance or consumption share for households and producers. Such an incentive will help importers offset the huge import bill imposed by the adjustment, thereby reducing the pressure on final consumer prices.

The recent downward trend in food and commodity prices based on data from the National Bureau of Statistics remains a daunting challenge given the fact that several factors have contributed. This puts the government and household budgets under pressure, thereby tightening governments' policy space and constrains household purchasing power especially during an economic slowdown. These price increases affect the poor and vulnerable household primarily through food and this underscores the need for an efficient and inclusive social protection system.

The review of international experiences provides important lessons for Nigeria regarding policy reforms and development of palliative measures. First, the use of clusters, targeting households and communities is particularly important. Second, engaging the public through public enlightenment programmes with respect to the policy reform will help mitigate the possibility of social tensions and civil unrest given the unfavourable socioeconomic conditions in the country. Third, in view of the expected high fiscal burden of the proposed cash transfer on government *vis-a-vis* dwindling oil revenue, the programme may consider households with annual incomes below N10,000.00 as eligible beneficiaries to better target the poor. It is pertinent to note that an important limitation of the cash transfer programme is the method or sequence of targeting households; and this may be overcome by developing a broad-based clustering system that ensures the operational feasibility of the entire programme to avoid substantial waste of resources.

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Technical Appendix

A1. Literature Review

Exchange rate is the price of one currency in terms of another and is traded in a foreign exchange market. The participants in this market are commercial banks, foreign exchange brokers, authorised dealers and the central bank. There are different foreign exchange markets (country and global level). The speed at which information is transferred between markets provides opportunity for arbitrage between foreign exchange centres and currencies. There is an extensive theoretical literature on the determinants of the extent of floating exchange rate and its behaviour over time. In the Keynesian model where prices are assumed to be fixed, exchange rate will be driven primarily by current account depending on the assumption of capital mobility. This implies that the Marshall-Lerner condition has to be satisfied if the floating exchange rate is to be stable.[17] A variant of this proposition is the introduction of capital mobility in line with the Mundell-Fleming model.[18] The trade-offs of fiscal and monetary policies vis a vis the exchange rate regime results in the so-called macroeconomic trilemma. The underlying notion of the trilemma is that policy makers have to make a choice of two out of the three goals: (i) monetary independence; (ii) fixed exchange rate; and (iii) free movement of international capital.

The purchasing power parity (PPP) has been relied upon as a model of exchange rate determination as well as a crucial element of the monetary model. The model relies on the assumption that perfect arbitrage exists under perfect market conditions in the absence of trade restrictions. This ensures that the price of a commodity is converted through the exchange rate will result in the same price in the two countries. This is referred to as the law of one price. The monetary model of floating exchange rate determination underscore the role of demand and supply of money. In addition to the assumption of flexible prices (full employment) and substitutability among a range of assets, the model emphasizes the role of expectations. The fundamental result of the model is the uncovered interest parity condition which asserts that if the exchange rate is expected to depreciate then the interest rate between two countries must be equal to the expected rate of depreciation or appreciation. The monetary model of exchange rate determination focuses on long run relationship. Dornbusch (1976) proposes the "sticky price" which accounts for short and long run dynamics. The model assumes that commodity prices and wages adjust slowly to changes in excess demand/supply (with PPP holding only in the long run), and that capital markets are efficient, being in continuous equilibrium with the rate of interest adjusting instantaneously.

Economic theory shows that a situation where a country's' currency is trading at a premium of about 100 percent has adverse implications for an economy in terms of balance of payment adjustment process and income distribution (Pauw et al. 2013). This in turn creates arbitrage opportunities which fuels speculative activities. A currency devaluation is used to correct external imbalances of countries and their impact are contemporaneous because their effects manifest during the first few months after the policy change (Thirwall, 1992). Although the adoption of floating exchange rate

[17] The Marshall-Lerner condition is the criterion for a devaluation to reduce the balance of deficit and this requires that the sum of import demand and foreign export demand elasticity should exceed unity assuming infinite supply elasticity. It is only when this condition is satisfied that a devaluation will improve the balance on goods and services. The exchange rate will have a normal effect on the balance of payment if this condition is satisfied, that is, a depreciation of the currency will eliminate the deficit while an appreciation will eliminate the surplus to restore equilibrium.

[18] The Mundell-Fleming model is concerned with the effectiveness of fiscal and monetary towards attaining internal and external balance. It is based on the IS-LM-BP analysis.

regimes by high-income countries may change their trade dynamics, most developing countries retain elements of fixed regimes, and have to confront, with seemingly increasing frequency, the dilemmas that arise from large balance of payment deficits (Twomey, 1983, p. 804). The magnitude of the impact of exchange rate adjustments to a large extent depends on the value of trade elasticities. While Hussein and Thirwall (1984) opine that the elasticity of export supply may be very low (perhaps due to structural rigidities and factor immobility), import and domestic price elasticity may be quite high to the extent that the profitability of exports remains largely unchanged. Thirwall (1992) suggests that when the price elasticity of demand for exports is large but finite and real wages are sticky downwards, devaluation might be a second best policy compared to structural interventions to raise foreign exchange earnings.

There is a plethora of policy papers and research articles on exchange rate determination and its impact on various macroeconomic aggregates. Although, the impact of exchange rate adjustment on household welfare in Nigeria has occupied the centre stage of academic and policy debate, empirical probe of this issue remains scanty. The literature for Nigeria is primarily dominated by studies that link exchange rate movement and its volatility to other variables using partial equilibrium models (See, Obadan, 2006; Mordi, 2006; Okpara and Odionye, 2012; Nwude, 2012; Olugbenga, 2012; Zubair, 2013; Salisu and Oloko, 2015; and Abubakar, 2016). An important observation from these studies is the crucial role of exchange rate to the macro economy and importantly, international crude oil prices given the monoculture nature of the economy. Exchange rate is an important variable that influences the economy and regulates international trade. This is because it converts foreign prices of imports into the domestic currency of a country (Siddig, 2011, p. 3). Thus the exchange rate determines the extent to which that an economy trades with the rest of the world.

Mishra and Spilimbergo (2011) use data for 66 countries over the period 1981-2005 to analyse exchange rate pass-through to domestic wages; taking into cognisance the extent of integration between domestic and foreign labour markets. Findings show that the elasticity of domestic wages to real exchange rate is less for countries that restrict external mobility of labour compared with countries with lower restrictions. In addition, the result reveals a positive and significant relationship between exchange rate movement, emigration and remittances. Mahran (1987) observe that exchange rate devaluation in Sudan not only fails to induce an increase in exports, but tends to increase domestic prices as well as production costs. This portends a negative impact on household welfare due to the negative impact on households' budget. This is evident through job losses due to readjustments of exporting firms to foreign exchange market conditions. Similarly, Eldaw (1992) finds that exchange rate devaluation had a negative impact on agricultural produce such as cotton, groundnut, cotton, wheat and sorghum in Sudan. The failure of the devaluation to prompt the expected export competitiveness is that the exchange rate adjustment increases domestic production costs as well as general prices of goods and services (See Mahran, 1987). Devereux, Engel and Tille (2003) explore the effect of the European single currency and find that the adoption of the euro insulates the prices in the Euro zone from exchange rate volatility. Burstein, Eichenbaum and Rebelo (2007) assess exchange rate pass-through following large devaluations in UK (1992), Korea (1997) and Uruguay (2002). Their results suggest that exchange rate pass through to domestic prices is significant given the role of sticky non-tradable goods prices in explaining post-devaluation real exchange rate movements.

Another strand of literature focus on the use of general equilibrium analysis. The study by Acharya (2010) use a computable general equilibrium (CGE) model to analyse the impacts of devaluation on growth, distribution, prices and other selected macroeconomic indicators in Nepal. The study

reveals that devaluation led to uneven income distribution with the high income quintile being the major beneficiaries. Also, an expansion of economic activities was observed especially in agriculture and manufacturing sectors while the service sector recorded a contraction. The author also reports that currency adjustment in Nepal led to an improvement in the saving-investment and export-import ratios but worsened the budget deficit. Similarly, using a general equilibrium model, Siddig (2011) found that devaluation leads to an increase in domestic prices which in turn negatively affects household demand.[19]

Applying a general equilibrium model that incorporates household survey data, Kojo and Ivaschenko (2007) investigate the welfare effect of a currency devaluation in Seychelles. Findings indicate that poverty headcount increases immediately after devaluation. In terms of per capita expenditure, the relative loss is larger for the high income quintile, thus causing a slight decrease in inequality. To mitigate the transitory adverse effects on the most vulnerable people, strengthening of social safety nets through increased transfers to poor households was found to be effective. Predicated on an economy-wide model for the Malawian economy, Pauw, Dorosh and Mazunda (2013) conduct simulations in order to ascertain the responsiveness of the economy responds to exchange rate shocks under fixed and flexible exchange rate regimes. They observe that the economy responds better to foreign exchange rate crisis under flexible exchange rate regimes.[20]

Al-Abri (2014) evaluate the choice of exchange regime for a small open oil exporting country using a general equilibrium model. The results indicate that flexible regimes can reduce the effects of external shocks and consumption volatility if foreign producers set their prices in local currencies. They conclude that flexible exchange rate can may lead to welfare improvement if accompanied by substantial financial and institutional reforms.[21] This means improved and easier access to credit by financial institutions is worthy of note while reform geared towards improving access to requisite social services should be pursued. Kamdil and Mirzaie (2003) investigate the effect of exchange rate fluctuations on output and prices using a sample of 33 developing countries. The results show that anticipated shift in exchange rate have a limited impact on output growth and price while the unanticipated component exerts both positive and negative effect on output and price. Burstein, Eichenbaum, and Rebelo (2005) examine the impact of a large devaluation on inflation in Korea, Uruguay and United Kingdom. The study reveals that the low rates of inflation as a result of large devaluation is caused by the slow adjustment in price of non-tradable goods and services and not the adjustment in import and export prices.

Casero and Seshan (2006) rely on macroeconomic and household level data to analyse the impact of devaluation on saving, real public sector wages, real income and poverty in Djibouti. They observe that a devaluation generates fiscal savings in the short run but has an adverse impact on poverty and income distribution. In other words, a 30 percent devaluation will increase savings by 3-7 percent of GDP after taking into account social transfers schemes for vulnerable groups whereas a fifth of the poor will fall below the extreme poverty line. A fifth of upper middle income households will fall below the national poverty line. Kraay (2007) examine the consequence of large currency depreciation on welfare in Egypt between 2000 and 2005 using regression analysis. The study found

[19] The findings also show that devaluation may increase income but not to the extent that it dampens the negative price effect on households.

[20] The results show that the growth of GDP, although negative, is 1.5 percentage point higher than under fixed exchange rate policy regime while poverty is 6.9 percentage point lower.

[21] The analysis also suggests that a basket peg improves welfare more than a unilateral peg to a single currency, as higher volatility of the anchor currency reduces consumer welfare.

that average welfare loss due to exchange rate-induced price increases is about 7.4 percent of initial expenditure. The exchange rate pass-through effect was relatively higher for food items.

Cravino and Levchenko (2015) examine the effect of the 1994 currency devaluation on income distribution in Mexico and found large distributional impact. Specifically, inflation of the consumption basket of those in the bottom decile was between 32-39% higher than for the high income decile. A study on the implication of Russian currency devaluation during 2014-2015 on macroeconomic fundamentals by Mironov (2015) shows that declining oil prices led to a reduction in domestic demand and lowered real exchange rate. This enhanced the competitiveness of Russian products and stimulated the supply side of the economy.[22] Rhodd (1993) examined the effect of real exchange rate changes on output with particular attention on Jamaica's devaluation episodes. The study found that devaluation had a contractionary effect in the short-run but expansionary in the long-run.

Faleiros, da Silva and Nakaguma (2016) assess the effect of exchange rate and labour productivity on the competitiveness of Brazilian manufacturing sector using a panel data set of 17 manufacturing firms in Brazil between 1996 and 2011. The study revealed that the impact of labour productivity on import penetration is greater than that of exchange rate. Considering the Indian economy, Dhasmana (2015) explores the impact of real exchange rate changes on the performance of Indian manufacturing firms over the period 2000-2012. The study revealed that industry-specific real exchange rate movements exert a significant impact on firm performance and that the effect varies across heterogeneous firms and industries. Prakash and Maiti (2016) investigate the effectiveness of a devaluation on trade balance in Fiji using vector error correction model and observe that devaluation of the currency led to an increase in inflation and weakened aggregate demand in the short run.[23]

Another strand of literature is based on group of country studies (See. Devereux, 2006; Rodriguez, 2016; Daude et al. 2016; Chowdhury et al., 2016). A general observation from these studies is the focus on trying to ascertain the factors that influence the exchange rate regime, the extent of integration and impact of external shocks as well as price flexibility an impact on domestic prices and aggregate demand. These studies underscore the importance of strong institutions, flexible exchange rate regimes as well as the need to build adequate buffers to mitigate the impact of external shocks.

Despite agitations over the purported negative impact of exchange rate adjustment on real wages and income distribution in developing countries, attempts at conducting rigorous studies with a view to informing policy decisions in Nigeria is scarce. This study contributes to two strands of established literatures. First is those related to exchange rate pass through and second the literature that focuses on household data to assess the welfare impact of price changes induced by macroeconomic shocks. In addition to the use of a modified version of the relatively new World Bank Subsidy Simulation (SUBSIM) tool developed by Araar and Verme (2012), the study considers the macro-micro transmission of the economy wide effects of a devaluation through the use of a social accounting matrix and household budget survey to assess the effect of a devaluation with a

[22]This creates the possibility of offsetting the decline in domestic demand through increased net exports.

[23] This implies that the J-curve phenomenon does not hold in Fiji. They conclude that devaluation in a small import-dependent economy like Fiji is not a permanent remedy to severe crisis and external shocks.

view to analysing the impact on households and proposing safety nets to mitigate the impacts over the short to medium term.

A2. Analytical Framework and Transmission Channel

A2.1. Analytical Foundation

The debate on appropriate exchange rate policy in developing countries has over the years occupied the centre stage in academic and policy circles. The rationale for an adjustment (or devaluation) of the exchange rate is to avoid foreign currency reserve shortage that can arise from inconsistency between the fixed exchange rate regime and the country's monetary policy (See, Obstfeld and Rogoff, 1996). An important response to foreign exchange deficit and/or aversion to deplete foreign exchange reserves is to devalue the currency. This triggers a fall in domestic demand for imported products as the price rises in domestic currency terms, and concomitantly, export earnings increase as the demand for competitively priced exports rise.
A devaluation of the domestic currency stimulates economic activities through the increase in the price of foreign relative to domestic products. It is expected that the demand for and supply of foreign exchange will return to equilibrium if the devaluation is sufficient (Pauw, Dorosh and Mazunda, 2013). This magnifies the exchange rate pass-through to inflation, especially in an import dependent economy like Nigeria where import is inelastic due to unavailable domestic substitutes.

An increase in the international competitiveness of domestic industries induced by a devaluation of the domestic currency tends to divert spending from foreign to domestic goods (Kandil and Mirzaie, 2003). Although the devaluation will make exports more competitive and appear cheaper to foreigners, the exchange rate adjustment may increase the cost of production the increase in price of imported intermediate inputs. The magnitude of the impact may however be driven by the exchange rate regime. Under a fixed exchange rate regime, excess demand for foreign exchange increases its sale at a premium in the parallel market thereby widening the gap with the official rate. Thus, foreign exchange deficit may arise from negative export earning shocks and this is exacerbated by a narrow export base. Under such circumstance, the monetary authority rations the supply of foreign exchange by providing access only for essential imports. The impact of a devaluation can be analysed through the direct impact on households, and indirectly through firms and government. The focus of this study is on the household impact.

A2.2 Household and Welfare Change

The distributional impact of an exchange rate adjustment is predicated on the expenditure function expressed as a function of prices and quantities**.** The effect of an exchange rate adjustment is captured by the proportional change in welfare consequent upon a change in household spending and the vector of prices. This is represented by the following;

$$e = p_1 q_1 + p_2 q_2 \quad (1)$$

$$e = p_1' q_1' + p_2' q_2' \quad (2)$$

Where e is monetary spending, p is price and q is quantities. The subscripts are used to represent the post adjustment values. The subscript 1 denotes the products affected by the adjustment while the second subscript represents all other products. The expenditure function is a veritable tool for money metric measurement of wellbeing. This means that the change in welfare due to an increase price is a function of the change in consumed quantities.

When prices are normalised at consumer equilibrium, the last consumed unit of products consumed will generate the same level of utility. Given the assumption of marginal price changes, the consumer can select any combination of product quantities ($q_1' q_1'$), but the decrease in wellbeing remains unchanged. Based on this assumption, the welfare impact can be assessed in the case where the change in quantities concerns the first good and this is expressed as;

$$\Delta w = \Delta q_1 = -q_1 dp_1 \quad (3)^{24}$$

Where *dp* represents the relative price change ($\Delta p_1 / p_1$). It is pertinent to note that this formula is applicable to any household behavioural response including changes in quantities consumed due to the exchange rate adjustment.

In a case where multiple product prices are considered, the welfare equation is modified as follows;

$$\Delta w_h = -\sum_{b=1}^{B} e_{1,h,b}\, dp_1 \quad (4)$$

Where b represents the blocks and h is households. The sum across households represents the total change in welfare.

A2.3 Changes in Quantities

The estimates of the changes in commodity consumed following the adjustment of the domestic currency is useful for analysing the impact of the reform. It also plays an important role in estimating the impact of the adjustment on government revenue given that it may decide to intervene in order to mitigate the impact of the adjustment on households. In order to estimate the change in quantities, an understanding of the demand function and price-quantity elasticity of the commodities is required. The model for estimating the changes in the quantities of the products affected by the devaluation is;

$$\Delta q_1 = q_1 dp_1 \varepsilon_1 \quad (5)$$

Where the own price elasticity ε_1 is typically negative and lies between 0 and -1 in developing countries like Nigeria. Moreover, this range conforms to the elasticities provided by Nwafor et al (2007) for Nigeria. Note that we assume households behave equally so that then total impact on quantities is the sum of changes in quantities consumed across all the households.

A2.4 Changes in Government Revenue

The assessment of the impact of exchange rate adjustment in terms of government revenue is computed using the following formula;

$$\Delta r = \sum_{h=1}^{H} e_{k,h} dp_k \,(1 - \varepsilon_k (s_k - dp_k)) \quad (6)$$

Where $\boldsymbol{s_k}$ is the unit exchange rate change impact on product k.

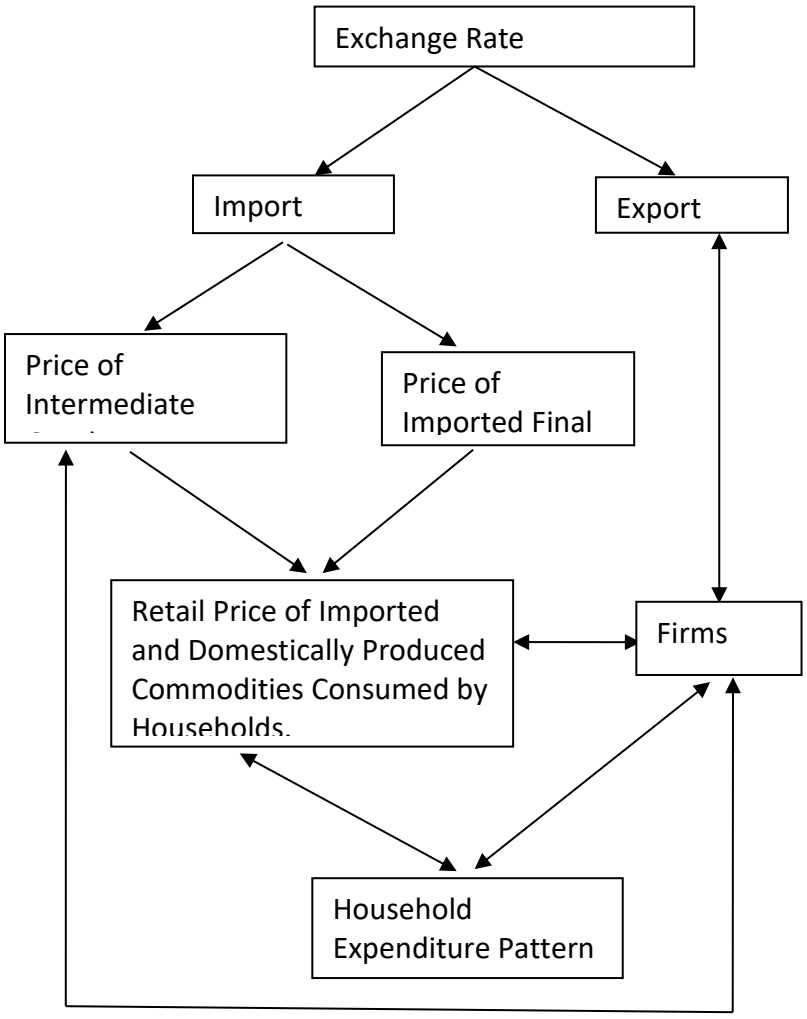
A2.5 Exposition of the Model

The estimated model captures the impact of an exchange rate devaluation through inflows and outflows of the social accounting matrix. The inflow component focuses on the change in cost of imported intermediate and final goods while the outflow component is concerned with the change in revenue of exports and household income. Specifically, the import component is the sum of two components: (i) the impact of the increase in the cost of intermediate imported goods. In this case, the impact on household wellbeing is measured through the increase in prices of final products generated by the increase in prices of intermediate products. (ii) The impact of the increase in cost

[24] Since prices are normalised, we can also write $\Delta w = -e_1 dp_1$

of final imported goods. In this case, the impact on household wellbeing is estimated through the increase in prices of final imported goods.
The export component is represented by changes in revenues of households working in sectors exporting goods and services. The impact on household wellbeing is therefore measured in terms of changes in household income. Schematically, the import and export price transmission mechanisms can be illustrated in Figure A1. Although there is a tendency for labour to shift from the informal and service sector to the tradable sector, we assume labour is immobile across sectors due to structural factors such low skilled manpower required in more formal sectors.

Figure B1: Import and export price transmission mechanism



A2.6 Transmission mechanism

The imports and exports effects are modelled separately and the total welfare effect is the sum of the two effects:

$$\Delta w_i(p, y_i) = \underbrace{\sum_{m=1}^{M} -x_{i,m} dp_m}_{Impact\ through\ imports} + \underbrace{dy_i}_{Impact\ through\ exports} \quad (7)$$

Equation 7 is the Laspeyeres index formula where Δw_i is the change in household welfare; $x_{i.m}$ is initial expenditure on product *m*, *M* is the total number of products; dp_m is the price change and *dy*

is the change in income. Therefore, the change in household income depends on the change in final prices generated by import prices (dp_m) and changes in final incomes generated by changes export revenues (dy_i). Further discussion of how price and income changes are generated through the import and export channels are highlighted.

A2.7 Import channel

The extent to which the prices of products consumed changes due to import price shocks is analysed using a Leontief price model and the disaggregated SAM. The Leontief price model can be expressed as follows:

$$p = (I - A_K)^{-1} M_{N-K} \quad (8)$$

Where A_k is the matrix of technical coefficients of the K endogenous sectors and M_{N-K} is that of the $(N - K)$ remaining exogenous accounts among which the capital, labor and import accounts are found. If we consider only an import shock, then the change in price is;

$$dp = (I - A_K)^{-1} dM_{IMP} \quad (9)$$

Where dM_{IMP} is the vector of change in values of imports. Thus, an exogenous currency adjustment is simulated through an increase in price of imports, which is applied to all sectors that import products. The share of imports of each sector is used to measure the price shock more precisely by multiplying these shares for the change in price. Alternatively, the change in import prices is applied uniformly to the whole import sector.

A2.8 Export channel (exogenous)

An important consideration in the modelling process is whether the export shock is exogenous or endogenous. It is *exogenous* if the exports of the country considered are not large enough on a global scale to affect world prices. In this case, the country is a world price taker and the global price of exported goods is not affected by the country adjusting its currency. It is *endogenous* if the exports of the country considered are large enough on a global scale to affect the world prices. In this case, the country is a world price contributor and the exchange rate adjustment contributes to reducing the global prices of the exported commodities and this, in turn, affects the country's income through exports. Thus, we assume that the income effect of the export shock is exogenous. This is the most suitable assumption for a developing economy like Nigeria that tends to have exports that are not large enough to affect world prices. This is referred to as the Exogenous Export Price model (EXEP).

It is assumed that the producer is paid by the equivalent amount in local currency for exported goods. For the exporter, the benefit through the local currency depreciation is explained by the increase in revenues in local currency for the same exported quantity. For each sector, we assume that the increase in benefit or in wages is relative to the intensity or the share of exports of the sector. Thus, two sources of information are relied upon. Starting from the SAM, we estimate the share of exports in each economic sectors, to be denoted by γ_k. The expected proportional change in income within the sector k is given a;

$$\vartheta_k = \gamma_k [e/(1 - e)] \quad (10)$$

where e denotes the percentage of currency devaluation. Once we have estimated the proportional increase in income within each sector (ϑ_k) based on the SAM, we apply a full transmission of this increase to the household sector via income and apply this income increase to all workers working in each export sector. Formally, the change in household income is given by;

$$dy_i = \sum_{z=1}^{Z_i} \sum_{k=1}^{K} \vartheta_k y_{i,z,k} \quad (11)$$

Where z denotes workers, k sectors, i households and Zi the number of workers in the household.

A2.9 The export channel (endogenous)

The second model is the Endogenous Export Price model (ENEP). In this case, $(\eta_k < 0)$ denotes the price elasticity of demand for export of good k while r_k represents the per dollar revenue of the exported good k.

$$r_k = 1 = p_k q_k \quad (12)$$

Since the prices are normalised to one at the initial period (before the currency devaluation), we find that:

$$\begin{aligned} dr_k &= (1 + \eta_k) dp_k \\ dr_k &= (1 + \eta_k)(-e) \end{aligned} \quad (13)$$

In the case of a currency devaluation ($e > 0$), the revenue in local currency increases if and only if $\eta_k < -1$ (high elastic demand on exports). If we denote the proportional change in revenue of sector k by $(\rho_k = \gamma_k dr_k)$, we can substitute ϑ_k by ρ_k in equation (11) to define the change in income of household i with the ENEP model as follows;

$$dy_i = \sum_{z=1}^{Z_i} \sum_{k=1}^{K} \rho_k y_{i,z,k} \quad (14)$$

The assumptions of the ENEP model conform with the J-curve effect of a devaluation over time (See, Scottand and Hatemi, 2004); but this approach is much less realistic for countries that do not export quantities large enough to affect world prices such as Nigeria. On the other hand, it is unlikely that nothing will happen to the exported quantities and this makes it imperative to model what happens to household incomes if quantities exported change. These elasticities, however, are by no means easy to estimate and depend on several factors including exogenous changes in global prices, availability of stocks, technological changes, productivity and the capacity to expand production or the willingness on the part of exporters to shift domestic to export sales. Estimations of elasticities can vary form values close to zero to values as high as -9, see for instance Scobie and Johnson (1979).

Table 11: SUBSIM analysis process summary

Phase/Action	***Step***	***Action***
A- Incidence Analysis	1	Product analysis
	2	Budget analysis
	3	Distributional incidence analysis
B- Price shock model	4	Identify the price shock(s)
	5	Define the assumptions
	6	Estimate elasticities
C- Impact analysis	7	Estimate household welfare changes
	8	Estimate budget changes
	9	Compare different scenarios

Source: Araar and Verme (2012, p. 9)

Table 12: Impact on well-being through expenditure (Scenario_1: 30%)

	Quintile_1	Quintile_2	Quintile_3	Quintile_4	Quintile_5	Total
Cereals & tubers	-1.19	-1.12	-0.98	-0.88	-0.68	-0.86
Meat & fish	-0.52	-0.61	-0.64	-0.64	-0.57	-0.60
Vegetable & fruits	-0.29	-0.26	-0.23	-0.20	-0.15	-0.20
Other food	-0.70	-0.81	-0.90	-0.99	-1.17	-1.01
Tobacco	-0.01	-0.02	-0.01	-0.02	-0.01	-0.01
Clothing & Footwear	-0.63	-0.55	-0.52	-0.44	-0.35	-0.44
Water & Electricity	-0.03	-0.03	-0.05	-0.05	-0.05	-0.04
Housing & Energy	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
Transport	-0.18	-0.24	-0.34	-0.40	-0.63	-0.46
Education	-0.34	-0.37	-0.43	-0.51	-0.70	-0.55
Health	-0.05	-0.06	-0.08	-0.08	-0.07	-0.07
Communication	-0.09	-0.10	-0.12	-0.13	-0.15	-0.13
Insurance	-0.00	-0.00	-0.00	-0.00	-0.01	-0.00
Total	-4.04	-4.19	-4.29	-4.33	-4.54	-4.38

Table 13: Impact on well-being through expenditure (Scenario_2: 50%)

	Quintile_1	Quintile_2	Quintile_3	Quintile_4	Quintile_5	Total
Cereals & tubers	-1.98	-1.87	-1.64	-1.46	-1.13	-1.43
Meat & fish	-0.87	-1.02	-1.06	-1.06	-0.94	-0.99
Vegetable & fruits	-0.49	-0.43	-0.39	-0.33	-0.25	-0.33
Other food	-1.16	-1.35	-1.50	-1.65	-1.96	-1.69
Tobacco	-0.02	-0.04	-0.02	-0.03	-0.01	-0.02
Clothing & Footwear	-1.05	-0.92	-0.86	-0.73	-0.59	-0.74
Water & Electricity	-0.05	-0.05	-0.08	-0.08	-0.08	-0.07
Housing & Energy	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Transport	-0.31	-0.41	-0.57	-0.67	-1.06	-0.76
Education	-0.57	-0.61	-0.71	-0.85	-1.16	-0.91
Health	-0.09	-0.10	-0.13	-0.13	-0.11	-0.12
Communication	-0.15	-0.17	-0.20	-0.21	-0.25	-0.22
Insurance	-0.00	-0.00	-0.00	-0.00	-0.01	-0.01
Total	-6.73	-6.98	-7.15	-7.22	-7.57	-7.29