ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

EXAMINING THE NEXUS BETWEEN AGRICULTURAL FINANCING REFORMS AND NIGERIA'S MACROECONOMIC PERFORMANCE: A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS (2012-2020)

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Abstract

This study conducted a computable general equilibrium analysis (2012-2020) to investigate the relationship between Nigeria's agriculture financing reforms and the country's overall macroeconomic performance. Specifically, the study evaluated the impact of the agricultural financing reforms on household income and household welfare. The study finds that agricultural financing reforms through a decrease in interest rates on agricultural loans by 10% and 8% have positive significant impact on household welfare. While the impact of the policy options (decrease in interest rates on agricultural loans by 10% and 8%) on household income is not significant. The study therefore recommends a review in the interest rates on agricultural loans to improve household income. This recommendation is premised *on* the findings that both 10% and 8% reductions failed to improve the income levels of the households.

Keywords: Macroeconomic Performance, Agricultural Financing Reforms, A Computable General Equilibrium Analysis (CGE), Nigeria.

Jel Classification: B23, B26, E17, E4, G28

1. Introduction

Agriculture contributes immeasurably to the Nigerian economy in a variety of ways, including providing food for a growing population, supplying suitable raw materials (and labour input) to a growing industrial sector, providing a key source of employment, generating foreign exchange earnings, and establishing a market for the industrial sector's products. (Okumadewa et al., 1999

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and FAO, 2006). For a developing country with a mono-item oil economy, such as, Nigeria's, insufficient agriculture financing connotes incredible threats, one of which is fluctuating food prices which are precedents to inflation. Agriculture funding is typically dictated by the public sector, which creates institutional support for the enhanced growth of agriculture in the form of agricultural research, extension services to farmers, product marketing, input supply such as improved seeds and fertilizers and land use legislation. Furthermore, private sector participation is not limited to local or foreign direct investment, but also includes sponsorship of agricultural research and breakthroughs in universities, farmer capacity building, and, most importantly, the availability of capital to agribusinesses. International governmental and non-governmental organizations, such as the World Bank and the United Nations' Food and Agriculture Organization, among others, contribute through on-farm and off-farm support in the form of finance, input supply, and technical know-how enhancement of other support organizations, amongst other areas of support. There has been considerable debate among economists and policymakers about the shift towards a more friendly market-oriented economy (Schafer, 2018). The explanation is that the implementation of the neoclassical economic dogma, as viewed by policy makers, can push the economy on the path of sustainability, progress and growth. Prior to and after Nigeria's independence, the financial sector has undergone several transformations. Reforms play an indispensable role in the growth and development of any organization or system. As part of their monetary change program, the Nigerian government embraced alterations within the financial sector, with the intention of effecting substantial changes and securing entry into the banking sector (Omankhanlen, 2012). Nigeria's financial sector is one of the largest and most diversified in Sub-Saharan Africa and with the introduction of the structural adjustment program in the 1980's, the framework for the sector was liberalized (Afangideh, 2010). The sector has recently undergone substantial changes in terms of the policy landscape, the number of organizations, the structure of ownership, the scope and depth of markets, as well as the e-regulatory framework. According to Finance Maps of World (2012) the Central Bank of Nigeria (CBN) provided some incentives for banks to allow for the achievement of the minimum capital base in 2005. These include permitting banks to deal through foreign exchange by CBN, enabling the banks to take deposits from the public sector while the fiscal authorities were made responsible for the collection of revenue from the public sector. Furthermore, certain tax benefits in the area of stamp duty and capital allowance were given to banks; transaction costs were reduced, and an expert panel was created by the government to provide banks with technical support (Onoja et al., 2011).

Other reform processes included the merger of banking institutions and the implementation of a regulatory structure based on certain rules; the establishment of a web portal for all people to share any confidential details on banking systems with the Central Bank; the development of an electronic process for reporting bank returns; the revision and updating of the banking system. These reforms empowered banks to expand their capital base. The government setup an effective and disciplined banking system by combining numerous local banks, therefore, there was no compelling justification for the Nigerian Government to rely entirely on foreign banks. Computable General Equilibrium (CGE) models use real-world data to predict how

an economy will react to changes in policy, technology, or external factors. CGE models are appropriate whenever it is necessary to estimate the impact of changes in one part of the study, such as agricultural finance reforms and economic growth, on the rest. There has been little or no research on the impact of agricultural financing reforms in Nigeria, particularly on the use of CGE to estimate how the economy will react to policy changes or other external forces. Additionally, the analysis of literature suggests that few studies have examined the influence of policy experiments on macroeconomic variables and household welfare in terms of standard of living in Nigeria using the Hicksian Equivalent Variation as a welfare metric.

1.1. Research Questions

This study aimed to address the following research questions: (i) What is the impact of agricultural financing reforms on household income in Nigeria? and (ii) How does agricultural financing reform influence household welfare in Nigeria? By examining these questions, the study aimed to shed light on the effects of agricultural financing reforms on both income and overall well-being of households in Nigeria.

1.2. Objectives of the Study

The broad objective of this research is to examine the nexus between agricultural financing reforms and Nigeria's macroeconomic performance: a computable general equilibrium analysis (2012-2020). Specifically, the study seeks to:

i.   examine the impact of agricultural financing reforms on household income in Nigeria.

ii.   investigate the impact of agricultural financing reforms on household welfare in Nigeria.

1.3. Research Hypotheses

This study was guided by the following hypotheses stated in the null forms:

i. H_{01}: Agricultural financial reforms do not have significant impact on household income in Nigeria.

ii. H_{02}: Agricultural financial reforms do not have significant effect on household welfare in Nigeria.

2. Literature Review

A few studies have distinguished financing as an obstruction to the increase in agricultural yield in Nigeria. (CBN, 2004; Bernard, 2009). Similarly, the International Food Policy Research Institute (IFPRI, 2008), (Bernard, 2009), Dim and Ezenekwe (2013), and (Kamil et al., 2017) have determined that the agriculture sectors' insufficient support hinders the sectors' full potential for growth and economic development in the country. Using survey data and a probit regression

model, Dong et al. (2010) evaluated the relationship between credit constraints and rural household income in China. The study examined how credit constraints influence agricultural productivity and rural household income in China. The findings of the study indicate that under credit constraints, production inputs, along with the skills and education of farmers, cannot be completely utilized. By eliminating credit restrictions, agricultural output and rural household income can be enhanced. Increased government agricultural investment was explored by Iorember and Jelilov (2018) in Nigeria, where they looked at the influence on the well-being of both wealthy and impoverished households. A computable general equilibrium model was utilized in the study because of its applicability for managing the economy-wide and welfare consequences of specific economic policies, as well as its ease of use. The results of the simulations suggest that increasing the share of farm expenditure in household income increases the welfare of both rich and poor households. Households and the general economy benefited the most from a 25 percent boost in agricultural expenditure in Nigeria, according to the World Bank.

2.1. Concept of Economic Growth

Economic growth, according to Tadaro and Smith (2012), is a process in which the economy's productive capacity is raised over time, resulting in higher levels of national output and income. Thus, economic growth is defined as a persistent increase in a country's per capita output or income, as well as an increase in its labour force, consumption, capital, and trade volume Jhingan (2013). Economic growth, as defined above, is a long-term process characterized by an increase in real per capita income and volume of production associated with a significant increase in the economy's productive capacity, urbanization, and an equitable distribution of income and wealth among the population, all of which contribute to the reduction of poverty and unemployment.

2.2. Agriculture Finance and Economic Growth

The theories of the link between finance and economic growth may be traced back to Schumpeter's (1982) work, as well as Demirguc-Kunt et al. (2001), Shaw's (1973), and Mckinnon's (1973); King and Levine's (1993). These studies suggest that finance and economic growth have a beneficial link. Finance is a significant factor in the process of economic growth, according to Demetriades and Hussein (1996). According to Olagunju and Ajiboye (2010), the absence of a formal national credit policy and an insufficient number of credit institutions in Nigeria is a significant reason for the agricultural sector's reduction in economic contribution. Agricultural credit can be described as the mobilization of resources at all levels for the purpose of increasing agricultural production and productivity and strengthening productive capacity. Similarly, Shepherd (2002) asserts that credit affects farmers' access to all available resources. As a result, implementing suitable macroeconomic policies and facilitating institutional financing for agricultural growth has the potential to support agricultural development by increasing the sector's contribution to employment, income, and foreign exchange creation (Olomola, 2017).

2.3. Financial Sector Development and Economic Growth

Okpara (2010) examined the effect of capital market performance on economic growth in Nigeria. Using a vector autoregression model and Granger causality test, the study established a long-run relationship between real GDP, market capitalization, new issues, share value traded, and turnover ratio in the Nigerian capital market. Okpara (2010) reached the same conclusion as Popoola (2014), who asserts that the market capitalization of the Nigerian Stock Exchange has a favorable effect on economic growth in Nigeria. Nkoro and Uko (2013) examined the association between financial sector expansion and economic growth in Nigeria using annual time series data from 1980 to 2009 using an analytical approach based on co-integration and error correction. The broad money stock in relation to GDP, private sector credit in relation to GDP, market capitalization in relation to GDP, bank deposit liability in relation to GDP, and prime interest rate were used as proxies for financial sector development, whereas real GDP was used as a proxy for economic growth. Despite the fact that market capitalization and private sector lending had no effect on economic growth, the study identified a favorable association between financial sector development and economic growth. Similarly, Maduka and Onwuka (2013) evaluated the relationship between financial market structure and economic growth using Nigerian data from 1970 to 2008 and concluded that financial market structure had a negative and significant effect on economic growth. Balago (2014), on the other hand, discovered a favorable association between banking sector expansion and economic growth in Nigeria using Ordinary Least Squares Regression and Vector Error Correction Models. He discovered that the development of the financial sector (as measured by banking sector credits, total market capitalization, and foreign direct investment) accelerated economic growth. Numerous other researches, such as Dandume (2014), Adeniyi et al. (2015), Obinna (2015), and Iheanacho (2016), have re-evaluated the association.

2.4. Empirical Review

Paul and Gylych (2018) examined the influence of increased government agricultural spending on the well-being of wealthy and impoverished households in Nigeria. A computable general equilibrium model was employed due to its relevance in managing the economy-wide and welfare consequences of specific policies. The simulation results indicate that increasing agriculture expenditure as a share of total expenditure improves the welfare of both rich and poor households. The biggest gain in household and general economic welfare was shown in Simulation 1 (a 25% increase in agriculture spending share), followed by Simulation 2 (10% increase in agriculture expenditure share), and Simulation 3 (a 25% increase in agriculture expenditure share) (5 per cent increase in agriculture expenditure share). They recommended that the government significantly increase support for agriculture through increased allocation to the agricultural sector, in compliance with the Food and Agriculture Organization and the Maputo (2003) declarations on agriculture.

3. Methodology

3.1. Research Design

Creswell (2003) described research design as the plan used to generate answers to the various research problems by the researcher. Welman et al. (2005) in agreement with Creswell (2003) also defined research design as a specific plan set out by a researcher to obtain information from research participants and research tools. This study is designed to examine the macroeconomic implications of agricultural financing reforms on the household welfare and household income in Nigeria; it is descriptive in nature and will therefore employ the descriptive research design.

3.2. Study Area

The study was conducted in Nigeria. In the Gulf of Guinea in Western Africa, the country has a total land area of 923 768 km2 (356 669 sqm), ranking it as the world's 32nd largest country by land area. Located between 40 – and 140-degrees' north latitude and 20 to 150 degrees' east longitude, Nigeria is a country in West Africa.

3.3. Method of Data Collection

This study employed time series data from secondary sources such as the Central Bank of Nigeria (CBN) database and other relevant entities; including the updated Social Accounting Matrix (SAM) derived from the 2006 Input-Output Table; (ii) the Central Bank of Nigeria's (2019) sectoral output data; and (iii) the National Bureau of Statistics' (NBS) Year 2019 household income and expenditure data for Nigeria in conjunction with the World Bank Living Standard Measurement Study (LSMS). The re-aggregated SAM comprises the agricultural, manufacturing, mining and petroleum industries, electrical and telecommunications sectors, and services sectors of the Nigerian economy. These industries create a variety of commodities for home consumption or export, as well as two households (rich and poor) who make money from labor and capital employed in the manufacturing process. The wealthy are resource owners who live in transcendently urban homes, whereas the poor are working people who are classified as rural farmers and urban poor. Information from the Nigerian Living Standard Survey for 2019 was used to obtain Shares of household income and expenditure.

3.4. Method of Data Analysis

3.4.1. Specifying CGE model

Based on the work of Dervis et al. (1982) and its adaptation to Nigeria by Olofin et al. (2003) and Obi-Egbedi et al. (2012), the CGE structure was modeled to suit the objectives of this study. All Cobb Douglas and Leontief types were used, and the Constant Elasticity of Substitution (CES) functions were used. The CES is homogenous to a degree of one, suggesting that when inputs rise, output will rise as well. The study utilized a basic Cobb–Douglas production function to reflect

the value created in each area. As shown in Equation 1, each sector's output comprises value-added, which is the product of two main inputs: labor and capital.

$$XV = avLAB_i^{\propto}CAP_i^{(1-\propto)}$$

(1)

Where XV stands for value added, LAB for labor, CAP for capital, av for value-added shift, and a for value-added share for a certain sector. The demand for the primary input is determined by minimizing the value-added equation (Equation 1).

As a result, Equations 2 and 3 can also be used to calculate labor and capital in each sector.

$$LAB_i = \propto_i PV_t \frac{X_t}{W}$$

(2)

$$CAP_i = (1 -\propto_i)PV_t \frac{Xt}{PK_i}$$

(3)

PVt, Xi, W, PKi are the price value-added, domestic output, current wage rate in the economy, and capital price in sector I respectively.

The household income function is written as follows

$$HHY_h = \sum hfylshi(LAB_iW) + \sum hfykshiCAP_iPK_i(1 - depr_i)$$

(4)

where HHYh is the household income of household (h) (rich or poor), is a function of labor supplied at the ruling wage rate (W) and capital stock (K) of the households at the ruling price of capital (PK) and depreciation rate (depri), and hfylshi is the share factor income from labor received by household (i) and hfykshi is the share factor income from capital received by household (i). Households spend their money on items produced by the sectors, including rival commodities imported from other countries. Imports and domestic demand, on the other hand, are believed to be imperfect substitutes under the Armington assumption (Armington,1969). Hence, the quantity of composite commodity (*i*) consumed by household (*h*) is given by

$$HEXPQ_{(h,i)} = \frac{hexp_{shi} * HHY_h}{PQ_i}$$

(5)

Where $HEXPQ_{(h,i)}$ is the quantity of composite commodity (*i*) consumed by household (*h*), $hexp_{shi}$ is the expenditure share for household (h) on goods from sector (I) PQ_i and is the price of a composite commodity sector (I) and $hexp_{shi}$ as defined earlier. Each household maximizes a Cobb–Douglas utility function subject to their income, thus the household utility function is given by

$$HHU_h = \sum hexp_{shi}logHEXPQ_{hi}$$

(6)

where HHU_h is household utility, $hexp_{shi}$ and are as defined. Household savings are defined as the difference between household income and expenditure, but total household savings are calculated by adding the savings of all households together.

$$SAV_h = HHY_h - \sum hexpS_i HHY_h$$

(7)

$$HSAV = \sum SAV_h$$

(8)

Where SAV_h and $HSAV$ are household savings and total households' savings respectively and the Agricultural loan disbursement function is given as:

$$AGRLOANEX_{AGR} = GSEC * \frac{GRTOT}{P_{AGR}}$$

(9)

Where $AGRLOANEX_{AGR}$ is Agricultural loan disbursement due to reforms, $GSEC_{AGR}$ is government sectoral consumption, $GRTOT$ is government total revenue and P_{AGR} is the price of the composite agricultural commodity (domestically produced and imported).

3.4.2. Simulation Designs

To achieve the objectives of the study, two policy scenarios were formulated and simulated in this study. These scenarios involve reducing the base-year share of agriculture loan interest rate by some magnitude, given that financial reforms in agriculture are directly related to output. The two scenarios include:

(1) 10 percent decrease in the interest rate on agriculture loan in line with the Interest draw-back policy of the CBN.

(2) 8 percent decrease in the interest rate on agriculture loan in line with single-digit interest rate policy

The evaluation of the effect of decreases in the interest rate on agriculture loans on households' welfare regarding utility gained or lost will be analyzed using the Hicksian Equivalent. Following Obi-Egbedi et al. (2012) and Abachi and Iorember (2017). The Hicksian Equivalent Variation (EV) is given as:

$$EV^h = \left[\frac{U_n^h - U_0^h}{U_0^h}\right] Y_0^h$$

(10)

Where,

Y_0^h =Income of household (h) before the policy change,

U_0^h =Utility of household (h) before the policy change,

U_n^h = Utility of household (h) after policy change, and

EV^h =Equivalent Variation of household (h).

A policy is said to affect households if the calculated value of the equivalent variation (Hicks in a coefficient) is greater than zero.

0 (i.e., if EV > 0). The higher the value of the equivalent variation, the more impactful the policy is to the households (Abachi and Iorember, 2017).

4. Results

4.1. Macroeconomic Impact of Increase in Agricultural Financing through 10 Percent Decrease in Interest Rate

In order to ascertain the impact of increase in agricultural financing on the macroeconomic variables of economic growth, household income and household welfare in Nigeria, scenario one (10 percent decrease in the interest rate on agriculture loan) was simulated and the results are presented in Table 1).

Table 1: Simulation One (SIM1 – 10% decrease in interest rate) Results of the Impact of Increase in Agricultural Financing on Macroeconomic variables of Household Income and Welfare in Nigeria

	Baseline Impact (N'Billion)	Simulated Impact (N'Billion)	Percentage Change (%)
Household Income	8,788.39	9,081.87	3.34
Household Welfare (EV)	-	1,300.11	-

Source: Author's computation using GAMS

Result in Table 1 shows that household income increases marginally from N8,788.39 to N9,081.87 representing 3.34% change due to increase in agricultural financing through 10% reduction in interest rate on agricultural loans. Regarding household welfare, the results revealed a Hicksian Equivalent Variation value of 1300.11 (EV = 1300.11) which shows improvement in the household welfare due to the policy change. Furthermore, for all the indicators, the results showed a positive increase suggesting that a policy of 10% reduction in interest rate on agricultural loans have significant positive impact on the macroeconomic variables.

4.2. Macroeconomic Impact of Increase in Agricultural Financing through 8 Percent Decrease in Interest Rate

In order to ascertain the impact of increase in agricultural financing on the macroeconomic variables of, household income and household welfare in Nigeria, scenario one (8 percent decrease in the interest rate on agriculture loan) was simulated and the results are presented in Table 2.

Table 2: Simulation Two (SIM2 – 8% decrease in interest rate) Results of the Impact of Increase in Agricultural Financing on Macroeconomic variables of Household Income and Welfare in Nigeria

	Baseline Impact (N'Billion)	Simulated Impact (N'Billion)	Percentage (%) Change
Household Income	8,788.39	9,035.19	2.81
Household Welfare (EV)	–	1289.13	-

Source: Author's computation using GAMS

Result in Table 2 reveal that, household income increases from N8,788.39 to N9,035.19 representing 2.81% change due to increase in agricultural financing through 8% reduction in interest rate on agricultural loans. Regarding household welfare, the results revealed a Hicksian Equivalent Variation value of 1289.13 (EV = 1289.13) which shows improvement in the household welfare as a result of the policy change. For all the indicators, the results showed a positive increase suggesting that a policy of 8% decrease in interest rate on agricultural loans have significant positive impact on the macroeconomic variables. To further buttress the findings, the results of simulation one (SIM 1) and simulation two (SIM 2) is presented on Figure 1. For SIM 1, Figure 1 shows that the impact of the policy (10% decrease in interest rate on agricultural loans) has higher impact on household income. While for SIM 2, Figure 1 indicates that the policy (8% reduction in interest rate on agricultural loan) has a lower impact on household income compared to Sim 1.

Figure 1: Percentage Change in the Macroeconomic Indicators Due to Simulation One and Simulation Two
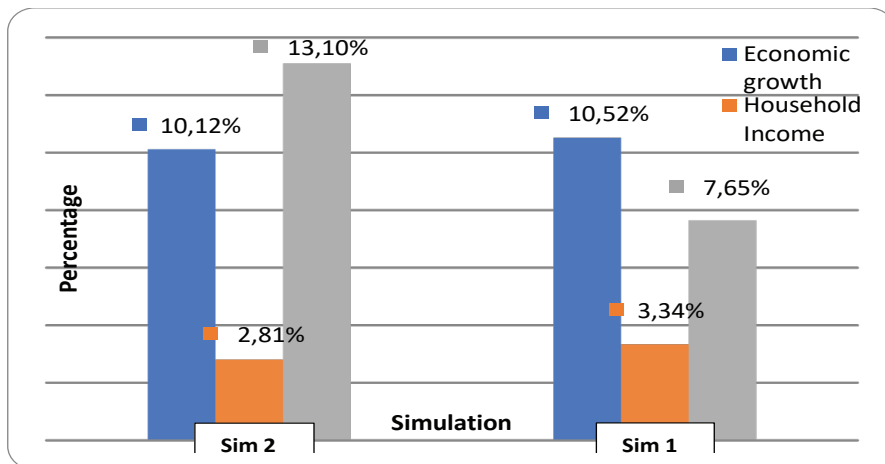
4.3. Diagnostic and Sensitivity Checks

To determine the robustness and reliability of the simulations results, the study employed two diagnostics and sensitivity checks; to evaluate if the model has been able to replicate the

benchmark or initial equilibrium, and to verify the non-violation of the Walras law which states that the Walras variable must be approximately zero. In the first case, the results indicated that the baseline simulations replicated the benchmark equilibrium, and in the second case, the results showed that the values of the Walras variable for both the baseline simulation and the counterfactual simulations are approximately zero as required. These suggest that the model has goodness of fit and has performed well; hence, the findings of the study are robust and reliable.

4.4. Test of Hypotheses

The first hypotheses of the study were tested using 5% as the threshold, while the second hypothesis was tested using the Hicksian Equivalent Variation, this is consistent with the study of Ishola et al. (2013); Iorember and Jelilov (2018).

4.4.1. Decision Rule:

For hypotheses one, the decision rule is to reject the null hypothesis (H_0) if a policy option has greater than 5% impact on the macroeconomic economic variables. Otherwise, do not reject H_0.

For hypotheses two, the decision rule is that to reject the null hypothesis if the value of the estimated Hicksian Equivalent Variation is greater than zero, otherwise, do not reject it. The Hicksian Equivalent Variation as a measure of welfare is also used to quantify the impact of the various policy measures – a policy experiment (simulation type) that has higher value of the Hicksian Equivalent variation is considered more desirable than the one with smaller value.

All the two hypotheses were tested using the results in Tables 1 and 2.

4.4.2. Decision

Hypothesis One: Since the percentage change in household income is less than 5% due to agricultural financing reforms (simulations one and two), the study fails to reject the null hypothesis and conclude that agricultural financing reforms have no significant impact on household income in Nigeria.

Hypothesis Two: Since the value of the estimated Hicksian Equivalent Variation is greater than zero (positive) due to agricultural financing reforms (simulations one and two), the study rejects the null hypothesis and conclude that agricultural financing reforms have significant impact on household welfare in Nigeria.

5. Discussions

5.1. Discussion of Findings

The discussion of the findings of the study is in line with the objectives and hypotheses of the study. The study confirmed that agricultural financing reforms through reduction in agricultural

loans does not necessarily lead to improvement in households' income. This is because, while agricultural financing reforms through reduction in agricultural loans may lead to increase in agricultural output, it does not determine the prices of agricultural produce. In fact, prices of agricultural produce may decline when the supply is high, and this may affect household income negatively. This study is in line with the study of Ayodele (2019). The study further showed that agricultural financing reforms through reduction in agricultural loans exert positive impact on household welfare in terms of utility gained. In addition to the income effect of the policy reforms, the positive impact of the policy options on agricultural output may in turn increase household consumption, thereby improving the welfare of the households. This finding agrees with the finding of Iorember and Jelilov (2018) and Obi-Egbedi et al. (2012) who also submitted that agricultural loans have a significant impact on household welfare with respect to utility gained.

6. Conclusion

The study investigated the impact of an increase in agricultural financing on macroeconomic aggregates such as household income and household welfare in Nigeria using a computable general equilibrium model. To achieve the objectives of the study, two policy scenarios (10% and 8% reduction in interest rate on agricultural loans) were simulated and the results for both cases indicated that all the macroeconomic indicators except household income increased significantly due to the policy options. The improvement of household's welfare was however found to be highest under simulation one (10 per cent decrease in interest rate on agricultural loan) compared with simulation two (8 per cent decrease in interest rate on agricultural loan). This is expected because, the cheaper agricultural loans are, the higher the rate of investment in the agricultural sector and of course, the higher the rate of consumption which translate to welfare of the people.

7. Recommendations

Based on the findings of the study which indicate that agricultural financing reforms have a positive significant impact on macroeconomic aggregates of household income and household welfare, the study recommends the implementation of the policy scenarios that lead to this conclusion. That is, a 10 percent or 8 percent reduction in interest rate on agricultural loans in line with the interest draw-back policy of the CBN.

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