

Policies for promoting food and nutrition security in Nigeria¹

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1. Background

The United Nations, in 2015, adopted the Sustainable Development Goals (SDGs) as a “blueprint for a better future”. Goal 2 of the SDGs ambitiously aims to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture. Specifically, SDG target 2.2 seeks to end all forms of malnutrition, reduce stunting and wasting among under-five children, and address the nutritional needs of adolescent girls, pregnant and lactating women, and elderly persons (United Nations, 2024a). According to the 1996 World Food Summit, food security exists when “*all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life*” (George-André, 2012, p.4). Almost ten years after adopting the SDGs, more than 864 million people (10.7% of the global population) are facing severe food insecurity - 310 million more people than in 2015 (FAO et al 2024). FAO et al (2024) further revealed that an additional 2.33 billion (28.9%) are severely or moderately food-deprived globally in 2023. World Bank (2024) is projecting that the severely food-insecure population will reach 956 million by 2028. The global food security crisis has been accentuated by the global poly crises - COVID-19, Russia-Ukraine war, climate change, global supply chain disruption, conflicts, and record high inflation (United Nations, 2024b).

In Nigeria, like the rest of the world, food and nutritional insecurity has worsened. According to FMARD (2016), Nigeria accounted for 5% of the global burden of undernutrition with over 14 million undernourished children. Similarly, the United Nations Children’s Fund (UNICEF, 2023) noted that about 25 million Nigerians are at risk of food insecurity in 2023, up from the 17 million people who were food-insecure in 2022. FAO et al (2024) also equally that the number of Nigerians who are severely food insecure more than doubled from 20.3 million between 2014 and 2016 to 49.4 million (22.6% of the population) between 2021 and 2023; and an additional 112 million people (51% of the population) are moderately food insecure between 2021 and 2023. Forecasts by the United Nations suggest that it could reach about 82 million Nigerians (64%) by 2030 (Akasike & Adaji, 2024). The bulk of the food-insecure population are in the North-East and North-West regions and include internally displaced persons because of conflicts. There is also a wide gap in food insecurity between rural and urban areas.

¹ This is a work-in-progress paper that is being prepared for the 2025 GTAP Conference. Please do not cite. For any information on the paper, kindly contact the corresponding author.

The food security situation in Nigeria is relatively serious compared to other countries. According to Global Food Security Index 2022 (Economist Intelligence Unit (EIU), 2022), Nigeria ranks 107th out of 113 countries on food security in 2022. Similarly, out of 28 sub-Saharan African countries, Nigeria ranks 25th with an overall score of 42 points. South Africa topped the sub-Saharan ranking with a score of 61.7 points, followed by Kenya (53 points) and Ghana (52.6 points).

The problem of food insecurity is translated to a public health challenge through inadequate food consumption and poor diets, reflecting in malnutrition and other related issues. FAO et al (2024) documents that 39.4 million Nigerians (or 18% of the population) do not have access to enough food to meet their daily energy requirements. About 9 million Nigerian children are estimated to be at risk of acute malnutrition or wasting, and 29% of these children could face Severe Acute Malnutrition (FAO, OCHA and UNICEF, 2023). Although Nigeria's undernourishment prevalence rate of 18% is below the sub-Saharan Africa average of 22.7%, 1 out of every 7 undernourished persons in the sub-region lives in Nigeria. Some of the SSA countries with high prevalence rates include Kenya (34.5%), Angola (23.2%), Ethiopia (22.2%), and Central African Republic (23.5%) among others. Interestingly, some SSA states like Ghana (6.2%) and South Africa (8.1%) have relatively lower prevalence rates. Poor diets are also associated with non-communicable diseases such as cancer, obesity, high blood pressure and heart diseases.

If unchecked, the current trend could substantially undermine the goal of achieving sustainable food and nutritional security by 2030. Food and nutritional insecurity pose significant public health and development challenges for the country, undermining human capital development and contributing to economic losses. The Nigerian government declared a state of emergency on food security in mid-2023. However, confronting the multidimensional challenges of food and nutritional insecurity requires a holistic policy approach. This is the goal of this study. The study examines and simulates policy options that can help to achieve food and nutritional security in Nigeria.

To address this challenge, the Nigerian government has formulated several policies, focusing on agricultural productivity, income support, education awareness, cash transfers and health interventions (see Appendix for overview of these policies). On the one hand, the National Food Security Program (NFSP), Agricultural Transformation Agenda (ATA), the Anchor Borrowers' Program (ABP), Agricultural Sector Food Security and Nutrition Strategy (ASFSNS) are key food security programmes focusing on agriculture-related interventions. On the other hand, the National Policy on Food and Nutrition (NPFN), National Plan of Action on Food and Nutrition, National Social Investment Programme (NSIP), National Strategic Plan of Action for Nutrition (NSPAN) and National Multi-Sectoral Plan of Action for Food and Nutrition, in addition to promoting agricultural productivity, focus on non-agriculture related interventions such as school feeding programme, cash transfer, nutrition education and awareness, micronutrient supplementation, pricing policy, etc. Despite these policies, food and nutrition security outcomes continue to worsen, raising questions about the effectiveness and impacts of these policy interventions.

Several studies have been conducted on the effectiveness and impact of policy interventions on food and nutrition security in Nigeria. While studies like Donkor, et al. (2017) and Awotide, et al. (2013) examine agriculture-focused interventions, Ogunsile and Ogundele (2016), Babatunde and Olagunju (2020) and Okeke and Abubakar (2020) focus on the effect of non-agriculture related

interventions such as nutrition education, cash and food transfers on food and nutrition security. However, most of these studies adopt a micro approach and fail to consider general equilibrium or feedback effects. For instance, the studies did not consider the possibilities of price or economic factors influencing food consumption choices and ultimately food and nutrition security. In addition, these policy interventions are examined independently, and there is no known study that has evaluated and compared the impacts of different policies with a view to ascertaining the optimal policy option(s) for enhancing food and nutrition security in Nigeria. While existing studies analyse the impact of specific policies, there is limited information on how the effect of one policy differs from another. These are the main gaps this study aims to fill.

This study aims to understand the food consumption patterns in Nigeria and simulate and compare the impacts of different policies on economic and food and nutrition security indicators. The research questions this study aims to answer are as follows:

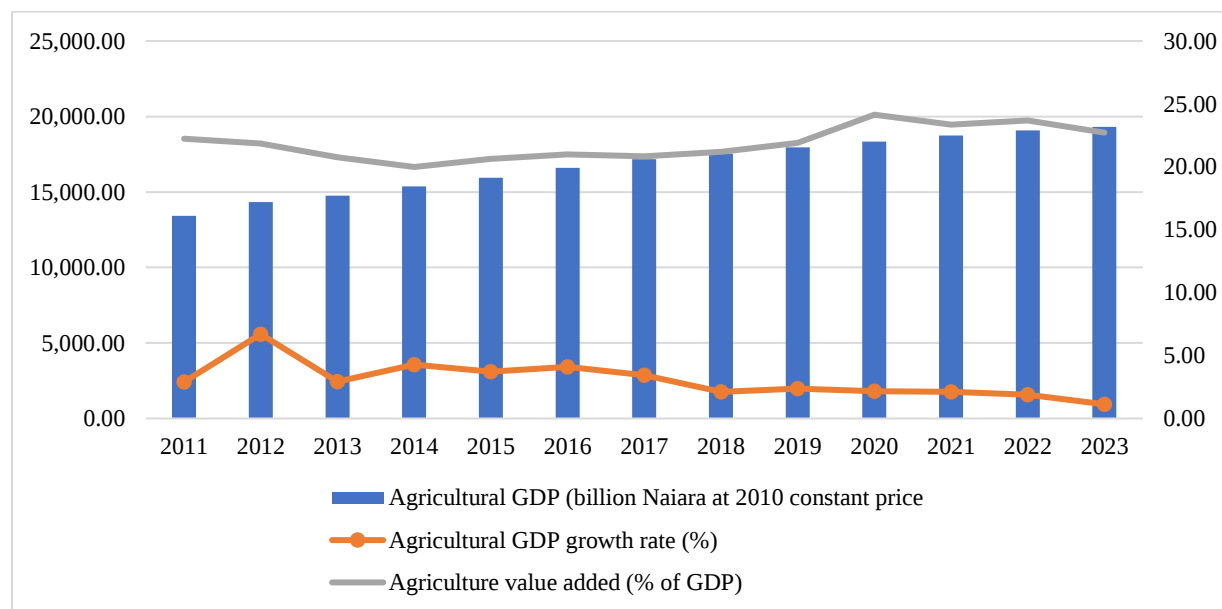
- (i) What are the food consumption patterns of Nigerian households, and do these patterns differ based on region, rural-urban and income level?
- (ii) What are the economy-wide and food and nutrition impacts of policy interventions to enhance food and nutrition security?

2. Dimensions of food security: Understanding the form and drivers of food and nutrition security in Nigeria

Nigeria has had a foretaste of myriad crises, ranging from external shocks and spillovers (such as COVID-19 pandemic, the Russia-Ukraine war) to domestic challenges (including worsening insecurity, climate change and macroeconomic instability). These crises, which are not mutually exclusive, disrupt food production, supply chains, and affordability, leading to increased food shortages and malnutrition among the population. The challenges of food and nutritional security in Nigeria is discussed within the context of the four dimensions of food security: availability, affordability, stability and utilization.

The first dimension of food security, availability, is related to the supply of food to meet the demand. In Nigeria, agricultural productivity has increased over the years, but still inadequate to meet local demand. As shown in Figure 1, agriculture output (agriculture GDP) increased steadily from increased from ₦13,429.38 billion in 2011 to ₦19,306.49 billion in 2023. However, the growth rate of agricultural GDP has declined from the peak level of 6.70% in 2012 to 4.11% in 2016, 2.36% in 2019 and 1.13% in 2023. The steady in the growth rate of agricultural GDP. Meanwhile, agriculture value added as a % of GDP has held steady from 22.22% in 2011 to 22.7% in 2023. The slow growth in the performance of the sector reflects the weak productivity in the sector and its abilities to meet the food supply for the local population. According to FAO (2022), 70% of Nigerians are involved in the agricultural sector, but agricultural productivity and crop yields have remained low due to the subsistence nature of agriculture in Nigeria.

Figure 1: Agriculture productivity indicators



Source: Data from Central Bank of Nigeria Statistical Bulletin and World Development Indicators of the World Bank

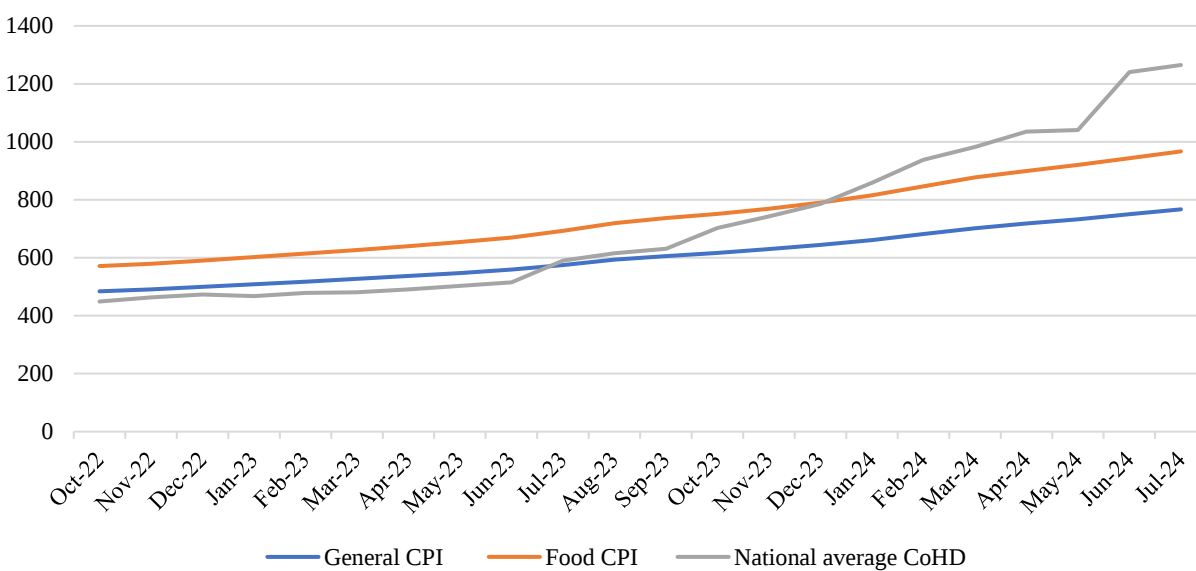
Food availability in Nigeria, especially with respect to production, is undermined by several factors. For example, heightened security challenges, particularly in the Northeast, have disrupted agricultural activities. GAIN (2022a) estimates that about 2.13 million farmers are displaced in the Northeast alone. Gavin (2023) reports that a cumulative of about 98,000 persons have been killed by non-state actors (including Boko Haram, Bandits, sectarian and other armed actors) since 2012. With farmers not being able to access their farms or transport their farm produce to markets due to threats from insurgent groups, the availability dimension of food and nutritional security is significantly undermined. This also aggravates the problem of post-harvest losses in Nigeria, which is as high as 50% for fresh fruits and vegetables (GAINS, 2022b). The monetary value of the post-harvest losses is estimated at ₦3.5 trillion (Olawoyin, et al., 2024), higher than the combined imports and exports of agricultural commodities, and more than triple the annual government budget for the agriculture sector.

Other crises that affected the availability dimension include climate change and the COVID-19 pandemic. Nigeria is experiencing extreme weather events (such as droughts and floods) resulting in crop failures, reduced yields, and food shortages, thereby exacerbating food insecurity. The existing vulnerability in the Nigerian food system was exacerbated by the COVID-19 pandemic. Lockdowns and movement restrictions hindered agricultural activities, and disrupted supply chains, leading to food shortages and price hikes (Dauda, 2023, Nicholas-Okpara et al., 2023).

The second dimension of food security is access, which is related to physical and economic access to food. Having adequate food production or availability is insufficient to guarantee food security as poor infrastructure, high prices, low income, etc. could undermine the translation of food production into access for households. For instance, Nigeria's headline inflation has trended above the central bank's upper bound target of 9% for over ten years. As of October 2024, the headline food inflation rate was 39.16% (NBS, 2024a). Spiraling inflation erodes the purchasing power of individuals, making food less affordable for many low-income households. The inflationary

pressure was heightened by massive currency depreciation. The naira has depreciated by over 100% since 2023. Exchange rate volatility does not only affect imported food prices but also domestic food prices through both adjustment and export effects. Low productivity and tepid economic growth reduce income, further limiting the affordability of a diverse and balanced diet. As shown in Figure 2 below, the cost of a healthy diet (CoHD) has almost tripled from ₦449 in October 2022 to ₦1,265 in July 2024.

Figure 2: Consumer price index and cost of healthy diets, October 2022 – July 2024



Source: National Bureau of Statistics

The third dimension, utilization, has to do with how the body metabolizes food and utilizes the nutrients in the food consumed. Merely having access to food is insufficient in combating food insecurity if individuals do not metabolize it efficiently due to factors like lack of nutrition knowledge, unhealthy eating habits, or health issues. As observed by Mumed et al (2023), citizen's education, healthcare provisions and income level are critical for achieving the utilization dimension. In the case of Nigeria, prevalence of wasting is 6.5% as of 2020, but about 12 million Nigerian children are affected by stunting. Although there has been progress in reducing the prevalence of stunting from 42% in 2000 to 34.2% in 2022, the current level is still higher than the African average. Based on the 2021 National Food Consumption and Micronutrient Survey, the dietary patterns of children in urban areas are suggestive of being unhealthy and obesogenic (FGoN & IITA, 2024). Meanwhile, the incidence of non-communicable diseases such as cancer, diabetes and hypertension has also been rising. 17% of adult Nigerian women were estimated to be obese in 2022, double the level in 2005 (Phelps et al., 2024).

In addition, the necessary infrastructure required to ensure that people get maximum nutrition for food consumed are not fully in place. According to the Multiple Indicator Cluster Survey (MICS), access to basic drinking water, sanitation and hygiene in Nigeria is 72%, 38% and 29% respectively. The access rate is even much lower for rural areas at 57%, 28% and 22% respectively. Without commensurate improvement in these complementary services, the utilisation dimension of food security is compromised.

The last dimension of food security has to do with stability of the other three dimensions over time. This means that availability, access and utilization of food must always be stable, and not susceptible to the impacts of exogenous factors (Manikas et al., 2023). To be considered as food and nutritionally secure, there must be a guarantee of smoothened food and nutritional intake over time (WHO, 2023). The food system is prone to several factors that could affect the status of households. For instance, poor weather conditions, political instability, economic instability and conflicts can have negative effects on the stability and sustainability of the food systems. Weak infrastructure, transportation challenges, and market inefficiencies can result in food supply disruptions. Political instability and conflicts can disrupt food production, distribution, and access. The current security situation in Nigeria adversely affects the production and distribution of food, contributing to increase in prices. Extreme weather conditions in recent years also affect agricultural productivity, resulting in crop damage and farm losses. The current macroeconomic challenges in the country, with poverty and unemployment levels rising, also undermine the stability of food intake for households.

3. Review of relevant literature: Impact assessment of policy interventions for enhancing food and nutritional security in Nigeria

Several studies have been conducted on the impact of public policy intervention on food and nutrition security in Nigeria. Some of these studies focus on interventions to enhance agricultural productivity. For instance, Donkor, et al. (2017) examines the effect of the Presidential Cassava Initiative on cassava production and food security in Nigeria using a three-stage multivariate linear regression model. The Initiative is a cross-country initiative (Nigeria, Ghana and DR Congo), and the intervention focuses on cassava production and processing development, and marketing of processed cassava. The results of the analysis show that the Initiative leads to an increase in cassava production and enhances national food supply and food security. Awotide, et al. (2013) analyses the impact of seed vouchers on poverty reduction among rice farmers in Nigeria. This is implemented alongside the USAID-funded Emergency Rice Initiative to boost rice production. The study uses randomized control trials to provide subsidised improved rice seeds to selected farmers. Using the inverse propensity score weighing (IPSW) and the local average treatment effect (LATE) estimation techniques, the study finds that the seed voucher system has a positive and significant impact on household income and per capita consumption expenditure.

Additional studies focus on the effect of interventions to enhance nutrition and healthy diets. One of such studies is Ogunsile and Ogundele (2016). The study analyses the effect of game-enhanced nutrition education on knowledge, attitude and practice of healthy eating among adolescents in Ibadan city of Nigeria. Using questionnaires to collect data and ANCOVA to analyse the data, the study finds that nutrition education has a significant effect on knowledge, attitude and practice of healthy eating in Nigeria. Ogbo, et al. (2017) analyse the effect of government policy responses for improving infant and young child feeding practices in Nigeria. Focusing on the Baby Friendly Hospital Initiative and the National Breastfeeding Policy, the study uses data from the Nigeria Demographic and Health Surveys from 1999 to 2013. The data is used to calculate prevalence rates, taking cognizance of the cluster sampling design. The study shows that the policy responses have not had significant positive impact of infant and children feeding practices. Specifically, the analysis shows that early initiation of breastfeeding decreased significantly by 4.3%; while exclusive breastfeeding remained unchanged. Minimum meal frequency also increased significantly by 13.8% while minimum dietary diversity and minimum acceptable decreased by 9.7%. Lastly, predominant breastfeeding increased by 13.1% while children ever breastfed by

16.4%. Babatunde and Olagunju (2020) examine the relative effects of cash and food transfer as an effective response mechanism against food insecurity during COVID-19 pandemic. Using phone survey data, they find that cash transfer is more effective than food assistance in improving food consumption and dietary diversity.

Further studies have gone to examine the effectiveness of social safety nets on food security, nutrition and health in Nigeria. Okeke and Abubakar (2020) examine the effect of cash transfer conditioned on mother's health care utilization during pregnancy on child health. They find that the cash transfer leads to an increase in the uptake of formal maternal healthcare services during pregnancy while also resulting in significant reductions in child mortality.

The review of the literature shows that there are several studies that have analysed the impacts of specific interventions on food and nutrition security indicators in Nigeria. However, there is no known study that has evaluated and compared the impacts of different policies with a view to ascertaining the optimal policy option(s) for enhancing food and nutrition security in Nigeria. In other words, while existing studies analyse the impact of specific policies, there is limited information on how the effect of one policy differs from another. This is the main gap this study aims to fill. In addition to the food and nutrition security indicators, the study also assesses the economic impact of food and nutrition policies.

4. Method

We use two different but complementary approaches to answer the research questions. For the first research objective which aims to analyse the food consumption patterns of Nigerian households, we analyse data from the Living Standard Measurement Survey 2018/2019. This survey contains data on food consumption of over 22,000 representative Nigerian households. From the data in the survey, the nutrient contents of the food consumed are estimated. This allows us to analyse consumption of different food groups, diet quality, and nutrient intakes, across different regions, rural-urban and income quintile.

For the survey, respondents report on the quantity of food consumed at home across many food categories in a unit of their choice. The quantity consumed are then converted into grams using detailed conversion tables for all non-standard units. The nutrient contents of the food consumed are subsequently derived from information from the 2019 FAO/INFOODS Food Composition Table for West Africa, accounting for the cooking and processing methods. In addition, the respondents report on the amount of food consumed outside the home. For food items consumed away from home, the expenditure and monetary value of consumption of the household is obtained. The calorie contents are estimated by dividing these expenditure by the median value of a calorie derived from consumption at home. Fat, protein and carbohydrates contents are estimated by using an equal share of energy as home consumption. Micronutrient contents are estimates by dividing expenditures by the median value of nutrient derived from consumption at home (Molledo, et al., 2014; 2018).

Overall, the food categories in the survey are grouped into 16 food groups, and the indicators of diet quality and adequacy include dietary diversity score (HCES-DDS, 0-16), hGDQS (adapted version of the Global Diet Quality Score, 0-45), food gap according to IPC/CH (less than 2100 kcal per day), WHO recommended macronutrient intake proportion (>30% of energy intake

derived from fat, <10% of energy intake derived from protein, and <400 grams/AE/day of fruit and vegetables.

For the second research objective, we use the DEMETRA, a single-country, recursive-dynamic, open-economy CGE model, and Nigeria's 2019 social accounting matrix (El Meligi, et al., 2024). The model helps to analyse the economy-wide and food consumption impacts of existing and potential policies. CGE models are useful to analyse economy-wide impacts of public policies and have been widely used to evaluate the impacts of agricultural and food security policies. The policies are simulated using the model to obtain macroeconomic, structural and household (food) consumption impacts. The results of the CGE model are then linked to a micro-model to examine the impacts of these macro changes on food and nutrition indicators, which are based on the food consumption pattern mapped with the survey data. In other words, the changes in food consumption patterns obtained from the results of the CGE model are connected to the diet quality and nutrient intake mapped to each food group based on the Living Standard Measurement Survey 2018/2019 data, which then provides information about how the simulated policies ultimately affect diet and nutrition, beyond only the quantity of food consumed.

The different policy scenarios analysed in this paper is obtained from food and nutrition policy stakeholders in Nigeria at a policy stakeholder engagement workshop. The workshop brought together government officials (representatives of Ministry of Agriculture and Food Security, Ministry of Health and Social Welfare, Ministry of Budget and National Planning, Office of the Special Adviser to the President on Agriculture, House of Representatives Committee on SDGs, National Agricultural Development Fund), academics, researchers, international organisations (United Nations World Food Programme) and civil society organisations (CSOs) to elicit policy ideas that can help to enhance food and nutrition security.

Following from the engagement, some key policy ideas emerge. Overall, the emerging views focus on the production and consumption sides. Policies to increase food availability are hinged on increasing production levels, reducing on-farm losses, and encouraging small-scale production for own consumption. These policies have to do with improving seed quality, promoting climate resilient agriculture, improving fertiliser quality, and agriculture sector mechanization. Some policy ideas on the demand/consumption side are also noted. The key policy interventions in this regard are nutrition education and behavioural change communication campaigns, income support for low-income households, and improve affordability of nutritious food.

Overall, the following six policy scenarios, which capture both the supply and demand-side of the policy interventions, are adopted.

Policy scenario 1: Increase in the production of key crops such as vegetables, millets, sorghum and other cereals; and rice through improved seed quality, improved fertiliser quality and application, adoption of climate resilient agriculture

Policy scenario 2: Reducing on-farm losses.

Policy scenario 3: Encouraging small-scale production for own consumption.

Policy scenario 4: Income support for low-income households.

Policy scenario 5: Improve the affordability of nutritious food through price subsidy.

Policy scenario 6: Nutrition education and behavioral change communication campaigns.

This work in progress report contains the results of two of the policy scenarios (1 and 3) and is based on the static version of the model. Modeling work is ongoing on the remaining scenarios

and the dynamic version of the model. Afterwards, the results of the model will be connected with a micro-model to analyse the impact on diet and nutrition indicators.

5. Preliminary results

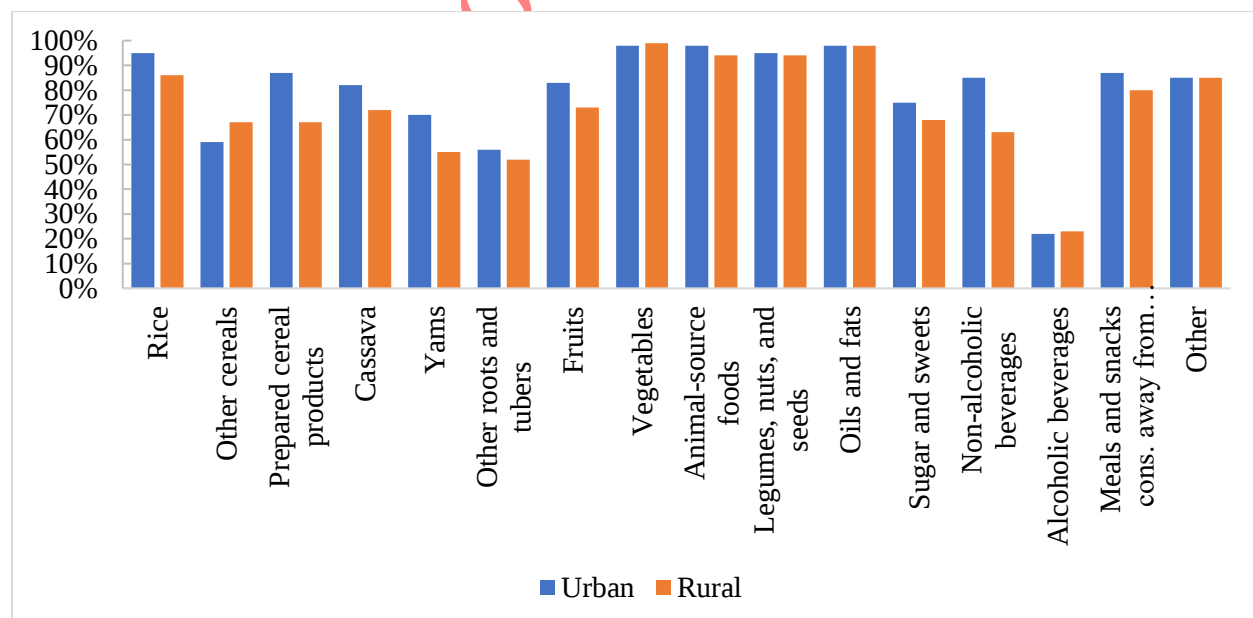
The preliminary results of the results of the analysis are presented in this section. The first section focuses on the results of the analysis of the food consumption pattern of Nigeria households. The second section presents preliminary results of the CGE modeling.

5.1 Consumption pattern and nutrient quality of Nigerian households

The survey shows that majority of Nigerians consume basic food items like rice, vegetables, animal-sourced foods, oils and fats, legume/nuts/seeds (Figure 3). The consumption of these different food groups also vary between rural and urban households, in most cases with urban households having higher consumption than rural households. 98% of urban households reported consuming vegetables, animal-sourced foods, oil and fats while 95% reported consuming rice, legumes/nuts/seeds. Only 83% of urban households reported consuming fruits. The food groups least consumed by urban households include other cereals (59%), other roots and tuber (56%) and alcoholic beverages (22%).

Vegetables is the is the most consumed food groups among rural households (99%), marginally higher than urban households (98%). 98% of rural households reported consuming oils and fats while 94% consumed animal-sourced proteins and legumes/nuts/seeds. 27% of rural households did not consume any fruits. The only food categories where rural households have higher consumption than urban households are other cereals, vegetables, and alcoholic beverages. It is noteworthy that about 87% of urban households and 80% of rural households consume meals and snacks away from home.

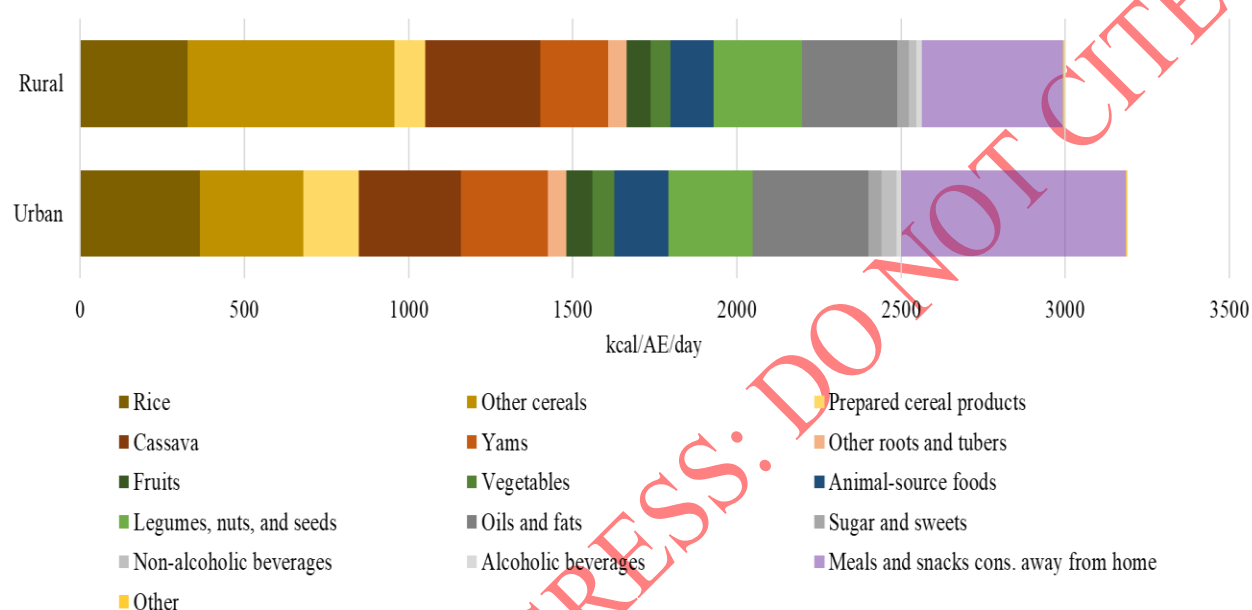
Figure 3: Proportion of households that consume different food groups



Source: Authors' computation

Figure 4 further shows that diets is dominated by staple foods, accounting for 52% of energy intake in urban areas and 56% in rural areas. Meanwhile, consumption of traditional staple cereals such as maize and millets is much lower for urban households. The diets of urban households is also higher in both nutritious food groups (animal-source foods, fruits and vegetables) and unhealthy foods (oils and fats, sugar and sugary drinks). Meals and snacks consumed outside the household are relatively more important food source for rural households.

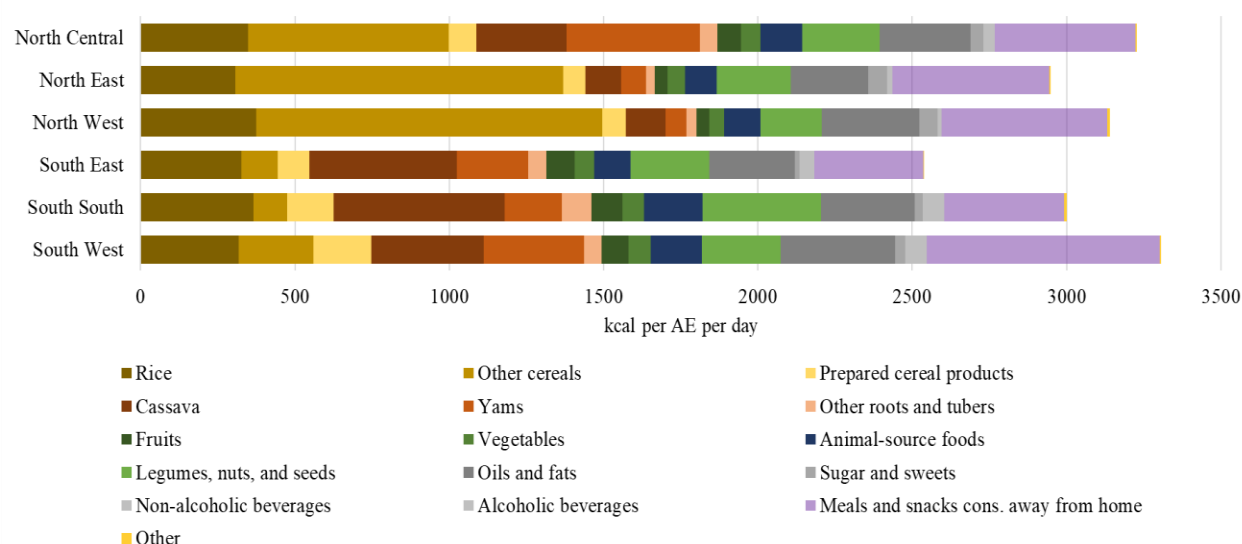
Figure 4: Consumption of different food groups, rural and urban households



Source: Authors' computation

Figure 5 presents the consumption of the different food groups across the six (6) geopolitical zones. Overall, the energy intake of households in the South East is the lowest while that of the South West is the highest. The diet of households in the North (North East, North West and North Central) are mainly dominated by traditional staple foods (cereals, maize, millet and sorghum). Rice and yam are also major source of food for the North Central region. Staple food accounts for about average 50% of overall energy intake. In the South, yam, cassava and rice are major food sources. Intake of fruit, vegetables and animal-sourced foods are low in the North West and North East.

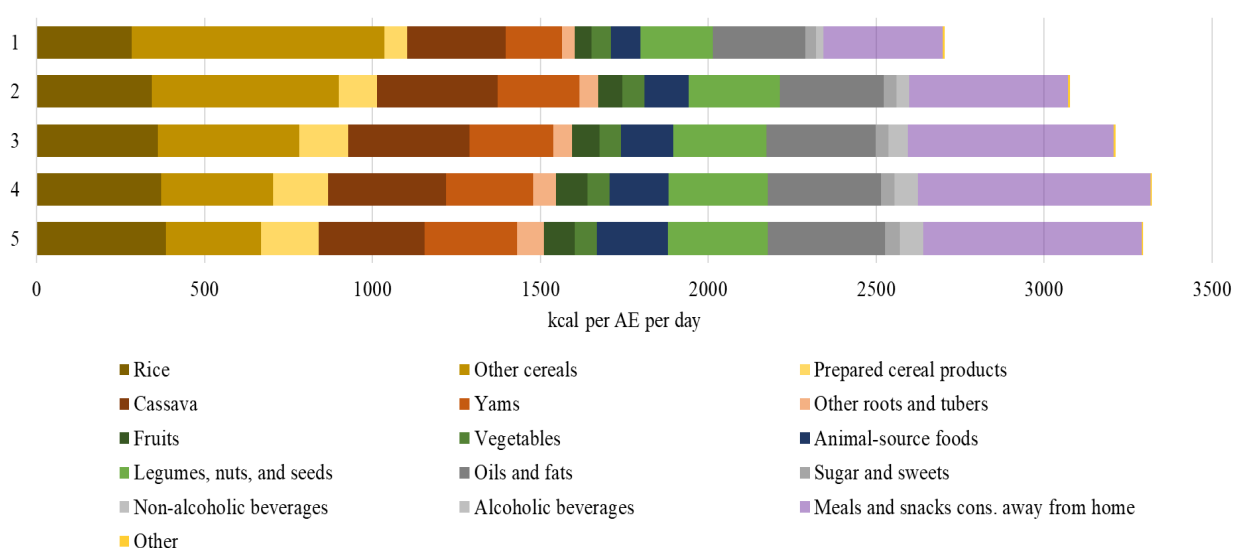
Figure 5: Consumption of different food groups, by geo-political zones



Source: Authors' computation

Figure 6 presents the consumption of the different food groups by income level. As shown by the results, the lowest income quintile group has the lowest energy intake, but the energy intake increases especially early in the income distribution. Low-income households depend heavily on traditional staple foods, including casava and yam. However, as the income level increases, the consumption of these food items reduces steadily and consistently, with households shifting consumption towards higher-value food items like rice and prepared cereal products. There is also a noticeable increase in the consumption of fruits and animal-source products as income level increases, while there is no significant change in the consumption of vegetables.

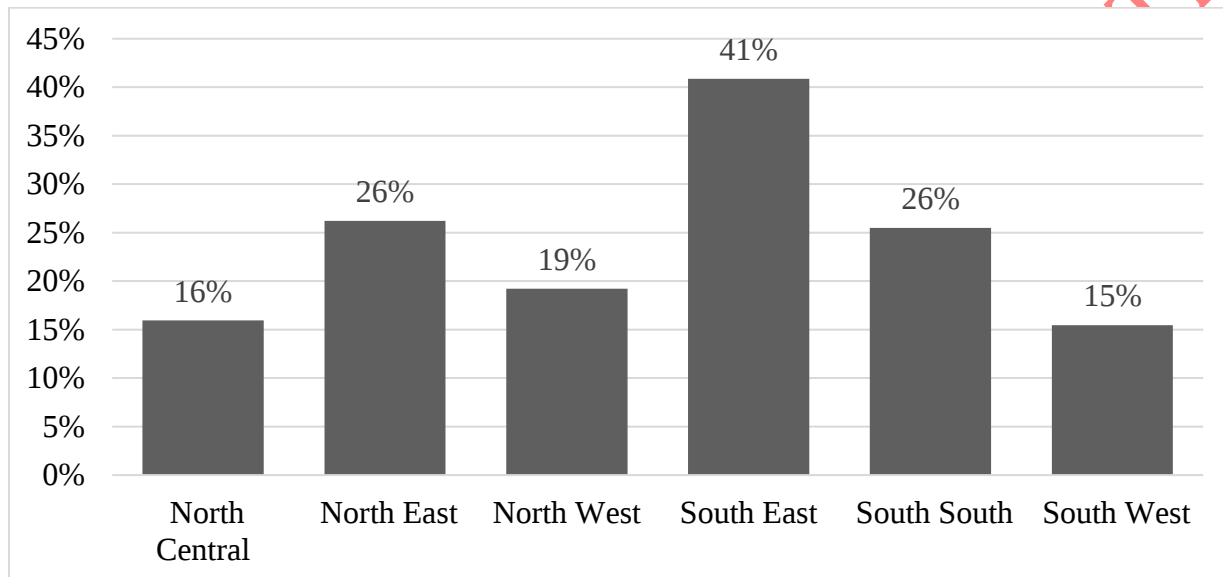
Figure 6: Consumption of different food groups, by income group



Source: Authors' computation

Figure 7 shows the estimated food gap by geo-political zone. The criteria for measuring food gap is food consumption equivalent to less than 2,100 kcal/AE/day. On average, 22% of Nigerian households are estimated to experience a food gap. The results also show a significant regional variation. For this data survey period, while the South West and North Central regions have the lowest food gap at 15% and 16% respectively, the South East region has the highest food gap at 41%. There is a need for further investigation to ascertain the situation of food security in the South East during the survey period.

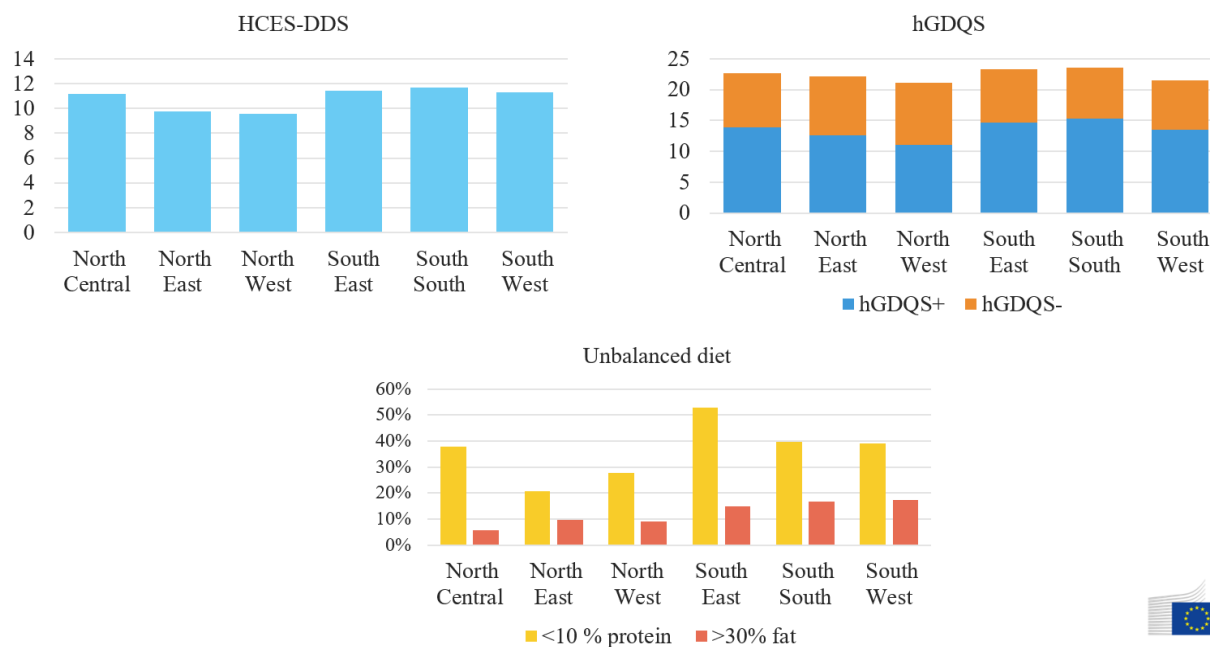
Figure 7: Estimated food gap, by geo-political zones



Source: Authors' computation

Figure 8 shows indicators of diet quality. On average, the HCES-DDS (diet diversity) score of 11 out of 16 shows fair level of diet diversity. However, the hGDQS score of 22 out of 45 shows that the average diet quality is low. Meanwhile, about 85% of households consume less than 400 grams of fruits and vegetables daily (in line with WHO and FAO recommendations). Less than 44% of households consumes a balanced diet, 37% obtain less than 10% of their energy intake from protein while 13% obtain more than 30% of their energy intake from fats and oils. At the regional levels, Figure 8 shows that southern households have the highest HCES-DDS and hGDQS scores relative to northern households. This indicates that the latter households consume less diverse and less quality diets, particularly due to the lower intake of healthy food groups. In terms of unbalanced diet, the South perform worse than the North, due to the intake of fat and protein outside the recommended thresholds of the WHO. Compared to northern households, larger share of households in the South obtains less than 10% of their energy intake from protein and more than 30% from fats.

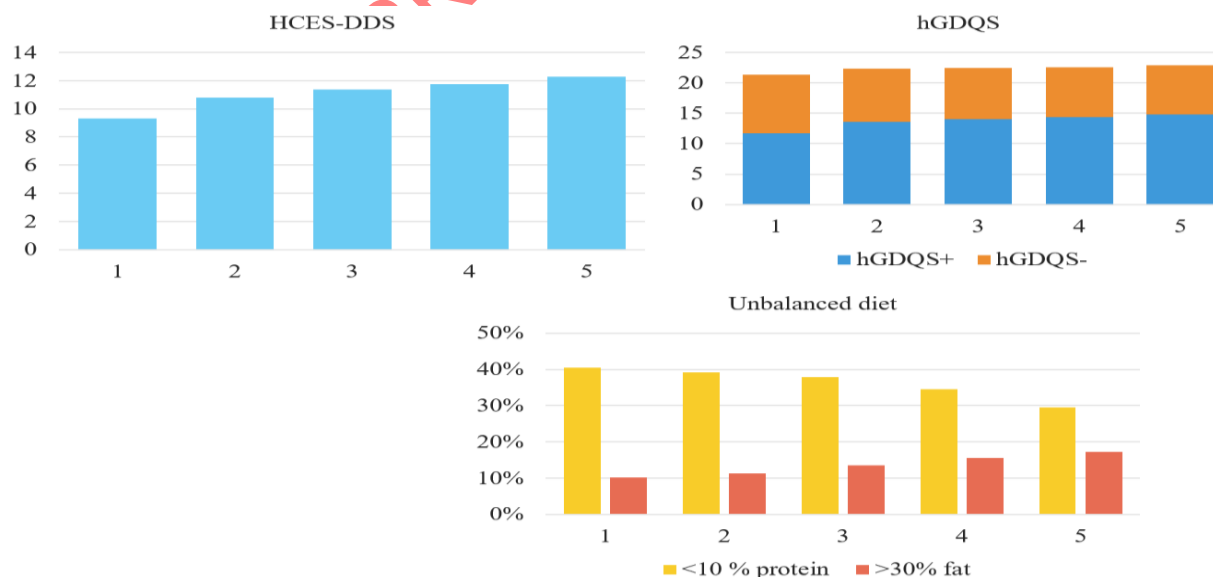
Figure 8: Diet quality and diversity, by geo-political zone



Source: Authors' computation

As shown in Figure 9, the diet quality and diversity tend to increase as the income level increase. This is a reasonable conclusion as higher income enables households to improve the diversity and quality of their diet. However, income level is found to be inversely related to balanced diet. As the income level increases, more households consume more fat and less proteins as recommended by WHO.

Figure 9: Diet quality and diversity, by income group

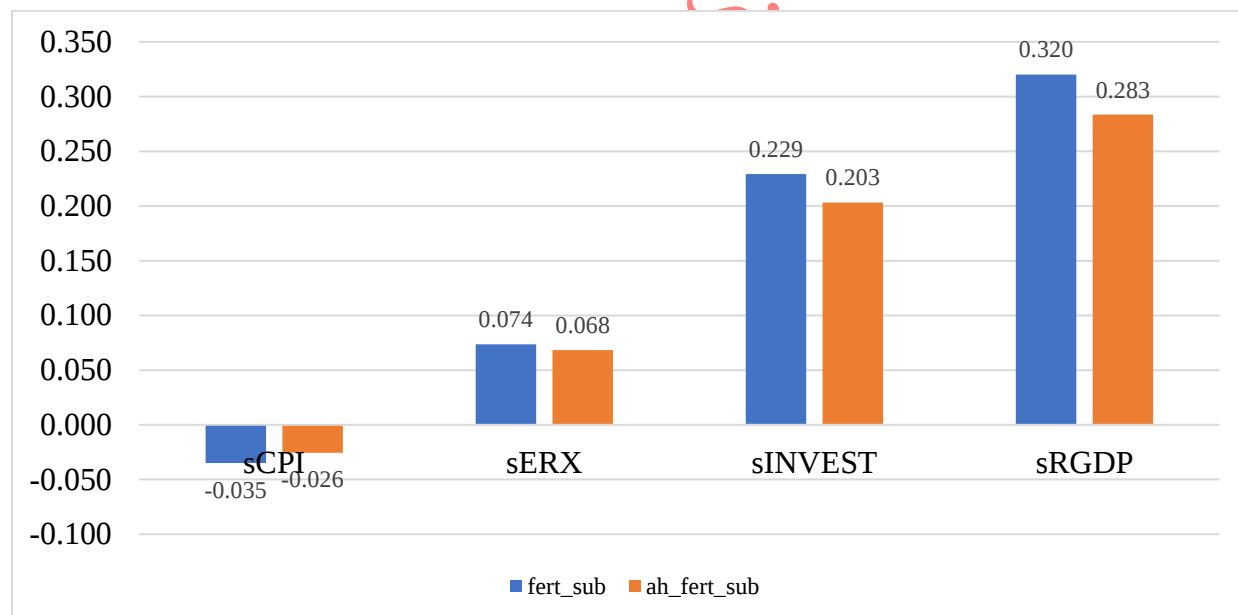


Source: Authors' compilation

5.2 Impacts of government policies to enhance food and nutrition security in Nigeria

This section presents the results of the CGE model which analyses the economy-wide impacts of public policies to enhance food and nutrition security. As noted earlier, this version of the paper only presents the results of two scenarios – scenario 1 (increasing the productivity of key crops through improved access to inputs (fertiliser) and scenario 3 (improving household access to fertiliser to enhance production for own consumption). The macro-level results show that both policy scenarios lead to a decline in the consumer price index (CPI), with scenario 1 having a larger proportional decline in CPI (Figure 10). The decline in CPI is driven by the lower production costs associated with the improved efficiency of inputs induced by the fertiliser subsidy. The disproportionate effect in scenario 1 is largely due to the large scope of the efficiency improvement compared to scenario 3 where this is limited to household production for own consumption. Due to the policy interventions, total investment expenditure increases as the lower production costs stimulate investment in key economic sectors. As a result, real GDP increases in both scenarios (by 0.32% and 0.283% under scenarios 1 and 3 respectively). The policy intervention implemented at a larger scale (scenario 1) has a larger effect on real GDP than scenario 3, which is limited to household production.

Figure 10: Macro-impacts of policy scenarios, (changes from the baseline, %)

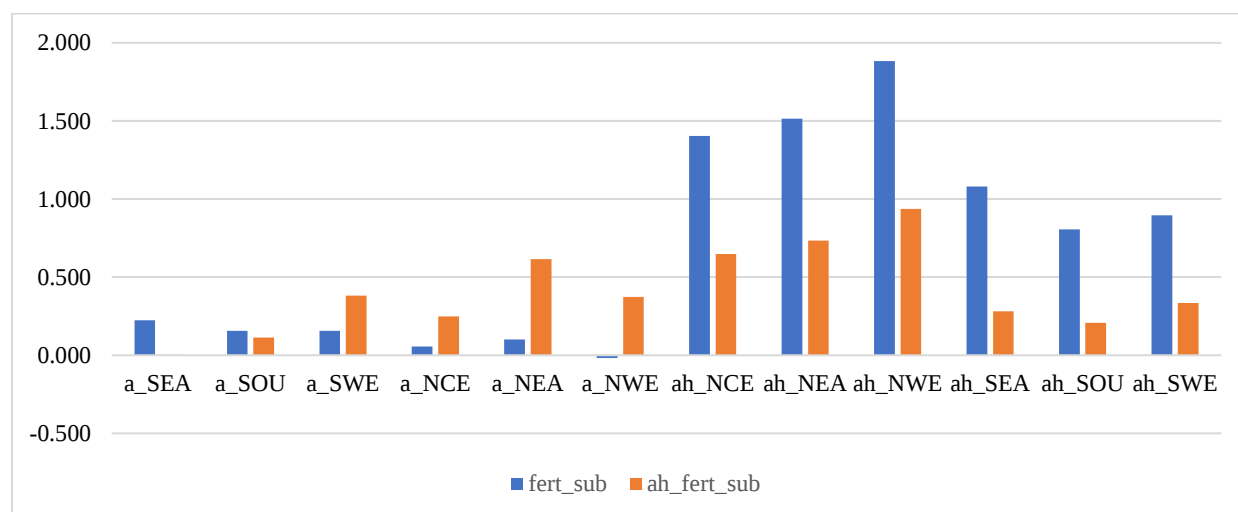


Source: Authors' computation

Figure 11 also presents the domestic production by regional agriculture sector. At the regional level, agriculture output increases for all regions except the North West for scenario 1. The regional effects on agriculture output vary based on the scenario. Under scenario 1, the agriculture output of the South East, South South, South West, North East, North Central increase by 0.224%, 0.156%, 0.156%, 0.101% and 0.057% respectively. However, the output of North West declines by 0.017%. Under scenario 3, the output of North East, South West, North West, North Central,

South South and South East increase 0.615%, 0.382%, 0.374%, 0.248%, 0.114% and 0.001% respectively. For household agricultural production output, scenario 1 has a proportional larger impact than scenario 3. Under scenario 1, the North West (1.883%), North East (1.516%) and North Central (1.404%) have the largest impact on household production output.

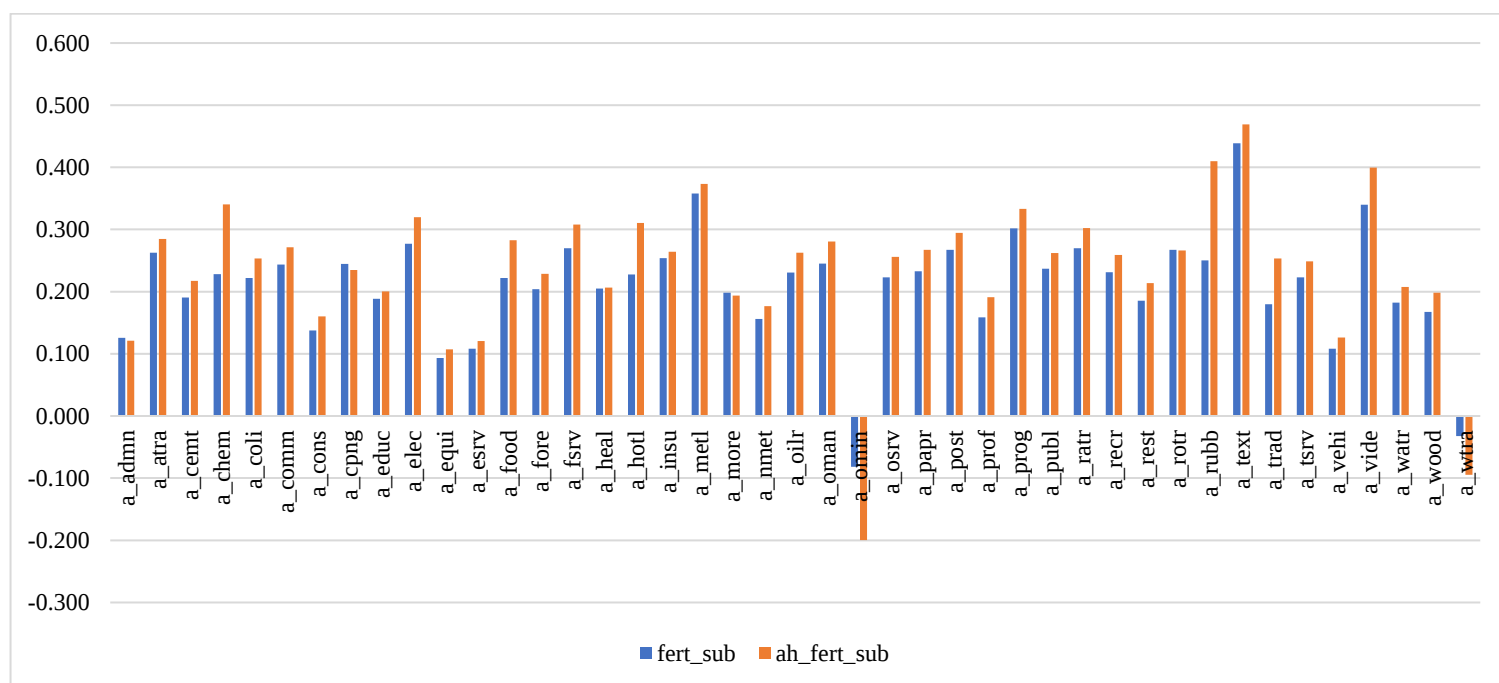
Figure 11: Impacts on regional agriculture activities, (changes from the baseline, %)



Source: Authors' computation

The policy interventions will have effects beyond the agriculture sector (Figure 12) via linkages with other sectors as well as the re-allocation of production resources. Overall, there is a positive effect on all non-agriculture sector except quarrying and other minerals sector and water transport sector, but an obvious fact from the results is that scenario 3 has a relatively larger effects on non-agricultural output than scenario 1. Among the non-agriculture sector, the largest impact is felt in the textile sector, with output increasing by 0.439% under scenario 1 and 0.469% under scenario 3. The motion pictures/sound recording and music production sector will also have output increase by 0.340% and 0.400% under scenarios 1 and 3 respectively. Similarly, the output of the basic metals, iron and steel sector will increase by 0.358% and 0.373% in both scenarios respectively. On the negative side, the output of the quarrying and other minerals sector will decline by 0.082% and 0.200% in both scenarios respectively and that of the water transport sector will decline by 0.032% and 0.095%.

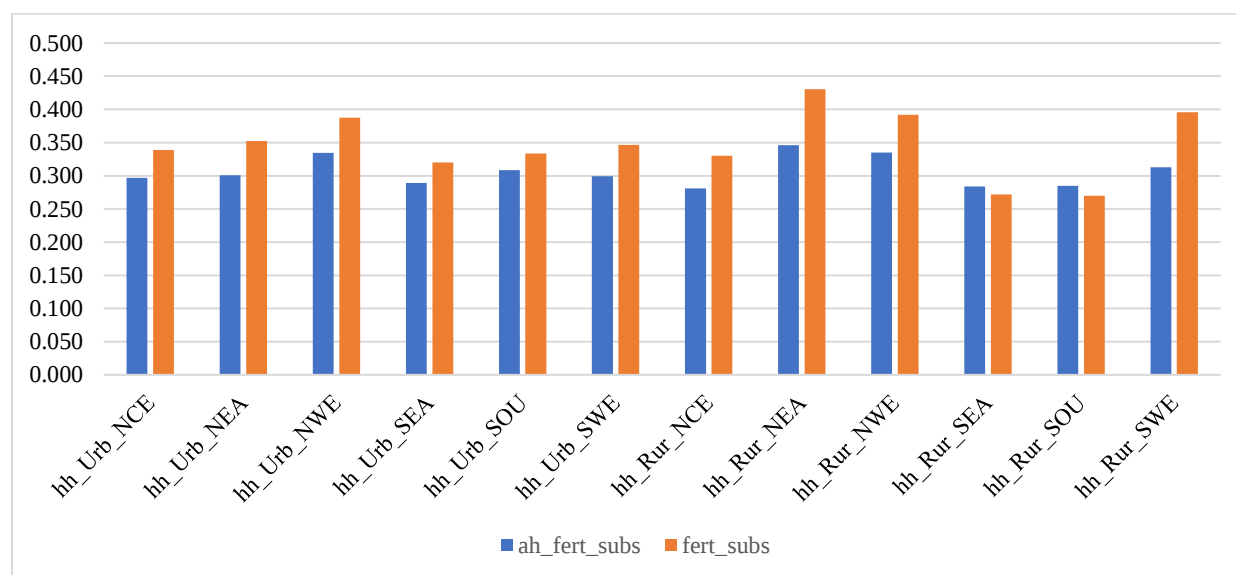
Figure 12: Impacts on outputs of non-agriculture sector (changes from the baseline, %)



Source: Authors' computation

The impact of the policy interventions on household income is presented in Figure 13. The implementation of the fertiliser subsidy increases the demand for production factors to stimulate increase in production. The increased demand for production factors results in increase in the price of the factors, contributing to an increase in household income. The results shows that the fertiliser subsidy for the overall economy has a much larger effect than the fertiliser subsidy targeted at home production for own consumption. The subsidy can stimulate a much higher demand in production factors, thereby having a disproportionate higher effect on production factors. Household income increases highest for rural North East households (0.431% and 0.345%), followed by rural South West households (0.396% and 0.313%) and then North West households (0.392% and 0.335%). These three household groups also have the highest increase in household income in urban areas. The household groups that experience the lowest income growth are rural South East (0.272% and 0.284%) and rural South South households (0.270% and 0.285%).

Figure 13: Impact on household income, (changes from the baseline, %)



Source: Authors' computation

The increase in household income leads to increase in domestic demand for commodities. As shown in Figure 13, the domestic demand for all commodities increase in both scenarios except for sorghum, other cereal and quarrying and other minerals. Domestic demand for sorghum increase by 1.927% under 1 scenario but decline by 0.474% under scenario 3. The increase in domestic demand is higher under scenario 1 compared to the scenario 3. This may be due to the scale of the impact of the overall fertiliser subsidy compared to the subsidy targeted at household farmers. Figure 14 shows the impact on food production. Overall, food consumption increases for all household categories, with rural North East (0.409%), South West (0.386%) and North West (0.387%) recording the largest increase in food consumption.

Figure 13: Impact on domestic demand for commodities, (changes from the baseline, %)

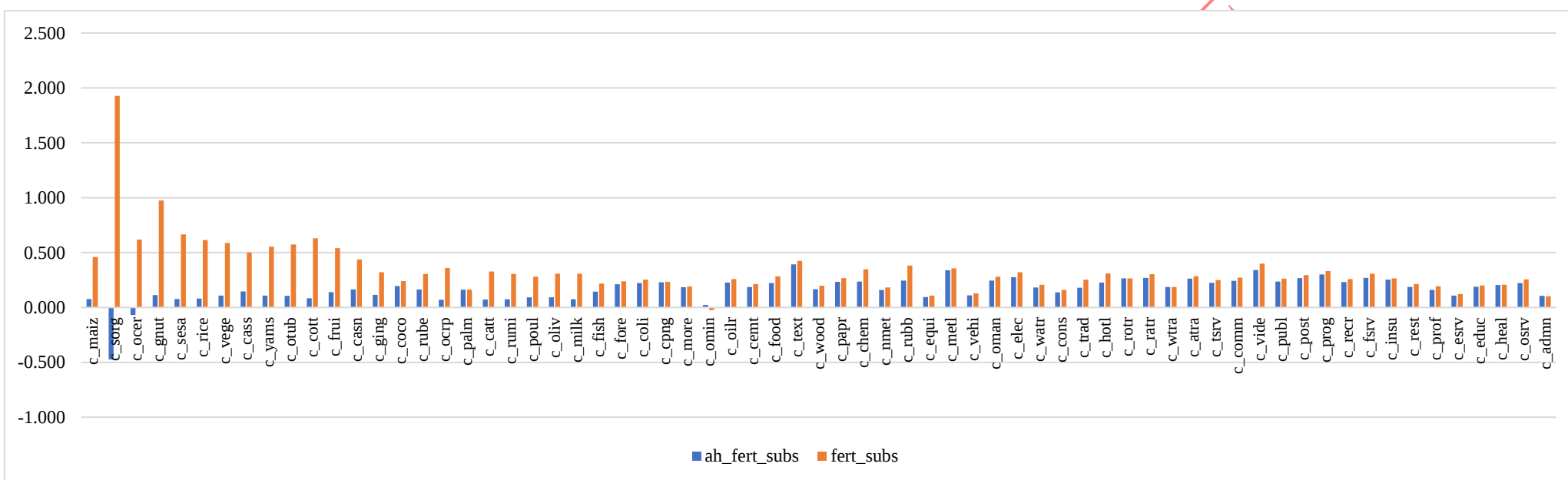
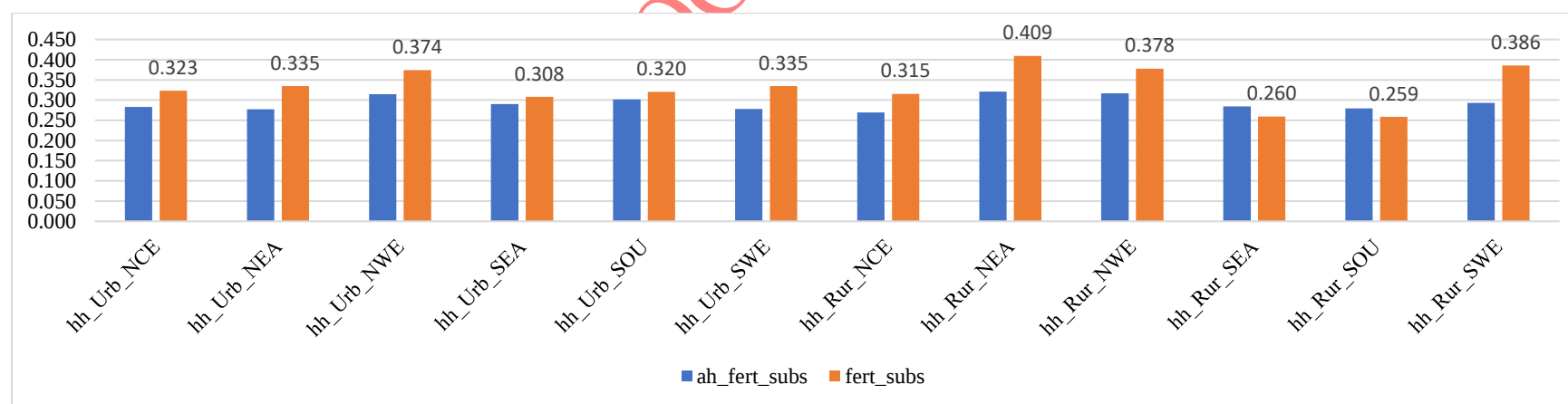


Figure 14: Impact on food consumption, (changes from the baseline, %)



Source: Authors' computation

6. Conclusion

This is a work-in-progress paper to examine the impact of the results of this paper show the relative effectiveness and impacts of policies to improve food and nutrition security in Nigeria. The paper analyses survey data to understand the food consumption pattern of Nigerian households, across regions and income level as well as the diet quality and diversity. A macroeconomic model is also employed to analyse the impact of specific policies. The DEMETRA CGE model is linked to Nigeria's SAM to analyse the macroeconomic and distributional impact of the policies. The paper is still ongoing as several scenarios are yet to be taken into consideration, and the CGE results will be further linked to a micro-model that links changes in food consumption to diet and nutrition indicators.

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Appendix: Overview of food and nutrition security policies in Nigeria

Name of programme	Start year	Areas of intervention	Key actors	Funding sources	Evidence of impact	Challenges
National Food Security Programme (NFSP)	2008	Broadening local production of food, minimizing food importation, enhancing agricultural output, increasing farmer's income	Federal Ministry of Agriculture and Water Resources	-	-	Weak infrastructure, limited extension services, constrained access to contemporary farming inputs and technologies
Agricultural Transformation Agenda (ATA)	2011	Strengthening the nation's agricultural sector, expanding agricultural output, boosting food sufficiency, generating employment opportunities	Federal Ministry of Agriculture and Rural Development	-	-	Inadequate credit access for farmers and agribusinesses, weak rural infrastructure, increasing insecurity in the country
Anchor Borrowers' Programme (ABP)	2015	Expanding credit and farm finance, offering agricultural inputs in cash and kind support for small-scale farmers	Central Bank of Nigeria	-	-	Farmer's inability to pay back the loans, funds mismanagement, corruption, issues of funds diversification
Agricultural Sector Food Security and Nutrition Strategy (2016-2025)	2016	Improving food security at the household and national levels, increasing access to safe and nutritious food, reducing malnutrition	Federal Ministry of Agriculture and Rural Development	Government budgets, donor agencies, private-sector partnerships	Some progress in crop production and biofortification	Poor infrastructure, limited fiscal space, inefficient coordination, effects of climate change
National Policy on Food and Nutrition in Nigeria (2016 update)	2016	Reducing hunger and malnutrition, improving nutritional knowledge, promoting food safety, enhancing household food security	Federal Ministry of Budget and National Planning	Government allocations, international aid	Some progress in school feeding programs and food fortification	Limited funding, weak infrastructure, poor coordination among sectors, scarcity of qualified nutritionists, cultural barriers
National Social Investment Programme (NSIP)	2016	Addressing poverty and hunger through diverse social assistance projects	Federal Ministry of Humanitarian Affairs, Disaster Management and Social Development	-	-	Insufficient funding, mismanagement
Home-Grown School Feeding Programme (HGSFP)	-	Expanding primary school enrollment and attendance, increasing children's nutritional outcomes	Federal Ministry of Humanitarian Affairs, Disaster Management and Social Development	-	-	Insufficient funding, mismanagement, poor nutritional quality and quantity of meals
National Strategic Plan of Action for Nutrition (NSPAN) 2021-2025	2021	Improving nutrition through healthcare services, particularly focusing on maternal and child nutrition and preventing nutrition-related non-communicable diseases	Federal Ministry of Health	Government resources, international donors	-	Widespread food insecurity, weak rural health infrastructure, insufficient health funding, poor coordination among stakeholders
National Multi-Sectoral Plan of Action for Food and Nutrition (NMPFAN) 2021-2025	2021	Improving the nutritional status of all Nigerians, particularly vulnerable groups, through multi-sectoral interventions	Federal Ministry of Finance, Budget and National Planning	Government budget, development assistance, donations, other sources	Progress in improving breastfeeding rates and integration of nutrition into primary health care	Limited funding, coordination, infrastructure, and cultural challenges, regional disparities in food access, insecurity

Source: Authors' compilation