

## **Determinants of Food Security In Sub-Saharan Africa: Effect Of ICT And Financial Improvement**

**By**

**Adeyinka Emmanuel Adeyemi**

School of Economic Sciences, North-West University, Vanderbijlpark, South Africa.

[yomicrown2002@gmail.com](mailto:yomicrown2002@gmail.com)

<https://orcid.org/0000-0002-0737-1248>

**And**

**Olukayode Amos Odefunsho**

Department of Accounting, School of Management Science, AbdulRaheem College of Advanced Studies,  
Igbaja, Kwara State.

Corresponding Authors E-mail: [Olukayodeodefunsho12@gmail.com](mailto:Olukayodeodefunsho12@gmail.com) +2347031191006.

### **ABSTRACT**

*Several issues have been identified as reasons for food security in Sub-Saharan African countries but the influence of information and communication technology (ICT) as well as financial improvement on food security cannot be ascertained. Sequel to this, the study investigates the influence of ICT and financial improvement on food security. The study selected 39 sub-Saharan African Countries to carry out the investigation. The study employs System GMM to take care of unobserved heterogeneity and potential endogeneity of the exogenous variables. Variables such as fixed broadband subscriptions, fixed telephone subscriptions, mobile cellular subscriptions, and secure internet servers are used to capture ICT; domestic credit to the private sector is used to capture financial improvement; while the food production index is used to capture the food security using data from year 2000 to 2020. The empirical results show that fixed telephone subscriptions is positive and statistically influence the food production index (food security), while its interaction with domestic credit to the private sector also significantly influences food security. This shows that the effect of change in the fixed telephone subscriptions has a positive impact on food security sequel to an increase in domestic credit to the private sector. The same can be said of mobile cellular subscriptions, the effect of change in mobile cellular subscriptions has a positive impact on food security as a result of an increase in domestic credit to the private sector. It is recommended that telephone and mobile cellular subscriptions should be improved to improve food production because information can easily be disseminated via the medium. Domestic credit to the private sector should also be increased in other to finance and improve food production.*

**Keywords:** Information & Communication Technology, Financial Improvement, Food Security.

## **I**

### **Introduction**

The Agricultural sector is one of the most essential sectors of the development of countries' economies in the provision of raw materials, employment, food security, and enhancing investments (Bello et. al. 2024). The sector has been playing its role in improving economies of many nations over the decades. This is the sequel to its provision of employment, provision of food to the populace, and contribution to the balance

of payment of the nation to mention but a few. For several decades in the globe, agriculture has been the main source of livelihoods for the developing world subsisting for a significant portion of their nations. It has been the key sector providing employment opportunities for nearly seventy percent of the rural population and contributing the largest share to their national gross domestic product (GDP) (Abegaz, 2017).

Sub Saharan Africa is afflicted by many forms of poverty. Human Development Index scores in most countries of the region have stagnated or declined since 1990, leaving this region as the poorest in the world (Bello & Sagagi, 2017). Indeed, 28 of the 31 low human- development countries are in Sub Saharan Africa (UNDP, 2014). It is generally believed that any nation that desire to reduce the incidence of poverty on its citizens should improve the agricultural sector, in order to achieve food security. Globally, food and nutritional insecurity remain an important matter of concern for both developed and developing nations (Bashir et al., 2012; Todaro & Smith, 2015; Gwanda et al., 2020). Importantly, food insecurity is directly related to poverty at various levels (FAO, 2013). According to the Food and Agriculture Organization (FAO, 2010), the decline in hunger the world has been enjoying over the past decades due to doubling world food production was at an end, in that the absolute number of undernourished people continues to rise, albeit slowly. Currently, more than 820 million people around the world are undernourished, thus posing a challenge to realizing the zero hunger (Goal number 2) target of Sustainable Development Goals by 2030 (FAO, 2019). The report further revealed that about 2 million people in the world experience moderate or severe food insecurity which puts them at a greater risk of poor health and malnutrition. Globally, the lack of regular access to nutritious and sufficient food remains the major cause of malnourishment. Bashir et al.

(2012) reported that malnourishment is an indication of food insecurity existing when the caloric intake of a household goes below the minimum dietary energy requirement. Food security is achieved at individual, household, national, regional, and global levels, when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 2019). Some factors have been identified as reasons for food insecurity in Sub-Saharan African countries. As cited by Abegaz (2017), “Limited rural development, insecurity, weak infrastructural development of power, road, and market access aggravate food insecurity in SSA. Weak government policy that adversely afflicted the agricultural sector is another factor contributing to food insecurity in the region. Poor health condition also poses its impact on food insecurity. The region is also characterized by the prevalence of contagious and fatal but preventable diseases of HIV/ AIDS, malaria, tuberculosis (TB), and other diseases. This reduces rural labor participation in agriculture and of-farming activities contributing to food insecurity. Moreover, rising global commodity prices and climate change will likely further exacerbate food insecurity in the region. Agricultural productivity in SSA, as measured by grain yield, is only about 40% of the rest of the world’s developing countries, and the gap has widened over the years (Tobin, 2009; Ingram et al, 2008).

In recent times, major agricultural interventions and efforts have been geared toward increasing productivity in SSA (Usman & Olagunju, 2019). For example, the development, dissemination, and adoption of improved crop varieties and fertilizer technologies have been widely promoted across the region (Abdoulaye et al. 2018; Ogunniyi et al. 2015; Lunduka et al. 2017). However, low productivity still characterizes the agricultural sector in the region (FAO 2004). Apparently, interventions may be significant in increasing the level of outputs in a certain context, but such increments are prone to inefficiency, especially when the available technology is not efficiently utilized. As such, it could be argued that it is quite more cost-effective to exterminate existing inefficiency than to introduce interventions as a means of increasing agricultural households' outputs (Tefaye & Beshir 2014).

Several studies on the causes of food security/insecurity concentrated much on micro-socioeconomic factors (Godrich et al, 2017; Abegaz, 2017; Opaluwa et al, 2018; Gwada et al, 2020; Kabir et al, 2020; Hakim et al, 2021; Nour & Abdalla, 2021; Sarkar et al, 2021; Ingutia & Sumelius, 2022), the nutritional factors: (Maitra & Rao, 2018; Opaluwa et al, 2019), rather than the macroeconomic factors.

Godrich et al (2017) consider factors such as price, promotion, quality, location of outlet, and variety as determinants of food security. While Abegaz (2017) sees rain shock, crop shock as well as extension workers visit and income as

factors that affect agricultural productivity, Opaluwa (2018) examines education, households' size, farm size, and household income as factors that affect food security. Furthermore, most studies consider factors such as women farmers, access to irrigation, effect of cooperative, distribution channel, household size, land size, gender as determinants of food security of agricultural productivity. Beside the fact that the aforementioned factors are microeconomic variables, they are also socio-economic variables. With this, one cannot say as per the factors that determine the food security or food productivity in an economy at large. This leaves us with many questions: what are the determining factors that affect food security in Sub Saharan Africa? What is the role of financial improvement on food security? Can ICT influence food security in Sub Saharan African Countries?

## **II. Objective of the Study**

The overall objective of this study is to investigate the effect of ICT and financial improvement on food productivity/security. The specific objectives are stated thus:

To investigate the influence of ICT on food productivity/security;

1. To examine the effect of financial improvement on food productivity; and
2. To examine the combine effect of ICT and Financial improvement on food security in Sub Saharan Africa countries.

## **III. Relevant Literature and Hypothesis Development**

This section looks into the concept of food security, the relevant theories, as well as the empirical literature in order to connect food security to technology and financial improvement.

**a. Concept of Food Security.**

Food security concept is believed to have originated three decades ago in the mid-1970s in the first world food conference and was narrow in its coverage and definition. This concept initially paid attention to the national and international level and was defined from the perspective of the food supply with special attention to stable food price and food availability (Young et al, 2001; Abegaz, 2017).

Food and Agriculture Organization (FAO) analysis focused on food access, leading to a definition based on the balance between the demand and supply side of the food security equation (Nour & Abdallah, 2017). Thus, it is meant to ensure that all people at all times have both physical and economic access to the basic food that they need (FAO, 1983). The widely accepted definition of World Food Summit (1996) indicates that 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. This widely accepted definition reinforces the different dimensions of food security and includes food access, availability, food use and stability: food availability: the availability of sufficient quantities of food of appropriate quality, supplied

through domestic production or imports (including food aid); food access: access by individuals to adequate resources (income) for acquiring appropriate foods for a nutritious diet; utilization: utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. This brings out the importance of non-food inputs in food security; stability: to be food secure, a population, household or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity)".

**b. Determinants of food security**

Mota et al, (2019) assess food insecurity and its determinants in the rural households in Damot Gale Woreda, Wolaita zone, southern Ethiopia. They use cross-sectional household survey and use primary data from 155 randomly selected households and use HFIAS and use bivariate and multivariate logistic regression analyses. The results of the study revealed that the majority (71.6%) of rural households in the study area were food insecure. The HFIAS shows that HH cannot cover the required daily food from the production generated from their agriculture as well as other activities. Households with large family size, households who cannot read and write and old household heads are more likely to be food insecure than their counterparties. Similarly low land size, lack of livestock, not having confidence to overcome food insecurity of

HH, borrowing money from informal rural money lenders and not using farm input by the HH are significantly associated with food insecurity. Finally, promoting income-generating activities, enhancing the micro-financing efficiency, initiating family planning, strengthening the inter resettlement programs, enhancing saving habits, creating employment opportunities at local areas to deter unskilled labor migration on-farm diversification”.

Abegaz (2017) looks at the position of food security and also investigates the determinants of food security in Ethiopia by employing binary multivariable logistic regression. Conducting Ethiopia Rural Household Survey, pooled data were gathered. The results of the study show that most households are not secured in terms of food and also, food security is significantly determined by rain, income, and region of the households.

Ingutia and Sumelius (2022) investigate the determinants of food security by focusing on women farmers in Kenya. The study also looks into the determinants of access to irrigation technology which can also influence food security. The study employs regression analysis using logistic, probit and linear endogenous treatment model to carry out its investigation. The results show that women who are members of cooperative have access to credit which helps in improving food security. The study exposes the fact that women who are not member of cooperative determine less food security compare to those who are cooperative members. Extension

services is determining factor of access to irrigation.

Sarkar et al (2021) examined the determinants of food security by considering effective utilization of food, food availability, and food access during the COVID-19 pandemic. The quantitative data used in this research were collected from a survey covering the agricultural food supply industry in China (Shaanxi Province). The survey was conducted from November to December 2020. The core analytical assumptions were made by employing exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modeling (SEM). It was found that the determinants of the effective utilization of food were positively related to the determinants of food access and food availability, and the determinants of food availability were positively related to the food access determinants. Nour and Abdalla (2021) paper focuses on the determinants of food security in Kassala state using the measurement of Household Food Insecurity Access Scale (HFIAS), using new primary data from a food security household survey in Kassala state and using the multinomial logistic regression analysis and both ordered logit and ordered probit regression to examine the determinants of food security. The results show that family-owned production significantly determined the food insecurity. It is revealed that other factors that affect household food insecurity include improvement in agricultural services, marketing, banking services, and road feature. Hakim et al (2021) measure technical efficiency

of rice production on food security and its determinants using two limit tobit. The technical efficiency is measured by using data envelopment analysis (DEA). The results show that the technical efficiency of rice farming is very low in East Java. Government assistance, irrigation, and extension have a significant effect on technical efficiency. Meanwhile, membership of farmer organization has no effect on technical efficiency. Around 69% of farmers can be categorized as food secure households. The estimation of logit regression shows that household size, income, land size, education, age, and gender significantly influence food security in East Java. Meanwhile, credit and technical efficiency did not have any significant effect.

Kabir et al (2020) assessed the determinants of food security among forest-based households in Oyo state, Nigeria by obtaining data from 240 respondents. Data obtained were subjected to descriptive statistics and logit regression model. The results revealed that most respondents produced food by themselves, some of them take two square meals per day and some skip meals as a coping strategy due to insufficient food. The logistic regression model reveals that sex, household size, household's head income and land ownership have significant effects on rural household food security in the study area.

Gwada et al (2020) examine the determinants of food security among smallholder soybean households in Butere Sub-County, Kenya. The study adopted the exploratory research design. A multi-stage sampling procedure was used to

select a sample of 201 respondents. Cross-sectional data were gathered through face-to-face interviews using pretested semi-structured questionnaires and analyzed using an ordered logistic regression model. Household Food Insecurity Access Scale was used to measure and categorize the soybean household food security status. The results revealed that the household food security status differed across soybean households and was greatly influenced by interplay of socio-economic, market, and institutional factors. Age of the household head negatively influenced food security, whereas the level of soybean commercialization, education, livestock units, network density, extension visits, and credit access were positively associated with household food security.

Danso-Abbeam (2022) examines household food security and its determinants in the rural areas of Southern and Northern provinces of Rwanda. Using cross-sectional data collected from 534 farming households, the study estimated household food security status by Food Consumption Score (FCS) and Food Insecurity Experience Scale (FIES) and applied ordered Probit model to identify drivers of household food security. The results indicate that a significant proportion (74.4%) of households had an acceptable FCS, but 36.52% of the farming households experienced moderate and severe food insecurity when assessed with FIES. Ownership of livestock was identified as a key determinant of food security using both metrics,

which affirms the importance of combating hunger and food insecurity in Rwanda.

Obayelu (2012) analyzes the determinants of household food security status in the North–Central Nigeria. This study employed a cross-sectional survey of 396 households in North–Central Nigeria and used multivariate-ordered logit analyses. The results from the ordered logit revealed that geographical location, marital status, gender of the household head, household size, food dietary diversity, total household expenditure, level of education, occupation of household head, household dependency ratio, social capital, and agricultural land-holding size significantly affect households' food security status. Oke (2015) examines the determinants of national food security in Nigeria. The study found that the various problems encountered by the food sector in the economy include policy ineffectiveness, high cost of production, high exchange rate, increasing population, etc. These factors cause inflationary pressures on food prices, and they are the reasons why food security in Nigeria has worsened in the country over the years. Muktar (2011) investigates the determinants of food insecurity in Nigeria, using an application of the binary choice modeling technique; it estimates the likelihood of food insecurity among some selected households in Kano State of Nigeria using the binary choice modeling technique, specifically the logit. The result obtained showed that household income, educational qualification, gender, size of household, assets owned by households, and

access to credits are among the major determinants of food insecurity. Amaza et al. (2006) identify and analyze food security measures in Borno State, Nigeria, using a multi-stage sampling technique and using the logit model method as analytical techniques for the study. Major determinants of this food insecurity factors are, household size, gender, educational level, farm size and type of household farm enterprise” (Nour and Abdalla, 2021).

### **c. ICT and Food Security**

ICT has been playing a developmental role in most economies of the world especially developed economies and in recent years, this impact is being felt in African economies. ICT played an important role in Africa's development process. However, incorporating ICT to a sector like agriculture, which contributes immensely to the economic development in Africa, clearly defined ideas are required (Ejemeyovwi, 2021).

Syien and Raj (2015) researched to determine the amount of access to and use of ICTs among farmers in the Indian state of Meghalaya. The majority of the farmers had cell phones, as well as television and radio, according to the data. The mobile phone was the most commonly used ICT. Farmers utilized mobile phones extensively for social communication, contacting middlemen for crop sales, and contacting specialists on a real-time basis for agricultural recommendations.

Chavula (2014) studied the role of ICT in agricultural production in Africa from 2000 to 2011 using panel data from 34 African countries. The study found that ICT plays a significant role

in enhancing agricultural production. However, the study further concluded that mobile phones have relatively fewer roles; yet, main lines contribute significantly to agricultural growth. Likewise, Namubiru, Ngaka, and Picho (2018) examined the effect of ICT on household food security in Uganda giving special reference to Acoholi sub-region. Cross-sectional and descriptive design was utilized, and the results indicated an average of 18.2% of the households in Acholi sub-region used ICT for food security while 31.9% did not use ICT for food security. Although Chavula (2014) found that mobile phones have less role, Namubiru, Ngaka, and Picho (2018) found the complete opposite as the majority of the population do have access to food through mobile phones”.

Olaniyi and Ismaila (2016) used a binary logit regression to analyze ICT usage and household food security status of maize crop producers in Ondo State, Nigeria. Cell phones, radio, and television were found to be the most widely used ICT methods for getting information on food security, according to the study. Household size, involvement in social organizations, farm size, cell phone usage, and impression of the contribution of ICT usage were shown to have substantial effects on household food security.

Ejemeyovwi et al. (2021) investigate the relationship between household ICT usage and food security in Nigeria, utilizing logit regression as the empirical analytic method. According to the findings, ICT use in male households has a statistically significant and favorable relationship

with food security. However, there is a negligible and negative relationship between food security and female families. It was also shown that among male household users, a 1% increase in ICT usage results in an increase in food security in Nigeria.

Anser et al. (2021) use a system Generalized method of moments (GMM) technique on panel data to explore the influence of the relationship of governance and information and communication technologies (ICT) adoption on food security in West Africa. The findings demonstrate that effective government and effective anti-corruption control may improve food security. It's also been shown that increased ICT use can help with food security. The interplay of ICT and government effectiveness has a favorable impact on food security, whereas the interaction of ICT and corruption control has a positive impact on food security.

Much literature has looked into the impact of financial development on growth and it is revealed that financial **Model** development can impact positively on growth. There is also the tendency that financial improvement can impact food security.

#### **IV. Methodology**

##### **a. Specification**

The study involved panel data from 39 Sub-Saharan African countries. Drawing vision from the empirical work of Anser et al (2021), the model was modified and the estimated models are specified in the Equations below:

$$\log fpi_{it} = \alpha_0 + \alpha_1 \log gdp_{it} + \alpha_2 \log infl_{it} + \alpha_3 \log rint_{it} + \alpha_4 \log domcre_{it} + \alpha_5 \log fixb_{it} + \alpha_6 \log fixtel_{it} + \alpha_7 \log mobcel_{it} + \alpha_8 \log secint_{it} + e_{it} \text{ ----- Eq 1}$$

Where,  $fpi$  is the food production index;  $gdp$  is the gross domestic product per capita;  $infl$  is the rate of inflation;  $rint$  is the real interest rate;  $domcre$  is the domestic credit to the private sector;  $fixb$  is fixed broadband subscriptions;  $fixtel$  is fixed telephone subscriptions;  $mobcel$  is mobile cellular subscriptions;  $secint$  is the secure

internet servers while  $\log$  represents natural logarithm of the variables. This study intended to employ System GMM to take care of unobserved heterogeneity and potential endogeneity of the exogenous variables. Therefore, equation 1 is transformed below:

$$\log fpi_{it} = \alpha_0 + \phi \log fpi_{it-1} + \alpha_1 \log gdp_{it} + \alpha_2 \log infl_{it} + \alpha_3 \log rint_{it} + \alpha_4 \log domcre_{it} + \alpha_5 \log fixb_{it} + \alpha_6 \log fixtel_{it} + \alpha_7 \log mobcel_{it} + \alpha_8 \log secint_{it} + e_{it} \text{ -- Eq 2.}$$

Where,  $\phi$  is the lag of food production index;  $\phi$  is the coefficient of food production index;  $\alpha_0$  is intercept;  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7, \alpha_8$  are the coefficients of independent variables; and  $e_{it}$  is the error term.

#### **b. Scope of Study**

Countries, to investigate the influence of ICT and financial improvement on food security in the

This study selected 39 Sub Saharan African region. The data year span from year 2000 to year 2020

#### **V. Analysis of Results**

This section deals with the interpretation and discussion of the findings obtained via the data. It

contains the descriptive statistics analysis, correlation analysis, and the generalized method of moment (GMM).

**Table1: Descriptive Statistics**

| Variable |         | Mean     | Std.Dev  | Min       | Max      | Observations |
|----------|---------|----------|----------|-----------|----------|--------------|
| fpi      | overall | 86.093   | 19.679   | 29.43     | 154.57   | N = 741      |
|          | between |          | 10.394   | 67.733    | 111.541  | n = 39       |
|          | within  |          | 16.788   | 35.888    | 133.64   | T = 19       |
| domcre   | overall | 17.257   | 16.460   | 0         | 106.260  | N = 788      |
|          | between |          | 15.561   | 3.876     | 81.966   | n = 39       |
|          | within  |          | 5.169    | -8.208    | 44.388   | T = 20.2     |
| infl     | overall | 9.146    | 27.267   | -9.616    | 513.906  | N = 786      |
|          | between |          | 11.929   | 1.619     | 60.675   | n = 39       |
|          | within  |          | 24.791   | -50.784   | 462.378  | T = 20.1     |
| rint     | overall | 8.190    | 10.889   | -60.781   | 52.437   | N = 560      |
|          | between |          | 6.698    | -0.285    | 32.545   | n = 32       |
|          | within  |          | 8.594    | -53.903   | 45.854   | T = 17.5     |
| gdppc    | overall | 1.518    | 4.439    | -36.556   | 28.676   | N = 818      |
|          | between |          | 1.449    | -0.858    | 5.837    | n = 39       |
|          | within  |          | 4.203    | -34.794   | 27.585   | T = 20.9     |
| fixb     | overall | 0.977    | 3.471    | 0         | 35.553   | N = 564      |
|          | between |          | 2.463    | 0.003     | 11.757   | n = 38       |
|          | within  |          | 2.249    | -10.380   | 24.774   | T = 14.8     |
| fixtel   | overall | 2.771    | 6.166    | 0         | 37.640   | N = 787      |
|          | between |          | 6.074    | 0.024     | 29.997   | n = 39       |
|          | within  |          | 0.877    | -3.526    | 10.414   | T = 20.1     |
| mobcel   | overall | 50.221   | 44.54    | 0         | 198.152  | N = 799      |
|          | between |          | 25.750   | 13.493    | 118.268  | n = 39       |
|          | within  |          | 36.539   | -35.994   | 133.804  | T = 20.4     |
| secint   | overall | 1612.068 | 16000.33 | 0         | 264256.6 | N = 421      |
|          | between |          | 8888.72  | 0.394     | 55466.78 | n = 39       |
|          | within  |          | 13320.14 | -53787.87 | 210401.9 | T = 10.8     |

**Source:** Researchers' Computation, 2024.

From the table above, the overall average value of the food production index (fpi) stood at 86.093; while that of domestic credit to the private sector (domcre), inflation rate (infl), real interest rate (rint), and gross domestic product per capita (gdppc), are 17.257, 9.146, 8.190, and 1.518 respectively. Also, ICT variables such as fixed broadband subscriptions (fixb), fixed telephone subscriptions (fixtel), mobile cellular subscription (mobcel), and secure internet servers

(secant) have overall average values of 0.977, 2.771, 50.221, and 1612.068 respectively.

Moreover, the table showed overall values at which the variables deviated from their mean values. The food production index (fpi) deviated by 19.679; domestic credit to private sector (domcre) by 16.460; inflation rate (infl) by 27.267; real interest rate (rint) by 10.889; and gross domestic product per capita (gdppc) by 4.439 respectively. While ICT variables such as

fixed broadband subscriptions (fixb), fixed telephone subscriptions (fixtel), mobile cellular subscription (mobcel), and secure internet servers

(secant) have overall deviation values of 3.470, 6.165, 44.54, and 16000.33 respectively.

**Table 2: CORRELATION MATRIX**

|        | fpi     | domcre  | infl    | rint    | gdppc   | fixb   | fixtel | mobcel | secint |
|--------|---------|---------|---------|---------|---------|--------|--------|--------|--------|
| fpi    | 1       |         |         |         |         |        |        |        |        |
| domcre | 0.1009  | 1       |         |         |         |        |        |        |        |
| infl   | -0.0301 | -0.1574 | 1       |         |         |        |        |        |        |
| rint   | 0.0868  | -0.2117 | 0.0559  | 1       |         |        |        |        |        |
| gdppc  | 0.0504  | 0.0739  | -0.2798 | -0.0744 | 1       |        |        |        |        |
| fixb   | 0.0439  | 0.6268  | -0.1636 | -0.052  | 0.1341  | 1      |        |        |        |
| fixtel | 0.1077  | 0.741   | -0.1756 | -0.0813 | 0.1679  | 0.9276 | 1      |        |        |
| mobcel | 0.2256  | 0.546   | -0.3033 | -0.2153 | 0.0691  | 0.5767 | 0.6241 | 1      |        |
| secint | 0.0238  | 0.046   | -0.0493 | 0.0075  | -0.0033 | 0.4396 | 0.2405 | 0.2713 | 1      |

**Source:** Researchers' Computation, 2024.

The table above is the correlation matrix for our series. It informs the study of potential relationships between food production indices and other variables. The table shows a positive relationship between food production index and domestic credit to private sector (domcre). Moreover, real interest rate (rint), gross domestic product per capita (gdppc), fixed broadband

subscriptions (fixb), fixed telephone subscriptions (fixtel), mobile cellular subscription (mobcel), and secure internet servers (secant) have positive relationship with food production index (fpi). However, there is a negative relationship between food production index (fpi) and inflation rate.

**Table 3: System GMM Estimates**

| Variables          | [1]                  | [2]                  | [3]                  | [4]                | [5]                | [6]                |
|--------------------|----------------------|----------------------|----------------------|--------------------|--------------------|--------------------|
| Constant           | 1.4347<br>(0.000)*** | 1.5857<br>(0.000)*** | 1.1596<br>(0.000)*** | 1.6703<br>(0.000)  | 2.1062<br>(0.000)  | 3.2163<br>(0.000)  |
| logfpiL1           | 0.6786<br>(0.000)    | 0.6290<br>(0.000)    | 0.7269<br>(0.000)    | 0.6133<br>(0.000)  | 0.4686<br>(0.000)  | 0.2548<br>(0.000)  |
| loggdppc           | 0.0215<br>(0.000)    | 0.0234<br>(0.000)    | 0.0235<br>(0.000)    | 0.0186<br>(0.000)  | 0.0143<br>(0.010)  | 0.0056<br>(0.001)  |
| loginfl            | -0.0091<br>(0.012)   | -0.0087<br>(0.014)   | -0.0093<br>(0.001)   | -0.0093<br>(0.002) | -0.0096<br>(0.002) | -0.0192<br>(0.000) |
| logrint            | 0.0081<br>(0.000)    | 0.0099<br>(0.001)    | 0.0133<br>(0.001)    | 0.0080<br>(0.032)  | 0.0130<br>(0.002)  | 0.0139<br>(0.007)  |
| logdomcre          |                      | 0.0238<br>(0.000)    | 0.0208<br>(0.000)    | 0.0198<br>(0.000)  | 0.0175<br>(0.000)  | 0.0645<br>(0.000)  |
| logfixb            |                      |                      | -0.0004<br>(0.940)   |                    |                    |                    |
| logfixtel          |                      |                      |                      | 0.0149<br>(0.000)  |                    |                    |
| logmobcel          |                      |                      |                      |                    | 0.0614<br>(0.000)  |                    |
| logsecint          |                      |                      |                      |                    |                    | 0.0013<br>(0.696)  |
| No of obs          | 316                  | 313                  | 247                  | 305                | 313                | 169                |
| Time Dummies       | Yes                  | Yes                  | Yes                  | Yes                | Yes                | Yes                |
| No of Instruments  | 159                  | 160                  | 158                  | 161                | 161                | 107                |
| Sargan/Hansen Test | 1.000                | 1.000                | 1.000                | 1.000              | 1.000              | 1.000              |

**Source:** Researchers' Computation, 2024.

The table 3 above shows the results of the dynamic model. The first column (1) shows the results of the effects of other macroeconomic variables such as lagged of food production index (logfpiL1), gross domestic product per capita (loggdppc), inflation rate (loginfl), and real interest rate (logrint) on food production index (logfpi). Column 2 shows the results of the effects of financial improvement on food production index along with other macroeconomic variables, while columns 3 to 6 show the measure of ICT and the interactions with financial improvement in determining the food productivity.

From the first model, it is shown that lag of food production index is positive and significant (0.6786) at the 1 percent level. It is also revealed from the results that gross domestic product per capita is positive (0.0125) and significant at the 1 percent level, while inflation rate is negative (-0.0091) but significant at the 1 percent level. However, real interest rate is positive (0.0081) and statistically significant at 1 percent level.

It can be observed from model 1 to 6 that the lag of food production index is positive and statistically significant across the model. This indicates that past food production index significantly influences the present food production. Likewise, the same can be said of gross domestic product per capita as it is positive and significantly influences the food production index across the models. However, inflation rate is negative across the models, but it is significant across the models. Moreover, real interest rate is positive and significant in all the models. This

shows the consistency of all these variables and their significance on the food production in the region.

The financial improvement is significant in all the models. This is evident with the coefficients of domestic credit to the private sector (0.0238, 0.0208, 0.0198, 0.0175, and 0.0645) which are positive and statistically significant. However, the coefficient of fixed telephone subscriptions (0.0149) is positive and statistically significant at the 1 percent level, while its interaction with domestic credit to the private sector is 0.0198. This shows that the effect of change in the fixed telephone subscriptions has a positive impact on food production index sequel to an increase in domestic credit to the private sector. The same can be said of mobile cellular subscriptions which its coefficient 0.0614 is positive and statistically significant at the 1 percent level while its interaction with domestic credit to the private sector is 0.0175. The implication is that the effect of change in the mobile cellular subscriptions has a positive impact on the food productivity index as a result of increase in domestic credit to the private sector.

The findings from this study indicate that the lag of the food production index, gross domestic product per capita, and real interest rates are positive and statistically significant across all models, signifying their consistent impact on food production in the region. These results are in line with existing empirical studies that emphasize the role of economic factors and ICT in enhancing agricultural productivity. For

instance, Chavula (2014) highlighted the significant role of ICT in agricultural production across 34 African countries, which aligns with the positive impact observed in this study for fixed telephone subscriptions and mobile cellular subscriptions on food production. This conformity suggests that ICT plays a crucial role in boosting food production when combined with financial improvements such as increased domestic credit to the private sector.

Ejemeyovwi et al. (2021) found that ICT use in male households positively influences food security in Nigeria, further supporting the positive relationship between ICT (both fixed and mobile subscriptions) and the food production index observed in this study. The interaction between ICT and domestic credit suggests that financial improvements amplify the positive effects of ICT on food productivity, echoing the findings of Anser et al. (2021) who demonstrated that the interaction of ICT and government effectiveness improves food security in West Africa. Moreover, the negative and significant impact of inflation across the models in this study is consistent with the broader understanding that economic instability can adversely affect food production, even when ICT and financial improvements are present. This observation is aligned with the conclusions drawn by Olaniyi and Ismaila (2016) and Namubiru et al. (2018), who emphasized the role of economic variables alongside ICT in determining food security and production outcomes.

## **VI. Conclusion and Recommendation**

Our empirical results show that past food production index can influence the present food production index as shown on all six models. The implication is that food production index of present can help in securing food in the following year. Aside the past food production, other factors such as gross domestic product per capita, inflation rate and real interest rate significantly impact food security. The significant influence of the gross domestic per capita reveals the influence of income on food security, which conforms to the studies by Abegaz (2017); Kabir et al (2020); and Hakim (2021) which opined that food security is significantly determined by income.

It is shown from our empirical results that financial improvement – represented by domestic credit to the private sector significantly influence food security in the region. This conformed to the study by Ingutia and Sumelius (2022) that access to credit helps in improving food security.

The empirical results also shown that fixed telephone subscriptions is positive and statistically influences food production index (food security), while its interaction with domestic credit to the private sector is also significantly influences food security. This shows that the effect of change in the fixed telephone subscriptions has a positive impact on food security sequel to an increase in domestic credit to the private sector. The same can be said of mobile cellular subscriptions, the effect of change in the mobile cellular subscriptions has a positive

impact on the food security as a result of increase in domestic credit to the private sector. This confirmed the studies by Syien and Raj (2015) and Olaniyi and Ismaila (2016) that mobile phone is commonly used ICT and that it significantly influences food security.

Based on the empirical literature and our results, it could be concluded that ICT and financial improvement influence the food security in the Sub Saharan African countries. Sequel to this, it

is recommended that telephone and mobile cellular subscriptions should be improved in order to improve food production because information can easily be disseminated via the medium. Moreover, domestic credit to the private sector should be increased in order to finance and improve the food production. With these, food production will be secured especially in the region

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