*International Journal of Accounting and Economics Studies*, 12 (2) (2025) 311-320

**International Journal of Accounting and Economics Studies**

*Website: www.sciencepubco.com/index.php/IJAES*
*https://doi.org/10.14419/092tzd92*
***Research paper***

# The Role of Agricultural Land, Education, and Food Production in Shaping Family Income: An African Perspective

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*Received: May 12, 2025, Accepted: June 17, 2025, Published: June 29, 2025*

**Abstract**

This study investigates whether agricultural land, education, and food production significantly impact family income. Family income is a significant economic factor representing GDP per capita and measuring the country's economic strength. Using SPSS Statistics version 25, we have applied a multistage-linear regression stepwise model, considering family income as the dependent variable and agricultural land, education, and food production as independent variables. We have collected data from World Development Indicators through a purposive sample of five countries, namely Ethiopia, Kenya, Nigeria, South Africa, and Zambia, representing all five corners of the African continent from 1991 to 2022. The results show that agricultural land, education, and food production significantly impact the family income in Ethiopia and Kenya. However, the Nigerian agrarian land is far beyond predicting the family income, as its P-value equals 0.162 > 0.05. Furthermore, in South Africa, education and food production do not significantly impact the family income, as their P-value for education and food production is 0.762 and 0.582, respectively, and both are > 0.05. Therefore, Africa needs to double its food production and education efforts compared to today's situation and the future to stimulate family income and solve food security and job opportunities issues. Hence, education must take the lead, as well as the review of land policies.

***Keywords***: *Africa, Agricultural land, Education, Family Income, Food production.*

## 1. Introduction

Family income consists of money generated annually by each family member allowed by law to work. Such money may be in salary or wages, return on investments, retirement scheme, other welfare support, or money from farm produce sales such as vegetables, fruits, milk, etc. Family income defines the ability to purchase goods and services received by family members per year, like teaching children, doing household activities, etc. (Murshed et al., 2022). The family is poor when the family income becomes less than 1,035$ per capita per annum (Zippel & Sherman, 2021). Therefore, we use "low-income countries or developing countries" to describe countries with a GDP per capita of less than 1,035 US dollars and subsequently weaker family income than required (Serajuddin & Hamadeh, 2020).
Furthermore, we speak of low-income countries (LIC) that fail to translate their resources into high-income families (Razi, 2016). If the family income is insufficient to cover the basic needs, the family becomes "Relative Poverty." According to Aguirre Unceta, absolute poverty is the lack of basic needs such as clean water, food, care, proper education, clothing, and shelter (Aguirre Unceta, 2021). Having understood the meaning of family income, we found that most African households struggle to put food on the table (Folbrer, n.d.). Generally, rich countries have a higher average family income than developing countries. As the family income increases rapidly with national income at first, it begins to decrease, with higher-income countries receiving diminishing returns to increasing national income(Odhiambo, 2022). Therefore, examining "why Africa has worse family income" than expected is crucial, given its abundant natural resources and favourable climatic conditions. Land reform in Africa has gone through cyclic processes of development priorities for over fifty (50) years, and up-to-date internal discussions related to land tenure, whether statutory or customary, formal or informal. Over time, the land has become the source of conflict despite being the source of wealth and speculation, particularly in Liberia and Sierra Leone (Peters, n.d.). If you look at Ghana, the large-scale investment in land does not create better job opportunities, especially when there is no proper business plan for labour-intensive work. Even if their contracts are signed, it is not easy to guarantee decent jobs(Fernando et al., 2022). In Ghana, the laws show no regulatory framework to protect workers; even if there is one, it is inappropriate. The public sector and industry-related labour

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policies are particularly prevalent (Gyapong, 2020). Land use is inseparable from food production. In Tanzania, only 2.2% of the agricultural land is used as required (Nziguheba et al., 2021). The survey of farmland and food production vulnerabilities to future water scarcity found that zero per cent of all farmland is vulnerable, including Australia, which is usually known as a dry climate (Fitton et al., 2019). The result of this study gives hope for food production possibilities so far. The question arises when we question whether one can use these factors (agricultural land and food production) in addition to education to predict family income. Coming to food production, particularly in Sub-Saharan Africa, they have fertile land and the necessary workforce to be food self-sufficient. However, the agriculture in that area depends on rain, which makes it sensitive to drought. In addition, smallholder farmers do this agriculture and usually don't apply fertiliser with less improved technology (Sharp, 2016). Non-modern food processing is a less profitable business.

Meanwhile, it represents a vital source to nourish the family and creates job opportunities despite constraints such as access to credit, improved technologies, training, and legal recognition (Kpossilande et al., 2020). If you look at the history of education, Africa had schools that had higher levels of learning from the precolonial period. In Tunisia, the Ez-Zitouna University was founded in 732, in Fez, Morocco, which had been established as a madrasa in 859, and many more. Then came education, the branch of colonial higher education they left behind after Africa became independent and could not sustain itself until now (Sintayehu Kassaye, 2018). According to Zamrodah and Yuhanin, growth will occur without development. There will be an educational contribution to family income in Africa without sufficient employment opportunities for multiple effective laureates at all secondary schools and universities. The past two decades have experienced tremendous increases in access to education, but changes in access and learning within that period have not shown much improvement. One child out of three does not complete primary school (Zamrodah, 2016).

Furthermore, some quality schooling reports show high literacy or limited numeracy skills after several years (Evans & Mendez Acosta, 2021). African countries have spent a considerable amount of financial resources on higher education. However, it is finally a loss through the brain drain, especially for those who study abroad and don't return to the country (Gyimah-Brempong et al., 2006). Despite these challenges, education contributes to economic growth through renewable energy consumption in BRICS countries (Tsaurai & Ngcobo, 2020). The research shows that the quality of education in Africa is low compared to other developing countries, which negatively impacts economic growth in Africa (Moreno & Hector, 2012). Through this study, we will investigate whether agricultural land, education, and food production significantly impact family income in the African context. Few studies have attempted to study the effects of education, agricultural land (arable land), and food production on family income. By applying multilinear regression statistical tests, we shall develop suggestions that stimulate family income in Africa and be a good indicator of any country's economic wealth growth (Evans & Mendez Acosta, 2021).

## 2. Review of literature

Africa comprises 54 economically different countries, but has a common denominator of European imperial colonialism and exploitation. Similarly, their post-colonial features are lousy governance and poverty, which are significant challenges (Kalu, 2018). According to the United Nations' current report, Africa is the second largest continent after Asia in terms of size and population. Africa has 30.3 million km2, including 11.7 million square miles of adjacent islands. Africa has 1.4 billion inhabitants, representing 16.72% of the world's population, and 60% are young. So far, Africa has known more than 80 coups and more than 15 presidential assassinations. All these issues have turned Africa into a destabilised area that is less effective in production and development (Ii, 2017).

### 2.1 Agricultural Land in Africa

Traditionally, unequal land distribution negatively impacts family income, particularly in rural African areas where farming is frequently done (Andersson Djurfeldt et al., 2021). In Africa, more than 50% of rural farmers hold less than 0.15 hectares of land in highly populated countries. Furthermore, in great land countries, the same population has 0.30 hectares of land due to unequal land distribution(Gyapong et al., 2020). In addition, land use in Africa is critically facing a non-sustainable agricultural intensification practice characterised by most of the small farmers in sub-Saharan Africa. The small farmers in Africa represent eighty per cent of the population, leading to soil degradation and decreasing food production. It makes it hard to meet the food demand for the African people, which is rapidly growing (Nziguheba et al., 2021). Poor performance and decreased agricultural produce fail to solve the African community's rural poverty and food security. However, when agriculture succeeds, it immediately contributes to family income. It creates jobs for family members and benefits from the sales related to the excess production of raw materials or finished goods and services. According to Ndlovu et al., agriculture keeps declining, making the entire family unable to achieve the expected results. The inefficiency refers to the expectations that they will keep getting government or non-government support (Ndlovu et al., 2021).

### 2.2 Education in Africa

One child out of three in Africa does not complete primary school (Zamrodah, 2016). According to Baliamoune-Lutz, Mina, the high unemployment rate experienced in Africa is highly linked to the low quality of education (Baliamoune-Lutz, 2020). However, education is one of the prerequisites for the development of any country. It is a tool to increase human capital potential in quality and quantity, its employability and human rights, and reduce social inequality. Education is an investment to improve a country's economy (Maseda et al., 2019). Not only does education contribute to the individual's income, but it also contributes to the whole nation's income in terms of per capita income. The payment of an educated person surpasses that of other individuals who did not go to school (Zvereva et al., 2020). In this study, we consider education to be an asset or property. Skills acquired through formal education are sold like any other asset to the job market. Education in this research consists of the production factor, as the most highly talented people, based on their education, occupy good posts linked with high income, which pushes many parents with high aspirations to invest in their children's education to contribute to their success in life (Adeoti et al., 2020).

### 2.3 Family Income Status in Africa

There are various definitions of family income, but many people recognise family income in terms of money (Mortazian, 2022). It can also be in kind, especially in Africa, where the family can feed on the production from their farm without buying food from the market (Maseda et al., 2019). Varghese et al. define family income as the money, including goods and services, created by a family member per year(Varghese et al., n.d.). The family is poor when the family income becomes less than $ 1,035 of the gross product per capita per annum. Poverty

has two major categories: "Absolute poverty and Relative Poverty." Africa is suffering from absolute poverty. Keyzer. Michiel and Isenbeeck, in their study "The Millennium Development Goals, How Realistic Are They?" During the detailed weight survey for length among African adults, Lia found that Africa lags with 58 per cent undernutrition rates (Keyzer & Wesenbeeck, 2006).
Furthermore, M. McMillan found that Africa is still poor because it failed industrialisation and relied on commodity exports (McMillan, 2016). It is unclear how Africa is still poor despite its rich natural resources such as minerals, forests, land, and water. All these arguments turn around family income, and we explore them as influencing factors. It is unclear how Africa is still poor despite its rich natural resources, such as minerals, forests, land, and water, on top of human potential (Anarfo et al., 2019).

### 2.4 Food Production in Africa

Food is a basic need that everyone needs in life. All other factors remain the same; more people require more food production(Pitcher, 2007). Food is a problem for both developed and developing countries(Fernando et al., 2022). The only difference is how they handle this issue. In developed countries, they administer food aid, food subsidies, or stamps (Ortiz et al., 2017). Similarly, developing countries do the same, but are not sustainable because they don't have enough resources for the long term (Mwaniki, 2006). The 2018 World Resources Institute report shows that 56% more food will be needed in 2050 than in 2010, because it is evident that as the population grows, the food demand will increase. Therefore, as Africa is the world's second-largest population, it should be the second-largest for food production. In Africa, food production has been very low, less than needed for the population growth rate. Moreover, the food produced in Africa is primarily for home use because food exports are less than 10 per cent (Sharp, 2016). According to Fitton et al., there is hope for agriculture to improve because the study revealed that food production is not vulnerable to climate change, even in Australia, which is known to be dry (Fitton et al., 2019). The issue of food production in Africa lies in the low use of fertiliser and irrigation, and the improvement of seeds for crop intensification (Gyapong, 2020). Beyond this, no recent study related to food production in Africa exists. For this study, we formulate the following research question: "Do Agricultural Land, Education, and Food production significantly impact the family income? An analysis of the African continent paradigm". Previous studies were standalone studies. They did not investigate the impact of all three independent variables on family income in Africa. The results from this study will prove the role of each of these economic factors on the family income among the chosen countries before extrapolation to the whole of Africa.

## 3. Research Methodology

To investigate whether agricultural land, education, and food production significantly impact family income in Africa, we refer to the existing literature and the data collected from the World Development Indicators (WDI) data set. This study will help us to examine the factors that affect the relationship between family income in Africa as the dependent variable and the three other significant factors, namely agricultural land, education, and food production, as independent variables. This quantitative research study uses the deductive approach (Ghorbel et al., 2022). Furthermore, it helps to investigate the impact of agricultural land, education, and food production as independent variables on family income. We have used a multistage linear regression model with the help of SPSS Statistics version 25 software to evaluate whether these three variables positively or negatively affect family income. A multistage linear regression model is a statistical modelling technique that frequently applies many linear regression models in successive steps to cope with hierarchical or clustered data, handle complex relationships, and increase forecast accuracy. A multistage linear regression utilizes a selection of variables at each step. Later rounds may incorporate new variables, interaction terms, or outputs from previous regressions to further understand the causal influence. Below is a graphical representation to show how the independent variables should be linked with the dependent variable in the centre(Mkong et al., 2021).

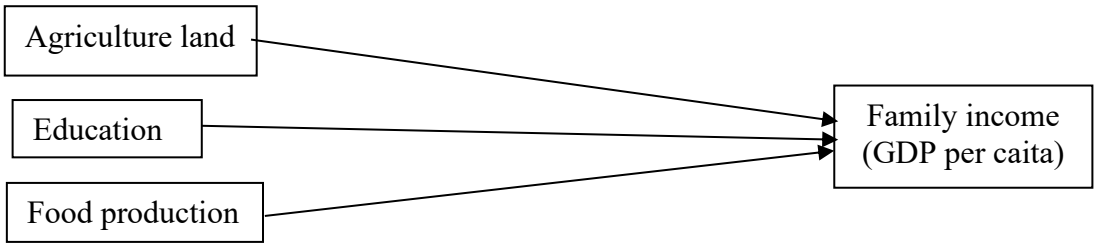


**Fig. 1:** Research Framework

Family income is a multidisciplinary factor (Palaniappan, 2017). This study will help us to know if agricultural land, education, and food production are independent variables that can explain the movement of family income as the dependent variable in Africa.

### 3.1 Sampling Method

Out of 54 African countries, we have used the purposive sampling method (Etikan, 2016) to select the five African countries representing the five corners of Africa, namely Nigeria (North East Africa), Kenya (Central East Africa), Ethiopia (North East Africa), South Africa, and Zambia (South Africa). We have used the purposive sampling method rather than the random model because the purposive sampling method is used over random sampling when the goal of a study is to select specific individuals or cases that are particularly informative or relevant to the research question, rather than to generalize to a larger population (Sinthumule, 2021). We used this method while the research required participants with specific traits, as in this study, we wanted to represent the five corners of the African continent, such as West Africa, East Africa, North Africa, South Africa, and Central Africa. The aim is to gain deeper insights before generalization to ensure that rich, detailed data from each corner of the continent is more relevant. Furthermore, we have collected the numerical data from World Development Indicators (WDI) concerning real GDP per capita to represent family income as a dependent variable and agricultural land, education, and food production as the independent variables (Palaniappan, 2017) to evaluate their impact on family income within a thirty-one (31) year period of time. To analyse the data, we have used the multistage linear-regression statistical analysis stepwise model, which accurately analyses the impact of agricultural land, education, and food production as the independent variables on family income as a dependent variable.

# 4. Results and discussion

The multistage linear-regression stepwise model describes all the variables under study. It involves two or more independent variables to predict the dependent variable (J. Joseph Francis, 2020).In this way, the independent variables, called predictors, are given by the symbol X. The dependent variable is the predicted variable, represented by Y, and the time is N.

**Table 1:** Variables notation

| Variables | Variable Types | Number of years | Remarks |
|---|---|---|---|
| Family income (Y) | Dependent variable | 31 | GDP per capita (constant 2015 US$) GDP: Gross Domestic Product |
| Agriculture land (X1) | Independent variable | 31 | Arable land (hectares) |
| Education (X2) | Independent variable | 31 | Enrollment Primary education (pupils) + Secondary education, general pupils (Gender Parity Index) |
| Food Production (X3) | Independent variable | 31 | Agriculture, forestry, and fishing, value added (constant 2015 US$) |

Table 1 describes the variables under study: agricultural land, education, and food production as independent variables and the family income as the dependent variable. This data covers thirty-one years. This study considers the family income by real GDP per capita. The objective of this research is to investigate whether agricultural land, education, and food production have a significant impact on family income in Africa. We have chosen a sample of five countries: Ethiopia, Kenya, Nigeria, South Africa, and Zambia. The multistage linear regression using SPSS Statistics version 25 software helps us understand and conclude this curiosity using the data collected from World Development Indicators for thirty-one years from 1991 to 2022. The following is a multistage linear-regression formula: Y β0+ β1X1+β2X2+β3X3. Where Y represents family income per capita or the real GDP per capita, X1 represents agricultural land, X2 stands for education, and X3 represents food production; β0 is a constant, and β1, β2, and β3 are the coefficients or slopes of X1, X2, and X3, respectively. The stepwise multistage linear regression model was an accurate tool for using SPSS version 25 as a statistics software to measure and analyse the data from the World Development Indicators (WDI) database. This study investigates the impact of agricultural land, education, and food production as independent variables on the family income as represented by real GDP per capita as the dependent variable for five countries: Ethiopia, Kenya, Nigeria, South Africa, and Zambia. The main objective was to evaluate the impact these three variables, considered independent or predictor variables, have on Family income in Africa.

## 4.1 Equation of the models

For this study, we have applied a Multistage linear regression stepwise model for data analysis to answer the following research question: Do Agricultural Land, Education, and Food production significantly impact family income?

**Table 2**Stepwise linear regression formula model

| Model | Equation |
|---|---|
| Model 0 | Family income(Y)= β0 (Constant) |
| Model 1 | Family income(Y)= β0 (Constant)+ $\beta_1$(Intercept)*$X_1$(Agricultural Land) |
| Model 2 | Family income(Y)= β0 (Constant)+ $\beta_1$(Intercept)*$X_1$(Agricultural Land) + $\beta_2$(Intercept) *$X_2$(Education) |
| Model 3 | Family income(Y)= $\beta_0$ (Constant)+ $\beta_1$(Intercept)*$X_1$(Agricultural Land) + $\beta_2$(Intercept) *$X_2$(Education) + $\beta_3$(Intercept) *$X_3$(Food Production) |

Table 2 clearly explains how we have formulated the equation to build a tangible conclusion based on the findings. Thus, the value of Y or the family income is constant if X1, X2, and X3 are held constant or equal to zero. It means that Y= β0 if X1 = X 2 = X3 = 0. β1, β2, and β3 (coefficient or slope) also called o partial regression coefficients because β1, β2, and β3 represent the contribution of X1, X2, and X3, respectively, to the dependent or response variable Y after it has been adjusted with other predictor variables (Porzio, 2013)In our study, X1 is the agricultural land, X2 is education, and X3 is food production.

**Table 3:** Descriptive Statistics of the five selected African countries

| Countries | Descriptive Statistics | Family Income | Agricultural Land | Education | Food Production |
|---|---|---|---|---|---|
| Ethiopia | Mean | 1 305 | 5 402 967 | 9 768 938 | 11 026 781 850 |
| | Std. Dev | 160 | 373 681 | 3 090 613 | 2 555 108 548 |
| Kenya | Mean | 1 305 | 5 402 967 | 9 768 938 | 11 026 781 850 |
| | Std. Dev | 160 | 373 682 | 3 090 613 | 2 555 108 548 |
| Nigeria | Mean | 2 026 | 33 906 667 | 31 247 356 | 66 262 342 361 |
| | Std. Dev | 475 | 1636 424 | 8 338 429 | 33 646 047 492 |
| S. Africa | Mean | 5 549 | 12 828 233 | 11 615 144 | 6 430 756 569 |
| | Std. Dev | 648 | 730 694 | 2 206 272 | 1 567 528 659 |
| Zambia | Mean | 10 367 | 3 212 600 | 3 105 270 | 1 152 501 411 |
| | Std. Dev | 247 | 474 043 | 1 055 219 | 122 058 380 |
| | N | 31 | 31 | 31 | 31 |

Table 3 shows N as representing thirty-one (31) years for which we have collected data for the dependent and independent variables. The standard deviation, also known as root mean square deviation, is an excellent measure of variation in the distribution of the data set. The standard deviation here shows the variability between the data set and the meaning of each factor under the study. With a sample of five selected African countries, we consider four variables; among them, the family income is the dependent variable, and the remaining three are independent variables or predictors, namely agriculture land, education, and food production. When the standard deviation is high, there is high variability between the variables and vice versa. But when the standard deviation equals zero, the model perfectly fits the data set.

**Table 4:** Coefficient Analysis

| | | | Coefficient Correlations | | | |
|---|---|---|---|---|---|---|
| | | Model | | Agriculture Land | Education | Food _Production |
| | 3 | Correlations | Agriculture Land | 1.000 | -0.733 | -0.154 |
| Ethiopia | | | Education | -0.733 | 1.000 | -0.532 |
| | | | Food Production | -0.154 | -0.532 | 1.000 |
| | 3 | Correlations | Agricultural Land | 1.000 | -0.733 | -0.154 |
| Kenya | | | Education | -0.733 | 1.000 | -0.532 |
| | | | Food Production | -0.154 | -0.532 | 1.000 |
| | 3 | Correlations | Agriculture Land | 1.000 | -0.370 | 0.300 |
| Nigeria | | | Education | -0.370 | 1.000 | -0.977 |
| | | | Food Production | 0.300 | -0.977 | 1.000 |
| | 3 | Correlations | Agriculture Land | 1.000 | -0.418 | 0.864 |
| South Africa | | | Education | -0.418 | 1.000 | -0.482 |
| | | | Food Production | 0.864 | -0.482 | 1.000 |
| | 3 | Correlations | Agri Land | 1.000 | -0.909 | 0.168 |
| Zambia | | | Edu | -0.909 | 1.000 | -0.068 |
| | | | Food Production | 0.168 | -0.068 | 1.000 |

(Note)a. Dependent Variable: Family Income

Table 4 shows how a strong correlation between two coefficients suggests that variations in one coefficient estimate are linked to variations in the other. Usually, this occurs when the predictor variables are not independent or are collinear. Determining the precise influence of each predictor on the response variable is challenging when coefficient estimates are couples. Collinearity between the predictor variables shows a high coefficient correlation. High correlations might result in significant standard errors and erratic regression estimates (Arayanan, 2020). Referring to the above results, we realize there is no collinearity between all variables for all five countries under the study. Therefore, we expect an effective output as the data does not have much similarity.

**Table 5:** Collinearity Diagnostics

| | | | | | Variance Proportions | | |
|---|---|---|---|---|---|---|---|
| | Model | Eigenvalue | Condition Index | (Constant) | Agricultural Land | Education | Food Production |
| | 3 1 | 3.831 | 1.000 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ethiopia | 2 | 0.158 | 4.922 | 0.02 | 0.00 | 0.02 | 0.01 |
| | 3 | 0.009 | 20.580 | 0.00 | 0.01 | 0.36 | 0.98 |
| | 4 | 0.001 | 53.861 | 0.98 | 0.99 | 0.62 | 0.00 |
| | 3 1 | 3.939 | 1.000 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kenya | 2 | 0.059 | 8.194 | 0.01 | 0.00 | 0.02 | 0.00 |
| | 3 | 0.002 | 46.656 | 0.02 | 0.12 | 0.44 | 0.74 |
| | 4 | 0.001 | 79.083 | 0.97 | 0.88 | 0.54 | 0.26 |
| | 3 1 | 3.855 | 1.000 | 0.00 | 0.00 | 0.00 | 0.00 |
| Nigeria | 2 | 0.142 | 5.204 | 0.00 | 0.00 | 0.00 | 0.03 |
| | 3 | 0.002 | 44.995 | 0.16 | 0.00 | 0.86 | 0.87 |
| | 4 | 0.001 | 62.979 | 0.84 | 1.00 | 0.14 | 0.09 |
| | 3 1 | 3.931 | 1.000 | 0.00 | 0.00 | 0.00 | 0.00 |
| S. Africa | 2 | 0.046 | 9.248 | 0.00 | 0.00 | 0.01 | 0.20 |
| | 3 | 0.022 | 13.301 | 0.00 | 0.00 | 0.86 | 0.02 |
| | 4 | 0.000 | 108.244 | 1.00 | 0.99 | 0.14 | 0.79 |
| | 3 1 | 3.915 | 1.000 | 0.00 | 0.00 | 0.00 | 0.00 |
| Zambia | 2 | 0.077 | 7.152 | 0.01 | 0.00 | 0.13 | 0.03 |
| | 3 | 0.006 | 24.753 | 0.11 | 0.14 | 0.24 | 0.69 |
| | 4 | 0.002 | 46.610 | 0.88 | 0.86 | 0.62 | 0.27 |

Table 5 helps us understand how eigenvalues are scalars associated with a linear system of equations in linear algebra. For a given square matrix A, if a non-zero vector v exists, then v.. If all eigenvalues of A have negative genuine parts, the system is asymptotically stable. If any eigenvalue has a positive fundamental part, the system is unstable. If eigenvalues are equal to zero, the genuine parts of the system are marginally stable(Kozlovskyi et al., 2018). Table 5 shows that all variables under the study have the Eigenvalue turning around zero, meaning that the genuine parts of the system are marginally stable except the constant. That gives confidence that the agricultural land, education, and food production are stable as time goes on and return to the equilibrium when time goes to infinity. Let's look at the variance of all the variables under the study. There is less collinearity, which gives confidence in results as they are likely to express their impact independently of each other.

Agriculture, education, food production; d. Dependent Variable: family income.

Table 6 tells us that when we refer to the adjusted R-squared value, the multistage regression model fits the collected dataset as the adjusted R-squared value is close to one in Ethiopia. That means agricultural land, education, and food production significantly impacted Ethiopia's family income for 31 years. The results show that in Ethiopia, for a year, the Adjusted R- square equals 0.837 for model one, where we have taken into consideration only the agricultural land as the predictor of the family income, and 0.864 for model two, considering the agricultural land and education, and 0.998 when you consider the agricultural land, education and food production respectively, all are close to one. That shows that the data set fits the model correctly to predict Ethiopia's family income (Y). This assumption reinforces the Significance Test or P-value, which equals 0.000 for models 1 and 3 and 0.016 for model 2, all < 0.05, respectively.

In Kenya, the result attests that the adjusted R square equals 0.662 for agricultural land, 0.918 for education, and 0.923 for food production, all relatively close to 1, which means the collected data fits the multistage linear regression model. That shows that the data fit the model to predict Kenya's family income (Y). Meanwhile, agricultural land and education significantly impact the family income in Kenya because their P-value equals 0.000 < 0.05. However, when farmland and education are combined with food production, their impact is not insignificant, as the P-value of this combination equals 0.102 > 0.05. Therefore, policies related to food production in Kenya must be reviewed to positively contribute to the family income by applying good agricultural practices and inputs to increase productivity and, consequently, the family income, namely, the gross domestic product per capita (GDP).

In Nigeria, the output shows that the adjusted R-squared confirms that this information equals 0.817 and 0.928, which are very close to 1 for education and food production. On the contrary, the agricultural land is far beyond the prediction of the family income as long as its

adjusted R-squared value equals 0.035, far below 1. That shows, in Nigeria, agricultural land does not fully contribute to the family income for thirty-one years under the study. That could be because the Nigerian government puts more effort into oil and minerals extraction and pays less attention to the agriculture sector. However, the findings from this study indicate that education and food production significantly impact the family income, as their P-value equals 0.000 < 0.05.

Furthermore, the agricultural land P-value is equal to 0.162 > 0,05, meaning that the agricultural land in Nigeria does not significantly contribute to the family income. Briefly speaking, agricultural land is being exploited and has less impact on family income. Nevertheless, Land reform seeks to address historical inequalities in land ownership, yet it may come at the cost of reduced economic productivity if not accompanied by adequate support systems. The trade-off lies in balancing equity and efficiency goals, ensuring that redistributive justice does not undermine a country's agricultural output and economic performance (Asiama et al., 2021). To substantially influence family income, Nigeria must make more efforts to improve its agricultural land management policies. In South Africa, the table summarizes the results starting with the adjusted R-squared in South Africa, which equals 0.794 for agricultural land, 0.787 for education, and 0.781 for food production, which are close to 1. It means that the multistage linear regression stepwise model fits the data set. The agricultural land alone significantly impacts family income, as confirmed by its P-value statistics test equal to 0.000 < 0.05. The P-value for education and food production is 0.762 and 0.582, respectively, and both are > 0.05 for education and food production. This means that the output related to education and food production doesn't significantly impact the family income in South Africa. That implies that education and food production are the independent variables that cannot predict family income in South Africa. Furthermore, this justifies the high unemployment rate of educated people in South Africa due to policies that fail to produce more educated people without creating equivalent job opportunities and the inefficiency of the food production system, which explains poor policies on those matters.

Meanwhile, in Zambia, Table 6 tells us that the Adjusted R-squared in Zambia equals 0.931 for agricultural land, 0.960 for education, and 0.960 for food production, respectively, all close to 1. It means that the multistage linear regression model fits the data set. In Zambia, agricultural land and education significantly impact the family income because their P-value equals 0.000 < 0.05, which means the model was accurate and fit the data set to influence the family income. Moreover, the two variables significantly impact the family income when the other variables are held constant or equal to zero. On the contrary, the P-value for food production is 0.307 > 0.05. That shows that food production positively influences family income, but this impact is insignificant compared to agricultural land and education. This means that the decision-makers in Zambia should look at promoting food production by using sustainable strategies such as agriculture, sound practices (pesticides and good seeds), and land management policies.

(Note) a. Predictors: (Constant) agricultural land; b. Predictors: (Constant), agricultural land, education; c. Predictors: (Constant),

**Table 6:** Model Summary for Regression Analysis

| Model Summary | | | | |
|---|---|---|---|---|
| | Dependent variable: Family income | Model 1 | Model 2 | Model 3 |
| | | Independent variables | | |
| Ethiopia | Agricultural Land | | 0.918[a] | 0.918[a] | 0.918[a] |
| | Education | | | 0.935[b] | .935[b] |
| | Food Production | | | | .999[c] |
| | Δ $R^2$ | | 0.843 | | |
| | $R^2$ | | 0.837 | 0.874 | 0.998 |
| | Adjusted $R^2$ | | 0.837 | 0.864 | 0.998 |
| | P-value | | 0.000 | 0.016 | 0.000 |
| | Δ F | | 150.016 | 6.656 | 1470.033 |
| Kenya | Agricultural Land | | 0.821[a] | 0.933 | 0.821[a] |
| | Education | | | 0.963 | 0.961[b] |
| | Food Production | | | | 0.965[c] |
| | Δ $R^2$ | | 0.674 | 0.250 | 0.008 |
| | $R^2$ | | 0.674 | 0.923 | 0.931 |
| | Adjusted $R^2$ | | 0.662 | 0.918 | 0.923 |
| | P-value | | 0.000 | 0.000 | 0.102 |
| | Δ F | | 57.783 | 88.084 | 2.869 |
| Nigeria | Agricultural Land | | .262[a] | .262[a] | .262[a] |
| | Education | | | .911[b] | .911[b] |
| | Food Production | | | | .967[c] |
| | Δ $R^2$ | | 0.069 | 0.761 | 0.106 |
| | $R^2$ | | 0.069 | 0.829 | 0.935 |
| | Adjusted $R^2$ | | 0.035 | 0.817 | 0.928 |
| | P-value | | 0.162 | 0.000 | 0.000 |
| | Δ F | | 2.064 | 120.236 | 42.531 |
| South Africa | Agricultural Land | | 0.895[a] | 0.895[a] | 0.895[a] |
| | Education | | | 0.895[b] | 0.895[b] |
| | Food Production | | | | 0.896[c] |
| | Δ $R^2$ | | 0.801 | 0.001 | 0.002 |
| | $R^2$ | | 0.801 | 0.801 | 0.804 |
| | Adjusted $R^2$ | | 0.794 | 0.787 | 0.781 |
| | P-value | | 0.000 | 0.762 | 0.582 |
| | Δ F | | 112.445 | 0.093 | 0.310 |
| Zambia | Agricultural Land | | .966[a] | .966[a] | .966[a] |
| | Education | | | .981[b] | .981[b] |
| | Food Production | | | | .982[c] |
| | Δ $R^2$ | | 0.933 | 0.030 | 0.001 |
| | $R^2$ | | 0.933 | 0.963 | 0.964 |
| | Adjusted $R^2$ | | 0.931 | 0.960 | 0.960 |
| | P- Value | | 0.000 | 0.000 | 0.307 |
| | Δ F | | 389.778 | 21.443 | 1.085 |

**Table 7:** Coefficient Analysis

| Countries | | Model | Unstandardised Coefficients β | Unstandardised Coefficients Std. Error | Standardised Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|---|
| Ethiopia | 3 | (Constant) | 1590.204 | 505.185 | | 3.148 | 0.004 |
| | | Agriculture Land | 3.558 | 0.000 | 0.012 | 0.216 | 0.830 |
| | | Education | -3.796 | 0.000 | -0.666 | -2.637 | 0.014 |
| | | Food Production | 2.265 | 0.000 | 1.604 | 6.522 | 0.000 |
| Kenya | 3 | (Constant) | 921.767 | 201.934 | | 4.565 | 0.000 |
| | | Agricultural Land | -5.148E-06 | 0.000 | -0.012 | -0.122 | 0.904 |
| | | Education | 7.048E-05 | 0.000 | 1.363 | 5.140 | 0.000 |
| | | Food Production | -2.515E-08 | 0.000 | -0.402 | -1.694 | 0.102 |
| Nigeria | 3 | (Constant) | 1590.204 | 505.185 | | 3.148 | 0.004 |
| | | Agriculture Land | 3.558 | 0.000 | 0.012 | 0.216 | 0.830 |
| | | Education | -3.796 | 0.000 | -0.666 | -2.637 | 0.014 |
| | | Food Production | 2.265 | 0.000 | 1.604 | 6.522 | 0.000 |
| South Africa | 3 | (Constant) | 14691.432 | 2259.233 | | 6.503 | 0.000 |
| | | Agriculture Land | -0.001 | 0.000 | -0.812 | -4.699 | 0.000 |
| | | Education | -1.552E-05 | 0.000 | -0.053 | -0.533 | 0.599 |
| | | Food Production | 4.122E-08 | 0.000 | 0.100 | 0.557 | 0.582 |
| Zambia | 3 | (Constant) | -128.983 | 147.265 | | -0.876 | 0.389 |
| | | Agricultural Land | 0.000 | 0.000 | 0.565 | 6.130 | 0.000 |
| | | Education | 0.000 | 0.000 | 0.428 | 4.698 | 0.000 |
| | | Food Production | -8.129E-08 | 0.000 | -0.040 | -1.042 | 0.307 |

(Note): Sig.: Significance at 0.05

Table 7 focuses on the Standardized coefficient or Beta (β) value analysis and the standard error, in addition to the t-value and the P-value. The standard error measures the data point's variability around the regression line. Suppose the variability is significant, meaning that the variability of the data point from the regression is high. On the contrary, if the variability is less, the variability between the data points from the regression line is insignificant. The regression line fits the data set perfectly when the standard error equals zero. In addition, the data points are normally distributed around the regression line. That is the case for Ethiopia, Kenya, Nigeria, South Africa, and Zambia, where the standard error for the three independent variables under study equals zero, referring to the third model. That means the multistage linear regression model is perfect and fits the data set, or you can say that the data points are normally distributed around the regression line. Ethiopia's agricultural land, education, and food production accurately predict family income. On top of that, agricultural land, education, and food production significantly impact the family income and confirm our hypothesis. Kenya shows that the coefficient analysis is conclusive because it gives the value of the standard error of the predictor. When the standard error equals zero, the regression line is perfect and fits the data set, so the data points are normally distributed. In Kenya, agriculture, land, and education significantly impact the family income as their P-values equal 00.05, except for food production, for which the value equals $0.102 > 0.05$. That shows that though there is a positive impact of food production and family income, its effect on family income is not significant. Kenya must put more effort into the food production sector to contribute significantly to family income. The standard error equals zero $< 0.05$ for all independent variables under study, which means the multistage linear regression is perfect.

## 4.2 Family income: Accounting and tax policies impact

Family income significantly influences financial reporting, household budgeting, and tax policies, even if the household doesn't prepare permanent financial statements or budgets (Sinthumule, 2021). In this study context, family income determines the complexity and detail of reports, and household budgeting affects saving, spending, debt, and flexibility. When you examine the tax policies, the family income shapes the tax brackets, credits, and benefits. While we expect the family income to increase, we immediately refer to the independent variables: agricultural land, education, and food production. The family income is reflected more in the household income statements, balance sheets, and cash flow statements. Therefore, higher-income families often deal with multiple income sources, such as salaries, investments, and rental income, requiring detailed record-keeping and more sophisticated reporting, which may be the subject of future research. Lower-income households may have simpler income structures but still need accurate tracking for benefits, subsidies, or budgeting. Wealthier households often use accounting advisors or software for detailed statements, projections, and tax planning.

Therefore, this study tries to understand the significant factors contributing to family income to plan for Africa's future properly. Land use in Africa must be maximum for the benefit of African citizens, and these latter must be well-educated and have enough food for their survival and prosperity. However, suppose you look at the agricultural land use in Ethiopia, Kenya, and Nigeria. In that case, it is ineffective despite having a strong relationship with the family income, with a P-value $> 0.8$, respectively. The family income impact on household budgeting directly determines the structure and flexibility of a household budget. That helps to determine the needs of the low-income, mainly food, housing, utilities, and little room for savings or emergencies. Moreover, middle-income families balance needs and wants, keeping moderate flexibility for goals and emergencies. On the contrary, high-income countries rely on wealth building, investments, luxury, and high flexibility, and they focus on optimization, as we will emphasize in our conclusion. Regarding tax policies, family income is central to how governments design and implement tax systems for this study. Most tax systems are progressive, meaning higher-income households pay more income taxes. Lower-income families may qualify for tax credits such as the earned income tax credit in the U.S. Higher-income households often benefit more from itemized deductions such as mortgage interest or charitable donations. Lower-income households typically take standard deductions. Higher-income families may use tax shelters, investments, or trusts to reduce taxable income legally. Formal accounting reporting at the household level is uncommon in many African countries, especially among lower-income families. However, family income still affects income sources. It keeps low-income families, such as rural households and informal sector workers, relying on irregular incomes from farming, casual labour, or informal businesses(Aguirre Unceta, 2021). Government policies usually provide income-based assistance like food subsidies and health care programs tied to reported income.

Middle- to high-income families, particularly professionals and business owners, are likelier to use mobile money statements like M-Pesa or Mo Cash. Education plays a significant role in diversifying the family income factor and tracking income and expenses using management software or spreadsheets. That requires maintaining records for loans, insurance, or taxes. For example, in Kenya, like any other country under the study, household budgeting income strongly influences how families plan and allocate resources. With this study, we encourage the household to formalise record-keeping, enhance willingness and ability to comply with local tax regulations, and promote

structured budgeting within households. Tools like mobile money, community training, and savings groups help bridge the gap between informal incomes and structured financial planning. Implementing the findings from this study will help the countries under the survey to value the importance of accounting tools to help keep records of lifetime expenses to improve their finance and, consequently, their family income management.

# 5. Conclusion

After reviewing several articles and literature related to agricultural land, education, family income, and food production, we present the findings on the topic under study: "The Role of Agricultural Land, Education, and Food Production in Shaping Family Income: An African Perspective". We have collected data from the World Development Indicators (WDI) database for thirty-one (31) years from 1991 to 2022 for the five following countries: Ethiopia, Kenya, Nigeria, South Africa, and Zambia. We have applied the multistage linear-regression data using SPSS Statistics version 25, stepwise analysis. We have carried out several tests, such as descriptive statistics, correlation, and regression tests, including the "adjusted R-squared" and significance tests. Below is the summary of the output result analysis.

**Table 8:** General Summary

| Model Summary | | | | |
|---|---|---|---|---|
| Countries | | Dependent variable: Family income | | |
| | Test | Model 1 | Model 2 | Model 3 |
| Ethiopia | Adjusted $R^2$ | 0.837 | 0.864 | 0.998 |
| | P- Value | 0.000 | 0.016 | 0.000 |
| Kenya | Adjusted $R^2$ | 0.662 | 0.918 | 0.923 |
| | P-value | 0.000 | 0.000 | 0.102 |
| Nigeria | Adjusted $R^2$ | 0.035 | 0.817 | 0.928 |
| | P- Value | 0.162 | 0.000 | 0.000 |
| South Africa | Adjusted $R^2$ | 0.794 | 0.787 | 0.781 |
| | P-value | 0.000 | 0.762 | 0.582 |
| Zambia | Adjusted $R^2$ | 0.931 | 0.960 | 0.960 |
| | P-value | 0.000 | 0.000 | 0.307 |

According to the summary analysis of the output results in Table 8, all the data we have collected fit the multistage linear regression stepwise model. In Ethiopia, the multistage linear regression confirms that agricultural land, education, and food production significantly impact the family income. Furthermore, this answers our research question as it was formulated: "Do agricultural land, education, and food production significantly impact the family income? An African Perspective". Moreover, for other countries, all independent variables positively influence family income, but one of the three may or may not significantly contribute to family income. For example, in Kenya, the P-value of food production equals $0.102 > 0.05$. This means its contribution to the family income is positive but insignificant compared to agricultural land and education, whose P-value equals $0.000 < 0.05$. Furthermore, in Nigeria, the agricultural land is far beyond predicting the family income if its P-value equals $0.162 > 0.05$ and its adjusted R-square equals 0, far below 1. That shows that in Nigeria, the agricultural land does not fully contribute to the family income for thirty-one years under the study. Furthermore, Nigeria needs to improve its land management policies. At the same time, in South Africa, the analysis results show that education and food production don't significantly impact family income, as demonstrated by the P-value of education equals $0.762 > 0.05$ and $0.582 > 0.05$ for food production. That indicates that the educated people in that country are not fully employed to generate revenue for their families. The government must implement a job creation policy to accommodate the number of educated unemployed people. The same test shows us that food production does not significantly impact family income in South Africa. The government and food production stakeholders in South Africa must implement appropriate policies related to food production matters, such as good agricultural practices, to increase food production in quantity and quality to sustain family income. In addition, the gross product per capita (GDP). The current results from this study also revealed that food production did not perform well in Zambia; as you can see, the P-value equals $0.307 > 0.05$.

Therefore, it cannot be used to predict family income. Through its agriculture ministry in Zambia, the government must mobilise all required resources to promote food production and turn it into an income-generating sector for its population by applying good agricultural practices. My recommendations to Ethiopia and Kenya are to maintain what they have achieved so far in agrarian land, education, and food production or do better. In Nigeria, in particular, the country's policymakers must double their effort in agricultural land policy. We all know that land is a primary asset, and whoever has land has wealth or at least has a place to start any project of their dream. Agricultural land should generate support for family income. Coming to South Africa, where the results show that education does not positively impact family income, the decision-makers should prioritise the private sector to create more job opportunities for educated people, on top of the government's efforts to create job opportunities in that country. That goes with promoting entrepreneurship or initiatives to support the graduates with funds to enable them to develop their initiatives and have good jobs. These measures can be extrapolated to all other African countries experiencing similar situations. The research results have again revealed that food production does not significantly contribute to family income in Zambia. More effort is required in the future, particularly in Africa, to make food production more effective than it is today. No country can dream about a better future without self-sufficiency in food production and education. Results show that households with greater income driven by educational attainment and land productivity are more likely to use basic financial management tools and have higher financial literacy, which promotes economic transparency and inclusion. In conclusion, we suggest that African countries not covered by this study and other developing countries worldwide to run this type of research to know which sector to allocate more resources based on its contribution to the family income and the gross domestic product per capita (GDP per capita). Future research would focus on digital agriculture, fintech, and the mining sector, boosting family income and job opportunities for African citizens.

# Acknowledgements

My gratitude goes to the anonymous peer reviewers and my colleagues at the workplace for their constructive discussions at all stages of this scientific work.

## Funding information

This research has not received any external funding.

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