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Econometrics Analysis of Okra Production Among smallholder farmer Ayamelum Local Government Area, Anambra State

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ABSTRACT: The econometrics analysis of okra production among smallholder farmers in Ayamelum Local Government Area of Anambra was carried out, using cross-sectional data from 100 randomly sampled respondents. The study employed various analytical techniques, including descriptive statistics and linear regression modeling. Regression analysis identified significant factors influencing okra production, including age, sex, marital status, education, and access to credit. Constraints to production were assessed using a Likert scale, revealing that poor access roads, inadequate capital, poor storage facilities, climate change, land fragmentation, high input costs, high labor costs, and labor scarcity during peak season were perceived as significant challenges. However, the study recommends that policymakers should address poor access roads, which emerged as a unanimous and significant constraint. Improving road infrastructure would enhance transportation efficiency, reduce post-harvest losses, and contribute to overall productivity and profitability for okra farmers in the region.

Keywords: *Econometrics, Analysis, Okra, Production, Smallholder, Farmer*

1. INTRODUCTION

Agricultural development is one of the most vital tools to end extreme poverty, enhance shared prosperity, and feed a projected 9.7 billion people by 2050. Growth in the agriculture sector is two to four times more effective in raising incomes among the poorest compared to other sectors (World Bank, 2023). In developing countries like Nigeria, the dynamics of local economic conditions has repercussions on production (Emegha, Ofobuike & Ochuba, 2025). In Nigeria today the exploitation of environmental resources and kidnapping have become business like and has affected farmers as well (Emegha, 2023). The society is a single inter-connected system in which each of its elements (agriculture) performs a specific function in the maintenance of the systemic equilibrium (Emegha, 2020).

Okra is a warm-season vegetable that thrives well in tropical and subtropical regions, making it well-suited for cultivation in Anambra State. In Nigeria as a whole, okra is typically cooked in water with other ingredients and fluted pumpkin mostly producing deliciously slimy soups (Okonkwo-Emegha, Achoja & Okeke, 2019). The fruits are also used to thicken soup and flowers and leaf buds can also be eaten. Okra holds significant importance in both the local and national economy of many countries, especially in regions where it is extensively cultivated. The cultivation and production of okra have numerous economic, nutritional, and social benefits, contributing to sustainable agricultural practices and rural livelihoods just like other vegetables (Okonkwo-Emegha, et al., 2020).

Okra is a versatile and valuable crop for farmers and marketers in Nigeria because of the money made from the sale of immature fresh leaves, fresh, and dried fruits, which are processed into a range of soup products. It is a nutritious food with many health benefits, rich in minerals (sodium, calcium, sodium, potassium, zinc, and iron), dietary fiber, antioxidants, folate, vitamins A, B, and C. Okra seeds are rich in unsaturated fatty acids, including the essential linoleic acid for human nutrition, as well as protein (15–26% of the total), edible seed oil (20–40%), and protein. The mature fruit and stems are used in the paper industry as well as okra mucilage used to make food additives (Babalola, Alemoru, & Lawal, 2020).

Small-scale farmers are often faced with limited resources and financial constraints that makes efficiency difficult, financially empowerment contributes maximally to household, food security and provides a degree of independence within their family budgets especially with the help of soft credit for efficiency (Okonkwo- Emegha, Umebali & Obiekwe, 2025). Credit plays an important role in okra production, accounting for a significant portion of the total output (Mgbenka and Mba, 2016). Smallholder farmers contribute significantly to the food supply, they have remained largely poor because they have not been able to harness the financial benefits of their efforts. These farmers often work with small parcels of land and have limited access to resources including money, contemporary technologies, and market data (Okonkwo-Emegha, Isibor & Adejoh, 2024).

Despite the economic value and high demand of okra there are few literature that exist in Ayamelum local government area to show the factors that limits and affect yield. This is the gap that this research seeks to fill in by analyzing the econometrics of okra production in ayamelum local government area of Anambra state. Therefore, the broad objective of this study was to analyze the econometrics of okra production in Ayamelum Local Government Area of Anambra State. However, the specific objectives were to: determine the factors affecting the production of okra and identify the constraints faced by okra producers.

2. **LITERATURE REVIEW**

Concept of Factors Affecting Okra Production

Okra (Abelmoschus esculentus) production is influenced by a combination of agronomic, environmental, socioeconomic, and management factors. Understanding these factors is crucial for optimizing yields, ensuring sustainable production, and addressing challenges faced by okra farmers. According to (Nwaobiala & Nwosu, 2013) non access to credit, pest and disease infestation and poor extension services are factors affecting okra production. Factors affecting Okra production include land acquisition, size of farm land, land preparation method and source of capital.

Below are generally key factors that affect okra production:

Climatic Conditions: Okra is a warm-season crop that thrives in tropical and subtropical regions. Temperature, humidity, and rainfall play a vital role in determining the success of okra cultivation. High temperatures promote growth, while excessive rainfall or water logged conditions may lead to water stress and disease development.

1. Soil Type and Fertility: Okra prefers well-drained soils with good fertility. Sandy loam or loamy soils are ideal for its growth. Adequate soil nutrients, particularly nitrogen, phosphorus, and potassium, are essential for healthy plant development and higher yields. (Babalola, Alemoru, & Lawal, 2020)
2. Varietal Selection: The choice of okra varieties affects production outcomes. Different varieties have varying growth habits, disease resistance, and fruit characteristics. Selecting suitable varieties based on the local agro-climatic conditions and market preferences is crucial. (Nwaobiala & Nwosu, 2013)
3. Crop Management Practices: Proper crop management techniques, including planting density, irrigation scheduling, and weed control, significantly impact okra production. Adequate spacing and regular weeding ensure optimum plant growth and minimize competition for resources. (Babalola, Alemoru, & Lawal, 2020)
4. Pest and Disease Management: Pests and diseases are major constraints in okra production. Common pests include aphids, stink bugs, loopers, and borers, while diseases like Fusarium wilt and root-knot nematodes can cause significant losses. Effective pest and disease management strategies are vital for protecting the crop. (Kehinde & Kehinde, 2022)
5. Water Management: Proper irrigation is crucial, especially during dry spells, to maintain consistent soil moisture levels. Drip irrigation and mulching can improve water-use efficiency and reduce water stress on okra plants.
6. Access to Inputs: Availability and affordability of quality seeds, fertilizers, and pesticides influence okra production. Limited access to these inputs can hinder yield potential and overall profitability. (Kehinde & Kehinde, 2022)

7. Market Access and Demand: The availability of a stable market and demand for okra produce is essential for farmers to earn a reasonable income from their harvest. Access to local markets and potential for export can influence planting decisions. (Babalola, Alemoru, & Lawal, 2020). Labor Availability: Okra cultivation requires a significant amount of labor, particularly during planting, harvesting, and weeding. Adequate availability of skilled labor can impact the overall efficiency of the production process. (Kehinde & Kehinde, 2022).

2.2 THEORETICAL FRAMEWORK

Theory of Production:

Theory of production, as defined by Robert Dorfman, is a fundamental concept in economics that delves into the principles guiding a business firm's decisions regarding the quantity of each commodity it will produce, the allocation of labor, raw materials, and other inputs it will employ. The theory of production examines the relationship between the factors of production (land, labor, capital, entrepreneur) and the output of goods and services. The theory is based on the “short run” or a period of production that allows production to change the amount of variable input, in this case, labor. The “long run” is a period of production that is long enough for producers to adjust various inputs to analyze the best mix of the factors of production. (Libretexts, 2022). It forms the basis for understanding how inputs influence outputs in the process of creating goods and services. In the case of okra cultivation, the theory of production serves as a guiding framework that aids in optimizing resource utilization and maximizing yield.

Production Theory Essentials

1. Inputs and Outputs: Just as in any economic activity, okra production involves inputs and outputs. Inputs can include labor, capital, raw materials, and technology, while outputs refer to the final products or yield, in this case, okra pods. (Nickolas, 2021)

2. Production Function: Production function is a mathematical equation that states the amount of product that can be obtained from every combination of factors,

assuming that the most efficient available methods of production are used. The production function is akin to a mathematical equation that illustrates how inputs contribute to the creation of outputs.(Nickolas, 2021) For instance, in the context of okra cultivation, a formula like Q = f(L, K) could represent how labor (L) and capital (K) influence the quantity of okra produced (Q). This function guides decision-making regarding the allocation of resources.

3. Marginal Product: Marginal product represents the change in output resulting from the addition of one more unit of an input while keeping other inputs constant. (Young, 2021) In okra production, this concept can help determine the optimal number of workers or the most effective use of capital to achieve the desired yield.

4. Isoquants: Isoquants are graphical representations that outline different combinations of inputs resulting in the same level of output. They aid in identifying the various ways resources can be combined to achieve a particular yield. For okra cultivation, isoquants could illustrate the different combinations of labor and capital leading to the same quantity of okra pods.

5. Costs: Costs play a pivotal role in production theory. Total cost, average cost, and marginal cost are important cost considerations. (Young, 2021) For okra production, understanding these cost factors helps in making decisions that balance production efficiency and economic feasibility.

6. Optimal Input Mix: Achieving the optimal input mix is similar to crafting the perfect recipe. In okra cultivation, it involves determining the ideal combination of labor, capital, and other resources to achieve the highest possible yield without wastage.

7. Law of diminishing marginal productivity: The law of diminishing marginal productivity is an economic principle usually considered by managers in productivity management. Generally, it states that advantages gained from slight improvement on the input side of the production equation will only advance marginally per unit and may level off or even decrease after a specific point (Young, 2021)

Application to Okra Cultivation

1. Economies of Scale: Just as the concept applies to buying in bulk, okra production can benefit from economies of scale. Increasing the scale of production might lead to lower average costs per unit of okra, contributing to overall profitability. (Kenton, 2022)

2. Short Run vs. Long Run: Okra cultivation, like other agricultural activities, experiences short-run and long-run dynamics. Immediate adjustments, such as changing labor input, can happen quickly, while longer-term changes like investing in improved irrigation infrastructure require more time and planning.

3. METHODOLOGY

Research Design

This study employed Survey Research Design.

Area of study

The study area, Ayamelum is a Local Government Area (LGA) in Anambra State, in the southeastern part of Nigeria with headquarters in Anaku. The towns that make up the local government are Anaku, Umueje, Omasi, Igbakwu, Umumbo, Omor, Umuerum and Ifite Ogwari. Ayamelum's area is situated at the border between Enugu state and Anambra state. The communities in the area are notable for food production. The tribe in Ayamelum LGA is the Igbo ethnic group with the Igbo and English languages spoken extensively within the area. Ayamelum LGA is home to a number of prestigious and indigenous festivals which include the Ofalla festival, the Obubezi festival, and the Olila aka festival. Ayamelum LGA has a boundary with Uzouwani local government in Enugu State in the North, in the South with Anambra East local government, in the East with Awka North local government and in the West with Anambra West local government Anambra State. The state's geographical coordinates lie between longitude 6º35E and 7º21E and latitude of 5º38N and 6º47E (Wikipedia.org/wiki/anambra state, 2022). Ayamelum has its administrative headquarters in Anaku. Its region is strategically positioned on the boundary between the states of Enugu and Anambra. The study area possesses significant economic and

agricultural potential, capable of generating revenue and providing employment opportunities for its residents. Currently, the Otuocha-Omor-Adani federal road serves as the sole access route to the local government area (LGA), Within Anambra State, the study area stands out as a key region for okra cultivation. The land area of the study area spans approximately 196 km2 and experienced a population increase from 223,641 in 2017 to 233,763 persons in 2019, based on a growth rate of 3.2% projected from the 2006 census figures of the National Population Commission (NPC) (The Anambra State Statistical Year Book (SYB), 2017).

The cultivation of okra is a major occupation for its population, making it a vital component of the local government's agricultural system. In view of the economic importance of okra for improving the livelihoods of rural farmers in Ayamelum Area, its production has almost out-shined other crops with exception of rice and cassava in the study area (Udemezue, 2017). The region's favorable climate and fertile lands contribute to successful okra production, allowing farmers to significantly contribute to the local and regional markets

The Population of the Study

The population of the study comprises of all the registered okra farmers (1,308) in Ayamelum LGA of Anambra State.

Sampling Technique and Sample Size

For this study, a multi-stage sampling technique was be employed. **In the first stage,** Ayamelum local government was be purposively selected because of the dominance of okra producers in the area. In the second stage, five (5) communities were randomly selected. The selected communities included: Umueje, Omasi, Igbakwu, Umuerum and Ifite Ogwari. In the final stage, twenty (20) okra farmers were randomly chosen from each of the previously selected communities. This resulted in a total of 100 respondents who formed the sample size for the study.

Method of data collection

Data was collected from a primary source using a validated structured questionnaire for this study, aligning with the study's objectives. Secondary data was also use, it was obtained from textbook, journal, reports, and internet.

Method of Data Analysis

To achieve the study's objectives, the data was analyzed using various statistical techniques:

Objective (iii) was analyzed using multiple regression analysis and Objective (iv) was analyzed using mean 4 - point likert scale

Multiple regression model.

The regression model was as specified as follows;

T = □□+ b1X1 + b2X2 +b3X3 + b4X4 ------- b11X11 + μ

Where T = okra output based on individual farmer (dependent variable)

□□= constant term

b1 – b12 = regression coefficients

X1 = age: (measured in year)

X2 = Sex; (male = 1, female = 0)

X3 = education; (measured by the number of years spent in formal education)

X4 = marital status, (1 for being married and 0 for none)

X5 = household size (measured by the number of people living under one roof)

X6 = credit; (dummy variable for receiving credit = 1 and 0 for not received).

X7 = Extension contacts (measured by number of times visited by extension agent in the last one year)

X8 = Cost of Labour (money spent in labour, man per day)

X9 = Cost of Fertilizer (money spent)

X10= Income. Respondents were asked to give the amount of money they earn annually from rice production.

X11 = Farming experience (measured in years)

μ = error term

4. RESULTS AND DISCUSSION

Factors Influencing the Production of Okra

The factors influencing the production of okra is presented in Table 1. F-statistics (14.23) *** was significant at 1% level of probability. A higher F-statistic suggests that the overall model is more likely to be significant. From the result, it could be inferred that at least, one of the independent variables is influencing the result of the dependent variable. The R-squared (0.615) indicates the proportion of the variance in the dependent variable (okra production) that is explained by the independent variables in the model. In this case, 61.5% of the variance is explained. The coefficient of age is 0.090 which is positively significant at a 1% level of probability. This suggests that a one-unit increase in age is associated with a 0.090-unit increase in the dependent variable (production of okra). This is in line with the report of Okonkwo-Emegha, et al., (2020) who reported that age of smallholder vegetable farmers are positively significant at 1% level of probability. The coefficient of sex is -1.000 which is negatively significant at a 5% level of probability. Being female is associated with a decrease of 1.000 units in the dependent variable compared to being male. The coefficient of marital status is -0.947 which is negatively significant at a 1% level of probability. Being married (or having a different marital status) is associated with a decrease of 0.947 units in the dependent variable compared to being single. The coefficient of education is -0.133 which is negatively significant at a 1% level of probability. Higher levels of education are associated with a decrease of 0.133 units in the dependent variable. More educated farmers tend to move to more paying jobs than okra production. This report is inversely related to the report of Okonkwo-Emegha & Isibor (2023) who reported that education is the bedrock and

growth of any enterprise with innovation and new technologies. The coefficient of Credit is 2.398 which is positively significant at a 1% level of probability. Access to credit is associated with a 2.398 unit increase in the dependent variable (production of okra). The coefficient of the cost of fertilizer is 0.000 which is positively significant at a 1% level of probability. The cost of fertilizer does not have any valuable influence on okra production. The regression analysis suggests that age, sex, marital status, education, and credit are significant factors influencing the production of okra. The model, as a whole, is statistically significant, as indicated by the F-statistic and the reasonably high R-squared value. The t-values help assess the significance denoting of individual coefficients, with asterisks the level of significance. In addition, the significant impact of age, marital status, and education on okra production aligns with the findings of Babalola et al. (2020) in the Kabba-Bunu Area of Kogi State. The positive association of access to credit with okra production corresponds with the results from Kehinde & Kehinde's research (2022); Okonkwo-Emegha, (2025).

In summary, the results suggest that several socioeconomic characteristics have a significant impact on the profit from okra production. Age and access to credit, are positively associated with profit, while education, sex and marital status are negatively associated. The model seems to be a reasonably good fit, explaining about 61.5% of the variability in profit. Thus, the null hypothesis is rejected based on the significant variables.

Table 1: Factors influencing the production of okra

Parameters	**Coefficient**	**Std. Error**	**t-value**
Intercept	11.140	3.459	3.22
Age	0.090	0.015	6.09***
Sex	-1.000	0.429	-2.33**
Marital status	-0.947	0.189	-5.01***
Household size	0.080	0.072	1.11
Farming experience	-0.050	0.034	-1.47
Education	-0.133	0.029	-4.52***
Farm size	-0.036	0.045	-0.80

Credit	2.398	0.430	5.58***
Cost of Labour	0.000	0.000	-0.98
Cost of Fertilizer	0.000	0.000	2.89***
F-statistics	14.23		
R-square	0.615		
Adjusted R-square	0.572		
Obs.	100		

Source: Field Survey, 2025. Sig. @ 10% (*), 5% (**), and 1% (***)

Constraints Faced by Okra Producers

The table presents the constraints faced by okra producers, with the variables captured using a 4-point Likert scale. The mean threshold for decision-making is set at 2.5, where variables with a mean score of 2.5 and above are considered significant challenges, while those below the threshold are not considered challenges. The grand mean of 2.90 indicates that, on average, the constraints listed in the table are perceived as significant challenges by the okra producers.

Individual challenges:

Poor Access Roads (Mean: 3.0): The mean score of 3.0 indicates that poor access roads are considered a significant challenge by okra producers. This means that, on average, respondents agree that poor access roads pose a constraint to okra production.

Inadequate Capital (Mean: 3.0): Similarly, inadequate capital is identified as a significant challenge with a mean score of 3.0. Producers agree that a lack of sufficient capital is a constraint to their okra production.

Pests and Diseases (Mean: 2.5): Pests and diseases have a mean score exactly at the threshold of 2.5. This suggests that, on average, respondents consider pests and diseases to be a moderate challenge but not a significant one.

Poor Storage Facilities (Mean: 3.0): The mean score of 3.0 indicates that poor storage facilities are perceived as a significant challenge. Okra producers agree that inadequate storage facilities pose a constraint to their production.

Climate Change (Mean: 2.9): With a mean score of 2.9, climate change is considered a significant challenge, as it falls above the threshold. Okra producers agree that climate change impacts their production. Climate change still remains a striking challenge in the production system in the developing countries like Nigeria (Emegha, et al., 2025).

Land Fragmentation (Mean: 2.7): Land fragmentation, with a mean score of 2.7, is also considered a significant challenge. Although it is slightly below the threshold, it is still perceived as a notable constraint.

High Cost of Farm Inputs (Mean: 2.9): The high cost of farm inputs, with a mean score of 2.9, is considered a significant challenge. Producers agree that the cost of inputs is a constraint to okra production.

High Cost of Labor (Mean: 3.1): The high cost of labor, with a mean score of 3.1, is identified as a significant challenge. Producers agree that labor costs pose a constraint to okra production.

Scarcity of Labor during Peak Season (Mean: 2.9): With a mean score of 2.9, scarcity of labor during peak season is considered a significant challenge. Okra producers agree that labor scarcity is a constraint during critical production periods.

However, the results suggest that poor access roads, inadequate capital, poor storage facilities, climate change, land fragmentation, high cost of farm inputs, high cost of labor, and scarcity of labor during peak season are considered significant constraints to okra production, as the mean scores for these variables are at or above the established threshold, this result is in line with the report of Okonkwo-Emegha, et al., (2024) who reported that the major constraints faced by smallholder vegetable producer are poor access roads, inadequate capital, poor storage facilities, high cost of farm inputs, high cost of labor, and scarcity of labor.

Table 2: Constraints faced by okra producers

Sn.	Challenges	Mean	Std. Dev.	Decisions
1	Poor access roads	3.0	0.830	Agree
2	Inadequate capital	3.0	0.866	Agree
3	Pests and diseases	2.5	1.126	Agree
4	Poor storage facilities	3.0	0.818	Agree
5	Climate change	2.9	0.752	Agree
6	Land fragmentation	2.7	1.179	Agree
7	High cost of farm inputs	2.9	0.805	Agree
8	High cost of labour	3.1	0.814	Agree
9	Scarcity of labour during peak season	2.9	0.810	Agree
	Grand mean	**2.90**		**Agree**

Source: Field Survey, 2025.

5. Conclusion

This study investigates the econometrics analysis of okra production among smallholder farmers in Ayamelum Local Government Area of Anambra State.

The regression analysis identified various factors that can statistically affect okra production either negatively or positively. They include age, sex, marital status, education, and access to credit. The model provides insights into the relationships between these variables and okra production, helping policymakers and farmers make informed decisions to enhance productivity. The R-square value of 0.621 implies that 62.1% of the variability in okra production is explained by the model. The positive socio-economic characteristics include sex, marital status, education, and access to credit, while the negative ones are age and farming experience.

Considering the constraints faced by the okra farmers in the study area, these constraints: poor access roads, inadequate capital, poor storage facilities, climate change, land fragmentation, high cost of farm inputs, high cost of labor, and scarcity of labor during peak season were the majority with a grand mean of 3.35. These findings can be crucial for policymakers, agricultural extension services, and other stakeholders to develop targeted interventions and support mechanisms to address

these challenges and improve the overall sustainability of okra production in the study area.

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