



Research Paper

The Effect of Land Area and Agricultural Production on Per Capita Income in Aceh Jaya Regency

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Abstract

This study examines the partial and simultaneous effects of agricultural land area and agricultural production output on per capita income in Aceh Jaya Regency, Aceh Province, Indonesia. The study used a quantitative approach with annual secondary time-series data for 2000–2024 ($n = 25$) obtained from Statistics Indonesia (BPS). The data were analyzed using multiple linear regression with t-tests and an F-test at a 5% significance level. The results show that land area and production output simultaneously have a significant effect on per capita income, as indicated by a calculated F-value of 62.481, which is greater than the F-table value of 3.443 (sig. 0.000). Partially, land area has a positive and significant effect on per capita income, with a coefficient of 0.634 and a calculated t-value of 6.469, which is greater than the t-table value of 2.074. Production output also has a positive and significant effect on per capita income, with a coefficient of 0.234 and a calculated t-value of 3.391, which is greater than the t-table value of 2.074. The coefficient of determination (R^2) is 65.3%, meaning that 65.3% of the variation in per capita income is explained by land area and production output, while the rest is explained by other factors outside the model. The study recommends protecting productive agricultural land from conversion and increasing agricultural productivity to raise per capita income. Further research should include other determinants, such as capital, commodity prices, technology, and labor quality.

Keywords: Land Area, Agricultural Production, Per Capita Income, Multiple Linear Regression, Aceh Jaya

1. Introduction

The agricultural sector plays an important role in developing countries, yet attention to agricultural development is often limited. There has been a tendency to neglect agriculture in



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efforts to accelerate economic development because it is associated with traditional practices, low productivity, inefficient production systems, and hidden unemployment. Nevertheless, a large body of evidence shows that agricultural and rural growth contributes more to poverty reduction and to the welfare of low-income households than growth in other sectors [1], [2]. In Indonesia, the expansion of agricultural commodities, such as oil palm, has been shown to raise household income and living standards among smallholder farmers [3]. For regions whose economies depend on agriculture, such as Aceh Jaya Regency, the performance of the agricultural sector is therefore closely linked to the welfare of the population [4].

Per capita income is one of the main indicators used to measure the prosperity and level of development of a country or region [5]. In economic terms, income is the return on the use of factors of production owned by households and firms, in the form of wages, rent, interest, and profit [6]. Several factors can affect income in agricultural areas, including the area of land cultivated and the amount of production [7], [8]. Production is essentially the product of the harvested area and productivity per hectare, so the production of a region depends on the area harvested in a given year and the level of productivity achieved [9].

Land area determines the number of crops that can be planted and, ultimately, the amount of production. For rural households whose main activity is farming, the land they own is one of the main determinants of the income they receive: when the area of land cultivated increases, farm income tends to increase, and when it shrinks, income declines [10], [11]. Agricultural products include everything obtained from crop cultivation and animal husbandry used for human consumption, industry, or other purposes, and an increase in agricultural output raises farm income and regional output [12], [13].

Previous studies have mostly examined the effects of land area and production on the income of individual farm households [6], [7], [8], [10] or on the gross regional domestic product (GRDP) of the agricultural or plantation sub-sector [13], [14], [15], [16]. Studies that link agricultural land area and production directly to per capita income at the regency level, using long time-series data, remain limited, particularly for Aceh Jaya Regency. This study therefore aims to analyze the partial and simultaneous effects of agricultural land area and agricultural production output on per capita income in Aceh Jaya Regency for the period 2000–2024.

2. Literature Review

Per Capita Income

Per capita income is often used as a measure of prosperity and the level of development of a country or region [7]. In a macroeconomic context, it refers to the total income earned by all factors of production, such as labor, capital, and natural resources, in a region during a certain period, measured as gross national product (GNP) or gross domestic product (GDP), divided by the population [5], [6]. When calculated using GDP adjusted for inflation, per capita income reflects the real value of the income received by individuals, without the influence of price fluctuations. Per capita income is calculated as follows [5]:

$$\text{Per capita income}_t = \text{Regional income}_t / \text{Population}_t$$

Land Area

Uncontrolled population growth and economic growth are two key factors that increase the demand for land for various uses, especially infrastructure, commercial, and residential purposes. Under these conditions, demand for land for non-agricultural uses also increases, leading to the conversion of agricultural land [17], [18]. In agriculture, land area refers to the area of land used for agricultural activities, such as crop cultivation, livestock, or other farming, and is measured in

hectares (ha) or square meters (m²) [6], [7]. Land area is the entire area where crops are planted, and it determines the quantity of output that farmers can obtain [19], [20]. In this study, land area is measured by the area of agricultural land in Aceh Jaya Regency.

Production Output

Production is an activity that directly or indirectly produces goods and services or increases the utility of economic goods. Every production process has a technical basis, which in economic theory is called the production function, that is, the technical relationship between factors of production (inputs) and output per unit of time. Production output is the amount of goods produced in a given period by individuals, groups, or firms [9], [19]. Production is thus a combination and coordination of inputs, resources, or production services in the making of goods, and the output of one production process may be an input for another or a final consumption good. Higher agricultural output has been found to increase farm income and the agricultural or plantation GRDP [13], [15], [16]. In this study, production output is measured by the total agricultural production of Aceh Jaya Regency.

Hypotheses

Based on the theory and previous studies, the hypotheses of this study are as follows: H1, land area has a significant effect on per capita income in Aceh Jaya Regency; H2, production output in the agricultural sector has a significant effect on per capita income in Aceh Jaya Regency; and H3, land area and production output simultaneously have a significant effect on per capita income in Aceh Jaya Regency.

3. Method

Research Approach and Data

This study used a quantitative approach. The research location was Aceh Jaya Regency, Aceh Province, Indonesia, and the period of analysis was 2000–2024. The data were annual secondary time-series data ($n = 25$) on agricultural land area, agricultural production output, and per capita income, obtained from publications of Statistics Indonesia (Badan Pusat Statistik, BPS) [4].

Data Analysis

The data were analyzed using multiple linear regression to determine the effects of land area and agricultural production output on per capita income in Aceh Jaya Regency, with the help of SPSS. The regression model is formulated as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + e$$

where Y is per capita income, α is the constant, β_1 and β_2 are the regression coefficients, X_1 is land area, X_2 is agricultural production output, and e is the error term. The hypotheses were tested using a t-test (partial) and an F-test (simultaneous) at a 5% significance level. With $n = 25$ and two independent variables, the t-table value is 2.074 ($df = 22$) and the F-table value is 3.443 ($df = 2; 22$). The coefficient of determination (R^2) was used to measure the proportion of variation in per capita income explained by the independent variables. Because the independent variables in a regression of this type may be correlated with each other, the results were interpreted with attention to the possibility of multicollinearity [21].

4. Result and Discussion

Regression Results

The results of the multiple linear regression analysis are presented in Table 1.

Table 1. Results of multiple linear regression

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	6.778	0.831		8.156	0.000
Land area (X1)	0.634	0.098	0.534	6.469	0.000
Production output (X2)	0.234	0.069	0.190	3.391	0.000

Dependent variable: per capita income (Y). Source: Data processed with SPSS, 2025.

Based on Table 1, the multiple linear regression equation is as follows:

$$Y = 6.778 + 0.634X_1 + 0.234X_2 + e$$

The constant of 6.778 indicates the value of per capita income when land area and production output are zero. The coefficient of land area (0.634) and the coefficient of production output (0.234) are both positive, meaning that an increase in land area or production output is associated with an increase in per capita income in Aceh Jaya Regency, assuming the other variable is constant. Based on the standardized coefficients, land area (Beta = 0.534) has a stronger effect on per capita income than production output (Beta = 0.190).

Partial and Simultaneous Tests

For land area (H1), $\beta_1 = 0.634$ ($\beta_1 \neq 0$), and the calculated t-value (6.469) is greater than the t-table value (2.074). Therefore, H0 is rejected and Ha is accepted, meaning that land area partially has a significant effect on per capita income in Aceh Jaya Regency in 2000–2024. For production output (H2), $\beta_2 = 0.234$ ($\beta_2 \neq 0$), and the calculated t-value (3.391) is greater than the t-table value (2.074). Therefore, H0 is rejected and Ha is accepted, meaning that agricultural production output partially has a significant effect on per capita income in Aceh Jaya Regency in 2000–2024. The results of the simultaneous test are presented in Table 2.

Table 2. Results of the simultaneous test (ANOVA)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4,478.000	2	2,269.000	62.481	0.000
Residual	2,009.000	23	54.297		
Total	6,487.000	24			

Source: Data processed with SPSS, 2025.

For the simultaneous test (H3), the calculated F-value (62.481) is greater than the F-table value (3.443), with a significance of 0.000. Therefore, H0 is rejected and Ha is accepted, meaning that land area and agricultural production output simultaneously have a significant effect on per capita income in Aceh Jaya Regency in 2000–2024. The coefficient of determination (R^2) is 65.3%, which means that 65.3% of the variation in per capita income is explained by land area and production output, while the remaining 34.7% is explained by other variables outside the model.

Effect of Land Area on Per Capita Income

The results show that land area has a positive and significant effect on per capita income in Aceh Jaya Regency. This finding is consistent with Ramadan *et al.* [6] and Novianty and Awaliyah [10], who found that land area affects farm income, and with Yamani *et al.* [13], who found that land area has the largest effect on plantation GRDP in South Labuhanbatu. Land is one of the main factors of production in agriculture, which is the backbone of the economy in Aceh Jaya. When agricultural land is expanded or used optimally, production potential increases, giving farmers the opportunity to earn more and raising per capita income in general. Conversely, if agricultural land

shrinks because of conversion to residential, industrial, or infrastructure uses, production capacity declines and directly reduces the income of the many households that depend on agriculture [17], [18]. These results differ, however, from Juanda *et al.* [15], who found that oil palm land area had a positive but insignificant effect on GRDP at the national level, suggesting that the role of land area depends on how productively it is used.

Effect of Production Output on Per Capita Income

The results show that agricultural production output has a positive and significant effect on per capita income in Aceh Jaya Regency. This finding is consistent with Pradnyawati and Cipta [7] and Saputra and Wardana [8], who found that production affects farmers' income, and with Mayasafitri *et al.* [14], who found that crude palm oil production significantly affects the agricultural GRDP. Most of the population of Aceh Jaya depends on agriculture, including food crops, horticulture, and plantations. When agricultural production increases, farmers' income tends to rise through higher sales, which in turn promotes local economic growth and contributes to higher per capita income. Conversely, a decline in production due to extreme weather, pests, or land conversion reduces farmers' income and the contribution of agriculture to GRDP [19], [20]. Fluctuations in agricultural output therefore have a direct impact on community welfare and on per capita income in Aceh Jaya. The relatively smaller standardized coefficient of production output compared with land area may indicate that productivity per hectare remains low, so increases in output come mainly from expanding the cultivated area rather than from intensification [16], [20].

Limitations

This study has several limitations. It uses only two explanatory variables and a relatively small number of annual observations ($n = 25$) for a single regency, so other determinants of per capita income, such as capital, commodity prices, technology, and labor quality, are not captured. In addition, the analysis does not report diagnostic tests for the classical regression assumptions, such as normality, multicollinearity, heteroscedasticity, and autocorrelation, which are important for time-series data [21]. The results should therefore be interpreted with caution.

5. Conclusion

Land area and agricultural production output simultaneously have a significant effect on per capita income in Aceh Jaya Regency, with a calculated F-value of 62.481, which is greater than the F-table value of 3.443 (sig. 0.000). Partially, land area has a positive and significant effect on per capita income ($\beta_1 = 0.634$; $t = 6.469 > 2.074$), as does agricultural production output ($\beta_2 = 0.234$; $t = 3.391 > 2.074$). Together, the two variables explain 65.3% of the variation in per capita income.

The government is expected to strengthen spatial planning and the protection of productive agricultural land to prevent land conversion that harms the agricultural sector, and to increase technical and financial support for farmers through productivity programs, such as the provision of superior seeds and irrigation. Farmers are encouraged to adopt more efficient and environmentally friendly agricultural technologies to increase production. Future research should include other variables that may affect per capita income, such as access to capital, commodity prices, technology use, and labor quality; extend the analysis to several regencies or provinces using panel data; and use other analytical methods, such as panel data regression, spatial econometric models, or path analysis.

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Authors' contributions and responsibilities

Muhammad Fauzi: conceptualization, data collection, formal analysis, writing – original draft. Yuliana: supervision, methodology, writing – review & editing. Edi Saputra: supervision, validation, writing – review & editing.

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Availability of data and materials

The data used in this study are secondary data published by Statistics Indonesia (BPS) and are publicly available. The processed data are available from the authors upon reasonable request.

Competing interests

The authors declare no competing interest.

Ethical approval

Not applicable. This study used publicly available secondary data and did not involve human participants.

Additional information

No additional information from the authors.

Declaration of Generative AI and AI-Assisted Technologies

During the preparation of this manuscript, Claude (Anthropic) was used to improve the language and readability of the English text and to format the manuscript, tables, equations, and references according to the journal template. The tool was not used to generate research data, perform the analysis, or draw conclusions. The authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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