

ANALYSIS THE EFFECT RICE HARVEST AREA, PROPORTION OF FOOD EXPENDITURE, AND FARMER EXCHANGE RATE ON FOOD SECURITY IN JAVA ISLAND.

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Abstract

Food security in Java Island still faces challenges, mainly due to the problem of rice production that tends to fluctuate and the unstable socioeconomic conditions of farmers. This study aims to analyze the area of harvest, proportion of food expenditure, and farmer exchange rate (FER) on food security, as measured by the Food Security Index (FSI), in five provinces in Java from 2018 to 2024. This study utilizes secondary data and employs panel data regression analysis with a fixed effects model. The results of the analysis indicate that the rice harvest area has a negative and significant impact on food security, while the farmer's exchange rate has a positive and significant effect; however, the proportion of food expenditure has no significant impact on food security. The findings suggest that increasing agricultural productivity must be accompanied by sustainable management, as well as improving farmers' welfare, to strengthen national food security.

Keywords: Harvest Area, Proportion of Food Expenditure, Farmer Exchange Rate (FER), Food Security Index (FSI), Food Security.

INTRODUCTION

Food security is a condition in which everyone has access to sufficient, safe, and nutritious food at all times (FAO, 2021). According to Amartya Sen (1981), the issue of food security is not only related to the availability of food, but also to the ability of people to access it. Food security is a crucial issue because it has a direct impact on the economic, social, and welfare stability of society. When food is difficult to access, people's purchasing power may decline, leading to an increase in the price of basic commodities and a decline in household welfare. The imbalance between rice production and demand prompts the government to import, which, if not managed effectively, can exacerbate the trade deficit and harm local farmers due to depressed selling prices (Supriyanto, 2024).

Indonesia is geographically divided into two central regions, namely the western and eastern parts. In the western part, Java Island is the main center, with a dominance of agriculture, industry, and trade. In the eastern part, South Sulawesi serves as a growth center, significantly contributing to food production and distribution (Alfi et al., 2023). The rice commodity remains the primary food source for Indonesians, with rice consumption reaching 93.8 kg per capita per year in 2023, significantly exceeding the consumption of corn and tubers. Therefore, maintaining the availability and affordability of rice is crucial for national food security.

Java Island, a national rice barn that contributes more than 50% of the total national rice production, plays a crucial role in food availability. However, in recent years, Java Island's rice production has often experienced fluctuations, as illustrated in the following graph.

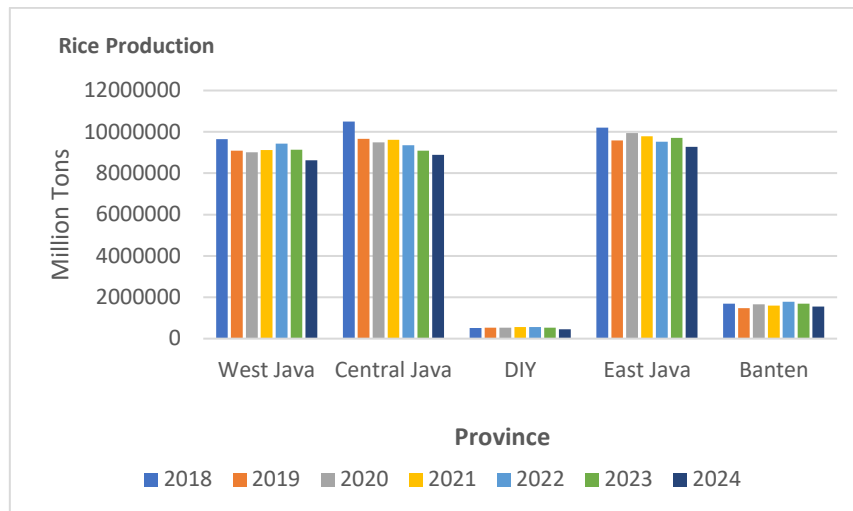


Figure 1. Rice Production in Java Island 2018-2024

Based on Figure 1, rice production in Java is dominated by three main provinces: West Java, Central Java, and East Java, with the highest production recorded in Central Java in 2018 at 10.5 million tons. Despite the relatively better agricultural infrastructure and farmers' access to technology in this region (Hilalullaily et al., 2021), all three provinces experienced a downward trend in production from 2018 to 2024. Central Java recorded the most significant decline, averaging 289,630 tons per year, followed by East Java with 246,755 tons and West Java with 239,572 tons. If this trend continues, it will have a profound impact on national food security, including potential food insecurity, rising rice prices, decreased purchasing power, and increased poverty and malnutrition. Therefore, this study focuses on Java Island, which is the national rice granary.

The decline in rice production is caused by several factors, including the conversion of agricultural land to non-agricultural uses, climate change, and extreme weather that disrupt the planting cycle; declining soil fertility due to the excessive use of chemical fertilizers; and limited access to modern agricultural technology (Nubun & Yuliawati, 2022). This condition has a direct impact on national production, especially if it is not balanced with the expansion or protection of existing agricultural land. Therefore, the size of the harvest area is a crucial indicator in determining the amount of food production, as the larger the harvested land, the greater the production that supports national food availability.

Food security depends not only on availability, but also on access to food, both economically, physically, and socially (Purwaningsih, 2018). The proportion of food expenditure is an important indicator in measuring the economic aspects of food security. By Working's law, the greater the proportion of food expenditure, the lower the level of income and food security of a household. Households with a proportion of food expenditure exceeding 60% are classified as food insecure due to limited access to nutritious food and other non-food necessities (Alfi et al., 2023). In Java Island, despite relatively better agricultural production and infrastructure, the pattern of community food expenditure is still influenced by the income level, economic conditions, and consumption preferences of each region.

Farmer Exchange Rate (FER) is an indicator of economic access that reflects farmers' purchasing power. A high NTP indicates that farmers' income is sufficient to meet their food and non-food needs, making it easier for them to access food. Conversely, a low FER reflects weak purchasing power, even though farmers are food producers. An FER above 100 indicates a satisfactory level of welfare, which is crucial for ensuring the sustainability of farming as a staple food provider for the community (Syifa Aulia et al., 2021).

This study uses the Food Security Index (FSI) as an indicator of food security, which covers four components of food security, namely 1) adequacy of food availability, 2) stability of food availability, 3) food accessibility, and 4) food quality/safety. IKP provides a comprehensive picture of a region's

food security, which is more effective in identifying food security challenges and risks at a large scale, making it relevant in formulating sustainable food security policies. Therefore, this study aims to analyze how the influence of rice harvest area, proportion of food expenditure, and farmer exchange rate (FER) affects food security on the island of Java.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

According to Amartya Sen (1981), food insecurity is not merely a failure of supply, but rather a failure of access to sufficient food. Sen suggests four ways in which individuals obtain food, namely through production, trade, work, and transfer (inheritance or aid). This analysis was later expanded by Dreze (1989), emphasizing the importance of access to food and other essential goods and services that impact food security (Silvia, 2022). In line with this, FAO defines food security as a condition in which everyone, at all times, has physical and economic access to sufficient, safe, and nutritious food.

Hanani (2009), as cited in Purwaningsih (2018), notes that food security comprises three main subsystems: food availability, access, and utilization, the outcome of which is reflected in nutritional status. If one of the subsystems is not fulfilled, food security is not good. The Food Security Agency also emphasizes that sufficient food availability does not guarantee food security if people still have limited access to it. In Indonesia, food security is measured through three key aspects: availability, affordability, and utilization, which are integrated into the Food Security Index (FSI). The FSI is the primary indicator used to measure food security, as employed in research by Romiza & Nopiah (2024) and Risvenjaya et al. (2024).

The aspect of food availability is evident in the rice harvest area. According to the Central Statistics Agency (BPS), the harvest area refers to the land area that produces commodities ready for harvest, while the planting area encompasses the total land used for planting a particular commodity. The larger the available land area, the greater the opportunity for farmers to increase rice production; conversely, a narrow land area will limit production. A decrease or increase in harvested area directly impacts the amount of rice production, which in turn affects food availability in the region. Thus, rice harvest area not only reflects agricultural production capacity, but is also an important indicator in maintaining food security. This finding aligns with research by Juliyanti and Usman (2018), Faisol Muttaqin and Suman (2023), Alfianti (2022), Putri Andaresta et al. (2024), and Rahim et al. (2024), which state that the rice harvest area has a positive and significant effect on food security.

Hypothesis 1: Rice harvest area has a positive and significant effect on food security.

One measure of economic access can be seen in the proportion of consumption expenditure. According to the Central Statistics Agency (BPS), the proportion of consumption expenditure is the percentage of income used by individuals or households to meet their consumption needs, including both goods and services, compared to their total income.

The working law states that the proportion of food expenditure is negatively related to household income, and food security is negatively related to the proportion of food expenditure. The greater the proportion of food expenditure of a household, the lower its food security (Purwaningsih, 2018). The proportion of household food expenditure that is 60% or more indicates that the household is food insecure. This occurs because when people spend more on food, it means they do not have better access to various choices, including nutritious food and other non-food necessities (Alfi et al., 2023). This finding aligns with the results of research conducted by Risvenjaya et al. (2024) and Alfi et al. (2023), which also state that the proportion of food expenditure has a negative and significant effect on food security.

Hypothesis 2: The proportion of food expenditure has a negative and significant effect on food security.

According to Sen, access to food is key in preventing food insecurity, in which farmers as primary producers play an important role. Farmers' welfare, as measured by the Farmer Exchange

Rate (FER), reflects their purchasing power and ability to make ends meet. FER is the ratio between the price index received by farmers (It) and the price index paid by farmers (Ib). The higher the FER, the greater the farmer's income compared to their expenses, reflecting an increase in welfare. According to the Central Statistics Agency (2015), an increase in the purchasing power of farmers indicates an increase in welfare. In line with research, Romiza & Nopiah (2024) state that FER has a positive and significant effect on food security.

Hypothesis 3: Farmer exchange rate has a positive and significant effect on food security.

RESEARCH METHODS

This research uses quantitative methods. The data used is secondary data issued by official institutions such as the Central Statistics Agency and the National Food Agency, the research time starts from 2018 to 2024, the research location is in 5 provinces of Java Island, DKI Jakarta is not included in the research because it only has FER in the fisheries subsector.

The first step is to choose the best panel data regression model. The Chow test and the Hausman test show that the most appropriate model is the fixed effects model. Furthermore, the classical assumption test is used to ensure that the regression estimate meets the basic criteria of classical linearity, thereby ensuring unbiased, efficient, and consistent results (BLUE). In panel data regression analysis, not all classic assumption tests are used; only multicollinearity tests and heteroscedasticity tests are employed (Basuki & Yuliadi, 2015). The best model results will be summarized into a regression equation. Then, hypothesis testing is carried out, which consists of the coefficient of determination (R^2) test, the simultaneous significance test (F-test), and the partial significance test (t-test). The model equation in this study is as follows:

$$FSI_{it} = \beta_0 + \beta_1 RHA_{it} + \beta_2 PFE_{it} + \beta_3 FER_{it} + e_{it} \quad (1)$$

Description:

FSI	= Food Security Index (percent)
RHA	= Rice Harvested Area (million/ha)
PFE	= Proportion of Food Expenditure (percent)
FER	= Farmer Exchange Rate (percent)
i	= Cross-section data
t	= Time series data
β_0	= Constant
$\beta_1 \beta_2 \beta_3$	= Independent variable coefficient
e_{it}	= panel data error

RESULTS AND DISCUSSION

Based on the test results, the selected model is the fixed effect model (FEM). The model estimation results in the study are as follows:

Table 1. Model Estimation Results

Variable	Coefficient	t-Statistic	Prob.
C	49,24390	1,448950	0,1589
RHA	-21,14379	-2,223302	0,0348
PFE	0,678318	1,330198	0,1946
FER	0,195320	2,237079	0,0337
<i>R-squared</i>	0,657375		
<i>F-statistic</i>	10,31910		
<i>Prob(F-statistic)</i>	0,000003		

Source: Eviews, Data processed

Java Island, as the national rice granary, contributes more than 50% of rice production. However, during the period from 2018 to 2024, rice production on Java Island experienced

fluctuations, with a downward trend from 2022 to 2024. The most significant decline in production occurred in Central Java Province, resulting in an average annual decrease of 289,630 tons. The area of rice harvest in Java Island has decreased by an average of 112,671.66 hectares per year. The most significant decrease occurred in Central Java Province, with an average decrease of 44,534.34 hectares per year. The proportion of food expenditure on Java Island averaged below 60%, meaning that the provinces on Java Island did not face food insecurity based on food expenditure proportions. The highest average proportion of food expenditure was in East Java Province, at 49.95%. The highest Farmer's Price Index (FPI) on Java Island occurred in 2024 in Central Java Province at 117.70%, and the lowest occurred in 2021 in Yogyakarta Province at 97.38%.

Based on the table, the results of the coefficient of determination, F-statistic, and t-statistic are obtained. In Table 1, the R-squared value is 0.6573, indicating that rice harvest area, proportion of food expenditure, and FER can explain 65.73% of the variation in food security. In comparison, the remaining 34.27% is attributed to other variables not included in this research model, such as rice price, farmland productivity, rainfall, population, rice consumption, energy consumption level, and others. The value of the F-statistic probability is significant, so H_0 is rejected, indicating that the variables of rice harvest area, proportion of food expenditure, and FER collectively affect food security in the five provinces on Java Island. Based on the Partial Test (t-test), the significant variables are rice harvest area and farmer exchange rate, while the variable of food expenditure proportion is not significant. The following is a discussion of each variable.

The results show that the size of the rice harvest area has a negative and significant effect on food security; therefore, the hypothesis is rejected. This is due to the less-than-optimal productivity of agricultural land in Java, despite the increase in harvested area. Stagnant and even declining productivity from 2018 to 2024 is caused by the low quality of production facilities, limited access to technology, and suboptimal land management. This condition has an impact on the decline in farmers' income because crop yields do not cover production costs and household needs, thus reducing purchasing power and the ability to buy agricultural inputs.

In addition, climate change and extreme weather events, such as El Niño in 2023, lead to prolonged droughts, decreased rainfall, and widespread crop failures (puso). As a result, farmers experience double losses and struggle to survive the next planting season, ultimately weakening food security. This finding aligns with the research of Murdiyanto (2018) and Kharismawati and Karjati (2021), which indicates that the rice harvest area has a negative and significant impact on food security. In this study, the increase in rice harvest area will reduce food security in Java Island, it can happen because food security is not only determined by rice production, several other factors influence such as food distribution, rice imports, food diversification, rice reserve stocks and government policies in maintaining price stability and food supply.

The results of the regression analysis indicate that the proportion of food expenditure has no significant effect on food security; therefore, the hypothesis is rejected. This is due to the disparity in food prices between provinces, which affects people's purchasing power. Regions with high food prices but low incomes tend to have a high proportion of food expenditure, not because consumption has increased, but due to price pressures.

Additionally, the food expenditure proportion indicator can be distorted by external factors, including local inflation, government intervention through subsidies, cash transfers, price stabilization, and shifts in people's consumption patterns. According to the National Food Agency (2025), government efforts to maintain price stability and food distribution also strengthen food security. In line with research by Tesselonica W et al. (2023), it was found that food expenditure is not a significant factor in food security, as other factors, such as rice productivity, rice consumption, and protein consumption, play a greater role.

The panel data regression test results indicate that the farmer exchange rate (FER) has a positive and statistically significant effect on food security, thereby supporting the accepted hypothesis. FER reflects the purchasing power and real income of farmers through the ratio between the price index received by farmers and the price index paid by farmers. When the FER increases,

farmers' incomes rise, allowing them to better fulfill their basic needs, including access to nutritious and quality food. Stability and an increase in FER also encourage farmers to stay in the agricultural sector, reducing the risk of land conversion and urbanization of the workforce.

This finding aligns with Romiza & Nopiah (2024), who state that increasing the selling price of farm produce enhances farmers' purchasing power and strengthens food security. Therefore, policies that maintain FER stability, such as fair selling prices, farmer market protection, and input subsidies, are key to realizing sustainable food security in Java.

CONCLUSION

This study concludes that the rice harvest area, the proportion of food expenditure, and the farmer exchange rate together have a significant influence on food security. The rice harvest area from 2018 to 2024 has a negative and significant effect on food security in Java Island. The farmer exchange rate from 2018 to 2024 has a positive and significant effect on food security in Java Island, while the proportion of food expenditure from 2018 to 2024 has no effect on food security in Java Island.

This study suggests that the policy for rice harvest areas needs to increase productivity by facilitating farmers' access to quality agricultural inputs, including subsidized superior seeds that are resistant to climate change, fertilizers, and environmentally friendly pesticides. To mitigate the risk of crop failure due to extreme weather, the government should expand the coverage of the Rice Farming Insurance Program (AUTP) and develop a technology-based early warning system to assist farmers in making informed cultivation decisions. Crop diversification can also be used as an alternative, allowing farmers to not depend solely on rice production. Policies that can be implemented to increase the exchange rate of farmers include the protection of agricultural commodity prices through the establishment of a reference price (or floor price), thereby protecting farmers from adverse market price fluctuations. Additionally, increased access to fertilizers, seeds, and other production facilities can also be beneficial.

The limitations of this study are that it does not account for the impacts of climate change and extreme weather, as well as potential changes in food patterns of carbohydrate sources that are not limited to rice in some communities.

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