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ANALYSIS OF THE EFFECT OF RICE PRODUCTION, POVERTY, AND PREVALENCE OF UNDERNOURISHMENT (POU) ON FOOD SECURITY IN INDONESIA

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Abstract. This research is motivated by the mismatch between potential and real conditions in Indonesia, resulting in food security problems. As an archipelagic, maritime, tropical, and agricultural country, Indonesia has abundant natural resource potential. Indonesia is one of the largest rice-producing countries in the world. However, Indonesia's food security condition is still low. It is proven by Indonesia's food security index, which is still below the global and Asia-Pacific averages. This research aims to analyze the influence of Rice Production, Poverty, and Prevalence of undernourishment variables on food security in Indonesia. This type of research is descriptive quantitative, using secondary data in the form of panel data for 2018-2022. The analytical method used in this research is panel data regression analysis. The results of this research show that the variables of rice production, poverty, and prevalence of undernourishment (PoU) together significantly affect food security in Indonesia. Partially, the rice production variable has a positive and insignificant effect on food security in Indonesia. The poverty variable negatively and significantly affects food security in Indonesia. The prevalence of the undernourishment variable has a positive and significant effect on food security in Indonesia.

Keywords: Poverty, Food Security, Prevalence of undernourishment, Rice Production.

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INTRODUCTION

Food is the most essential need that must be fulfilled for individuals to survive (Widayaningsih & Barokatuminalloh, 2016). The right to adequate food is one of the human rights, as mentioned in the 1996 Rome Declaration and Article 27 of the 1945 Constitution, paragraph 2. Food security is an issue that includes various dimensions that are very complex (Suryana, 2014). Food security is a primary concern globally, and it is estimated that more than one billion people will experience energy and food shortages (Widada et al., 2017). Therefore, meeting the food needs of the people in a country is something that cannot be ignored. A country cannot maintain economic growth if it does not address food issues first (Ariesa et al., 2019).

Indonesia is one of the United Nations (UN) members participating in implementing the Sustainable Development Goals (SDGs). Among the goals contained in the SDGs, the 2nd goal of the SDGs is Zero Hunger. Zero Hunger is also a key national program in the 2020-2024 RPJMN. Prevalence of undernourishment (PoU) is one of the indicators that becomes a benchmark achievement of the zero hunger goal. Prevalence of Undernourishment (PoU) is when a person consumes insufficient food to meet the energy needs necessary to lead an everyday normal life, active, healthy life (FAO, 2024). Prevalence of Undernourishment (PoU) can capture the dimensions of food security and nutrition of a region (Cassimon et al., 2022). Vhurumuku (2014) stated that food security can be measured through dietary diversity and food frequency. Indicators of dietary diversity and food frequency include the food consumption score, household dietary diversity scale, undernourishment, and spending on food. According to the results of research conducted by Solana (2022) stated that PoU is part of the food security problem, and a high PoU indicates the low food security of a region.

Food security in Indonesia is a serious concern because the scope of food production, distribution, and consumption are related to social, economic, political, and environmental dimensions (Suryana, 2014). Indonesia is known as an agricultural country which is rich in natural resources. However, due to N differences in geographical conditions resulting in differences in soil conditions and suitability for various types of plants produced for food needs, Indonesia faces a challenge in realising food security (Rahajuni et al., 2019). Malthus, in his theory also stated that the problem of food provision would be more complex in the future because the speed of food production growth is slower than that of population growth. Malthus in his theory stated that the increase in food production develops like an arithmetic pattern (addition) while population development moves with a geometric pattern (multiplication).

The food fulfilment of an area is closely related to the production of food commodities from the agricultural sector (Pujiati et al., 2020). Rice is the main food for the Indonesian population Azyan et al., (2023) stated that the symbol of food security in Indonesia can be seen from the availability of rice. Stable growth in rice production is the key to achieving food security, especially in developing countries (Bandumula, 2018). Other research by Wehantouw et al., (2021) and Widada et al., (2017) stated that rice production has a positive effect on the sustainability of food security.

Food security is also closely related to one of Indonesia's social problems, namely poverty. Poverty is a form of neglect of one's rights to various basic capabilities, such as the ability to get adequate nutrition and live in health (Mbajiorgu et al., 2022). Mutiah & Istiqomah (2017) stated that poverty is closely related to food security, especially in the aspect of food access/affordability. People experiencing poverty have the inability to fulfil their primary needs, which can lead to food insecurity (Rahajuni et al., 2019).

Based on the Global Food Security Index (GFSI) published by The Economist Intelligence Unit (EIU) New York, in 2022 Indonesia's food security level ranks 63rd out of 113 countries in the world with a score of 60.2 or 10th position in Asia Pacific region. It must be an essential concern because Indonesia is one of the world's largest rice-producing countries. As an agrarian and maritime country, Indonesia should have great potential to achieve high food security. However, in fact, Indonesia's food security index is still relatively low, below the global average of 62.2, and also lower than the Asia-Pacific Region average of 63.4.

Therefore, further research is needed on factors that have the potential to affect food security. By analyzing these factors, it can be measured to what extent Indonesia as an agriculture-based country, can meet its basic food needs. This research can also help the government sand other stakeholders design strategies and programs to sustainably improve food security, reduce inequality, and improve the overall quality of life of the Indonesian people to prevent Indonesia from a food crisis. In addition, this research is very relevant to economic welfare, community welfare, social and political stability, and sustainable development in Indonesia.

METHOD

This study uses a quantitative descriptive approach to analyze all objects and then draw conclusions about the influence between variables. According to Sugiyono (2015) quantitative research is an approach based on positivism that is used to investigate specific populations or samples. The focus of this research is food security, where the dependent variable uses the food security index as its proxy. The variables that are thought to affect it are rice production, poverty, and the prevalence of undernourishment (PoU).

This study uses panel data, a combination of cross-section and time series data. The time series data used is 2018-2022, while the cross data is 34 provinces in Indonesia. This study uses multiple regression analysis techniques, an extension of simple regression because it has more than one independent variable. The mathematical equation model can be written as equation (1):

$$KP = \beta_0 + \beta_1 LnPB_{it} + \beta_2 KMS_{it} + \beta_3 PoU_{it} + e_{it} \quad (1)$$

Description:

KP	=	Food Security (points)
PB	=	Rice Production (tons)
KMS	=	Poverty (percent)
PoU	=	Prevalence of undernourishment (percent)
$\beta 0$	=	Constant
$\beta 1,2,3$	=	Regression Coefficient
Ln	=	Natural Logarithm
i	=	Province
t	=	Year
e	=	Error term

The data in this study were analyzed with Eviews 12 software. This study applies the classical assumption test. The classical assumption test aims to get the model with the best estimate, namely the one with the best parameter estimates, linear, unbiased and efficient (BLUE). The classical assumption test includes the normality test, multicollinearity test, and heteroscedasticity test. While the hypothesis test in this study consists of the coefficient of determination, simultaneous F test, and partial t-test.

RESULT AND DISCUSSION

Panel Data Regression Model Selection

Chow Test

The Chow test is conducted to determine the most appropriate model for panel data estimation, namely between the fixed effect model and the common effect model. The hypothesis used in the Chow Test is as follows the Chow Test result show in Table 1:

H_0 : Common Effect Model

H_1 : Fixed Effect Model

Table 1. Chow test results

Effect Test	Prob.
Cross-section Chi-square	0.0000

Source: Data Processed, 2024

Based on Table 1, the Chi-Square probability value is 0.0000 <0.05, so H_0 is rejected and H_1 is accepted. So, the model chosen between the standard effect model and the fixed effect model is the fixed effect model.

Hausman Test

The Hausman test is conducted to determine the most appropriate model for panel data estimation, namely between the random effect model or the fixed effect model. The hypothesis used in the Hausman test is as follows and the Hausman Test result show in Table 2:

H_0 : Random Effect Model
H_1 : Fixed Effect Model

Table 2. Hausman test results

Test Summary	Chi-Sq.Statistic	Chi-Sq.d.f.	Prob.
Cross-section random	25.944332	3	0.0000

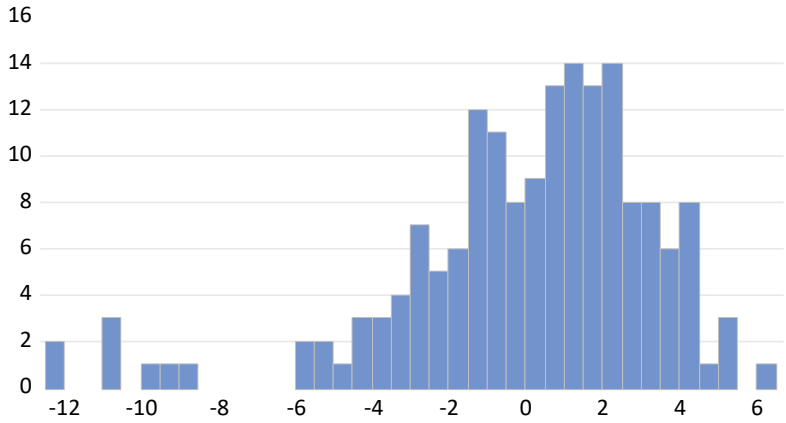
Source: Data Processed, 2024

Based on Table 2, the Chi-Square probability value is 0.0000 <0.05, so H_0 is rejected and H_1 is accepted. So, the model chosen between the fixed effect model and the random effect model is the fixed effect model. The Lagrange Multiplier test in this study was not carried out because the two tests that have been carried out (Chow test and Hausman test) have shown that the most appropriate model is the fixed effect model.

After obtaining the most appropriate panel data regression results using the fixed effect model, the next step is to conduct classical assumption testing, which consists of the Normality Test, Multicollinearity Test, Autocorrelation Test, and Heteroscedasticity Test.

Normality Test

The normality test aims to check whether the data follows a normal distribution.



Source: Data Processed, 2024

Figure 1. Normality test results

Based on the results of the normality test in Figure 1, with a probability value of 0.000000, which is smaller than alpha 5%, namely 0.05, the data in the study are not normally distributed. This study applies the central limit theorem assumption if the sample size is more than 30 (n> 30), then the data is considered normal (Gujarati & Porter, 2009). Based on this assumption, the normality test in this study can be ignored, and the data should be considered normally distributed.

Multicollinearity Test

Multicollinearity indicates a linear relationship between the independent variables in the regression model. The multicollinearity test results show in Table 3.

Table 3. Multicollinearity test results

	Ln_PB	KMS	POU
Ln_PB	1.000000	0.079390	-0.246116
KMS	0.079390	1.000000	0.539526
POU	-0.246116	0.539526	1.000000

Source: Data Processed, 2024

The criteria for a model free from multicollinearity problems is if the coefficient value between variables is greater than 0.8. Based on Table 3, there is no multicollinearity problem.

Heteroscedasticity Test

This test aims to determine whether there is inconsistent variation between one observation and another (confounding error) in regression. The heteroscedasticity test results show in Table 3.

Table 4. Heteroscedasticity test results

Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	-47.84250	195.3155	-0.244950	0.8069
Ln_PB	4.478141	15.59956	0.287068	0.7745
KMS	1.925600	4.628813	0.416003	0.6781
POU	-1.437308	0.876061	-1.640648	0.1032

Source: Data Processed, 2024

Based on the heteroscedasticity test with the Breusch-Pagan test, it shows that the probability value of each variable is greater than 0.05, so it can concluded that the model is free from heteroscedasticity problems.

Multiple Linear Regression Analysis Result

Table 5. Regression test results

Variables	Coefficient	t-statistic	Probability
Constant	75.49963	2.365972	0.0194
Ln_PB	0.852288	0.334407	0.7386
KMS	-1.896584	-2.507864	0.0133
POU	0.393509	2.749296	0.0068
RSquared		0.898802	
Adjusted R-Squared		0.871410	
F-statistic		32.81264	
Prob (F-stat)		0.000000	

Source: Data Processed, 2024

Based on the test results, the selected model is the fixed effect model (FEM). Therefore, the panel data regression equation that explains the effect of rice production, population, poverty, and prevalence of undernourishment (PoU) on food security is written as follows:

$$KP = 75.50 + 0.85LnPB - 1.90KMS + 0.39POU \quad (2)$$

Based on Table 5, the adjusted R^2 value is 0.871410. The meaning of this value is that the variables of rice production, poverty, and PoU can explain the food security variable by 87.14%, while the remaining 12.86% is explained by other variables not used in this research model. The following hypothesis test is the F test, which aims to determine whether the independent variables jointly affect the dependent variable. The F test is carried out using two criteria, namely the F-statistic value and the probability value of the F-Statistic. Based on Table 5, it is known that the F-statistic probability value is 0.000 < alpha (0.05), while the F-statistic value is 32.813 where the value is greater than the F table, namely F = (k-1), (n-k) = F (4,165) = 2.66, meaning that the independent variables simultaneously affect food security in Indonesia.

Rice Production

The panel data regression test results in Table 5 show that the rice production variable has a coefficient of 0.85, with a probability value of 0.74 more significant than the significance level (0.05). The t-statistic value is 0.334, while the t-table value is 1.654. Thus, it can be concluded that the rice production variable is statistically insignificant to food security in Indonesia.

This is due to the different levels of rice production in each province. Based on data from the Central Bureau of Statistics (2023), the highest rice production is concentrated in Java, including East Java with 5,500,801.88 tonnes, West Java with 5,447,806.31 tonnes, and Central Java with 5,380,509.51 tonnes. The insignificant effect of rice production on food security is also because food security is not only measured by food production. Food security consists of three subsystems: availability, distribution, and consumption. Rice production is one of the components of the food security subsystem, which is part of food availability.

Based on data from the Central Bureau of Statistics (2023), Indonesia's national rice production in 2018-2022 was relatively slow. In 2019, Indonesia's rice production was 31.31 million tonnes, a decline compared to 2018, when it was 33.94 million tonnes. The decline was caused by various factors, one of which was climate. Yuniasih et al., (2023) El Nio's weak intensity lasted from October 2018 to March 2020 in Indonesia. In that period, the highest anomaly occurred in November 2018, reaching 0.98°C. El Niño conditions in 2015 and 2019 caused Indonesia to experience prolonged droughts, which decreased production. From 2019 to 2021, production in Indonesia remained consistent at 31 million tonnes.

Various efforts have been made in Indonesia to overcome food security problems, one of which is implementing a local food policy. Ula (2021) It stated that the policy aims to fulfill people's food needs and reduce their dependence on rice. This is why rice production has no significant effect on food security. (Ula, 2021) Several local plant commodities, such as sago, cassava, and corn, can be used as food sources.

Poverty

Based on the panel data regression test results in Table 5, it is known that the poverty variable has a coefficient value of -1.90 with a probability value of 0.01, where the value is smaller than the significance value α = 0,05. The t-statistic value is -2.508, while the t-table value is -1.654. So, it can be concluded that the poverty variable negatively and significantly affects food security in Indonesia. The interpretation of the coefficient value is that if the poverty variable increases by 1 percent, assuming that other variables are constant, food security will decrease by 1.90 points.

This result follows the hypothesis that has been prepared and consistent with previous research by Ainistikmalia et al. (2022), which shows that poverty negatively affects food security because it causes households to be less likely to be food secure. Poverty will affect an individual's ability to obtain

food. People's food consumption is primarily determined by purchasing power, while poor people generally have low purchasing power. Therefore, poverty has a negative relationship with food security. When poverty increases, it will make it difficult for people to access food, so food security will be low. Zakiah (2018) concluded that people with a low economy generally experience food insecurity due to low energy consumption. Meanwhile, areas with low energy consumption have typically high poverty lines.

Based on BPS, the provinces with the highest average percentage of poverty during the 2018-2022 period include Papua, West Papua, East Nusa Tenggara, and Maluku. This is in line with the food security index, where Indonesia's four provinces have the lowest average food security index in 2018-2022. Papua has the highest poverty rate in Indonesia, with an average poverty percentage of 27.07%. In 2022, poverty in Papua was 26.56%, while its food security conditions were in the vulnerable category with a score of 37.80. This figure shows an improvement compared to 2021, where the poverty percentage was 26.86%, while the food security condition was in the very vulnerable category with a score of 35.48.

Prevalence of Undernourishment (PoU)

Based on the panel data regression test results in Table 5, the PoU variable coefficient value is 0.40 with a probability value of 0.01, where the value is smaller than the significance value α = 0.05. The t-statistic value is 2.749, while the t_{table} value is 1.654. So it can be concluded that the PoU variable has a positive and significant effect on food security in Indonesia. The interpretation of the coefficient value is that if the Pou variable increases by 1 percent, assuming other variables are constant, then food security will increase by 0.40 points.

PoU can have a positive effect on food security due to several conditions. PoU is an individual condition, but the indicators applied are to estimate the population or certain group level, not at the personal level itself. PoU can improve food security because high PoU indicates unmet food needs, so it will encourage efforts to increase food production and distribution to enhance food security in Indonesia.

The findings of this study are not in line with the initial hypothesis. Previously, the research hypothesis stated that PoU would hurt food security. This is undoubtedly a paradox because PoU is a population that experiences food shortages where their calorific needs are unmet, indicating a population experiencing hunger and malnutrition. When PoU is high, it suggests that there is high hunger, meaning that people are not food secure, which can be caused by a lack of income, food availability, poor food access, and other factors. Long-term undernourishment negatively impacts child development and a country's economic progress. (Islam, 2021).

CONCLUSION

Based on the analysis of the impact of rice production, poverty, and prevalence of undernourishment (PoU) on food security in Indonesia, it can be concluded that the independent variables have a significant effect on the dependent variable. Meanwhile, based on the partial t-test, the rice production variable does not affect food security. The poverty variable has a negative and significant effect on food security, and the PoU variable has a positive and significant impact on food security.

To improve food security, the government can maximize local food policies. Steps that can be taken include building and improving infrastructure to support local food production and distribution, providing education and training to farmers on sustainable agricultural practices and food processing

techniques, and educating the public on the nutritional benefits of local food to encourage people to support local products. On the other hand, expanding access to finance for the community, developing the quality of human resources through improving education and skills, improving health, improving population, and ensuring that people have access to production factors are also things that must be the government's focus. This can reduce the poverty rate and increase people's access to food. Poverty is expanding access to public finance, developing the quality of human resources through improving education and increasing skills, improving health, and improving population.

Concerning PoU, basically high PoU is a negative indicator that indicates a food security problem, so the main goal should still be to reduce PoU itself to achieve sustainable food security. So the steps that the government can take include improving the quality of education, increasing awareness of the nutritional status of the community by socializing the essential health and nutrition knowledge curriculum, increasing social assistance per capita in the short term, maintaining food price stability, and encouraging the creation of food diversification to increase the level of food security.

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