

DETERMINANT OF FOOD SECURITY IN THE TEN HIGHEST RICE-PRODUCING PROVINCES IN INDONESIA

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ABSTRACT

This study analyzes factors affecting food security in the ten highest rice-producing provinces in Indonesia. The purpose of this study is to analyze the effect of GDP per capita, rice prices, in-migration, and rice harvest area on food security in the ten highest rice-producing provinces in Indonesia in 2022 using a proxy rice availability ratio. This research was conducted using panel data analysis with a selected fixed effect model. Based on the results of research and data analysis, it was concluded that together the GDP variability per capita, rice prices, in-migration, and rice harvest area have a significant effect on the rice availability ratio. Partially, the GDP per capita variable has a negative and significant effect on the rice availability ratio, the rice price variable has a negative and significant effect on the rice availability ratio, the in-migration variable is not significant on the rice availability ratio, and the harvest area variable has a positive and significant effect on the rice availability ratio. The implication of the conclusions in this study is that government efforts are needed to foster awareness of food diversification, intensify price policy to protect consumers and producers or farmers, as well as optimize rice agricultural land, and support agricultural land protection to increase rice productivity.

Keywords: Food Security, Rice Availability Ratio, Rice-Producing Provinces, Panel Data

1. Introduction

Food is an essential basic need for humans to develop and survive. Therefore, disruption of food needs can trigger social, economic, and political problems that will disrupt national stability (Nanda & Mulyo, 2019). On the basis of these problems, many countries have made food security a strategic issue of their countries, especially Indonesia.

The condition of a country's food security is supported mainly by the agricultural sector as a food provider sector. As the main source of food for the Indonesian population, the availability of rice is also a symbol of community food security (Prabayanti, 2022). Rice production in 2022 is mostly supported by the ten highest rice-producing provinces in Indonesia, namely East Java, West Java, Central Java, South Sulawesi, South Sumatra, Lampung, North Sumatra, Banten, Aceh, and West Nusa Tenggara.

The high rice production in these various provinces does not only make the region have the highest IKP score. Only three of them are included as provinces with the highest IKP scores, namely Central Java (2nd), South Sulawesi (4th), and East Java (7th). This condition occurs because the

measure of success of a region in achieving food security is not only seen from food availability, but also the acquisition and absorption of food in the region (Teddy Saputra, 2022).

Food in Indonesia is synonymous with rice, according to the United States Department of Agriculture (USDA) Report, Indonesia is the country with the 5th highest rice consumption in the world in 2021 with a total consumption of 35.60 million tons / year (dataindonesia.id, 2021). This figure is also supported by data from the Central Statistics Agency which states that the average rice consumption of the Indonesian population has continued to increase since the pandemic, increasing from 2020 1,379 Kg/capita/per week to 1,451 Kg/capita/per week in 2021 (Katadata, 2022a).

One of the supporting factors in the absorption of food in a region, namely individual income, income is one of the factors that affect population demand for rice (Rosana & Widiastuti, 2016). According Saputro & Fidayani (2020) and Rachmah et al (2017) that income negatively affects food security through the share of food expenditure as a proxy for food security. This is because the increase in the share of food expenditure indicates declining food security.

Another factor that affects rice demand and consumption is the price of rice (Asih et al., 2021). Therefore, an increase in rice prices will tend to reduce people's purchasing power as well as affect the condition of food security of an individual (Khanam et al., 2015). In Prabayanti & Sutrisno (2022) study, it is stated that rice prices have a negative and significant effect, but research by Yosmar et al., (2016) and Silalahi et al., (2014) obtained negative, but not significant, results.

In terms of food availability, rice production is influenced by one of the population. The rate of population growth that tends to increase every year will affect the availability of food for the population. The rate of population growth in a region is generally influenced by births, deaths, and migration (Anggraini, 2012). Furthermore, research by Alpizar et al (2020) and Duda et al (2018) states that migration negatively affects the food security of a region.

As support in achieving national rice availability, efforts are certainly needed to increase rice productivity to encourage rice availability and rice production. One of the most essential factors in rice production is the area of rice harvest. Research by Ariesa (2019) and (Saputra, 2022), which states that the area of rice harvest has a positive and significant effect on food security.

Based on previous research, different analysis results were found related to factors affecting food security. Plus, only four of the ten provinces are classified as provinces whose calorie consumption is still above average, so it still needs attention. Therefore, it is important to conduct research on the factors affecting food security in the ten highest rice-producing provinces in Indonesia through proxy ratios of rice availability with the recency of the study, namely on the use of in-migration variables.

2. Literature Review

2.1 Production Theory

According to Boediono (1993), production is an activity that aims to add value to an object or create a new object so that the object can be more useful to satisfy needs. Production theory is an

important concept because it is related to the determinants of production scale. The scale of such production is analyzed through the production function. Samuelson (2010) production function is the relationship between the amount of input needed and the amount of output that can be produced from the production process. The production function describes the relationship between the amount of input used in production and the amount of output from production. Mathematically the production function can be expressed as follows:

$$Q = f (C,L, R,T)$$

Where Q expresses the quantity of total production (output) while the factors of production (input) include, C the amount of physical capital, L the amount of labor, R the quantity of natural resources, and T the technology used. In the field of food crop agriculture such as rice, production optimization can be done by combining production capital factors such as land/rice fields, machinery, irrigation canals, medicines and fertilizers and production labor factors, in this case the number of skilled workers working in agriculture. Simple analysis using isoquants assumes the use of two variable factors of production, *ceteris paribus* (Sukarniati, 2013).

2.2 Food Security

Food security according to the World Food Summit in 1996 is a condition when everyone at all times has access to sufficient, safe, nutritious food to maintain health and live an active life. It generally refers to people who have "physical and economic access" to foods that meet their nutritional needs and food preferences (WHO, 2010). Conceptually, the food security framework prepared by the Badan Ketahanan Pangan (BKP) consists of three main pillars, namely availability, affordability and utilization.

3. Research Methodology

3.1 Research Setting

This study used secondary data sourced from reports from Badan Pusat Statistik (BPS) and the Ministry of Agriculture. The locations in this study are the ten highest rice-producing provinces in Indonesia in 2022, namely East Java, West Java, Central Java, South Sulawesi, South Sumatra, Lampung, North Sumatra, Banten, Aceh, and West Nusa Tenggara. The analysis method used in this study is descriptive quantitative analysis using panel data regression analysis. The variables in this study include GDP per capita, rice prices, in-migration and rice harvest area as dependent variables and rice availability ratio as independent variables with data collection techniques through documentation techniques.

3.2 Analytical Approaches

There are three techniques for estimating panel data, namely Gujarati, 2013), namely Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). Where the three models were selected by going through three tests, namely the Chow Test, Hausman Test, and Lagrange Multiplier Test.

3.3. Operational Definition of Variables

3.3.1. Gross Domestic Bruto Per Capita (GDP per capita)

GDP per capita is the sum of all gross value added from all sectors divided by the total population in the region (Badan Pusat Statistik, 2022). GDP per capita in this study used constant prices with a base year used 2010.

3.3.2. Rice Prices

Rice prices are the average rural consumer prices of rice by province (Badan Pusat Statistik, 2022).

3.3.3. In-migration

In-migration is the sheer number of migrants in and the lifetime inflow of the province. (Badan Pusat Statistik, 2022).

3.3.4. Rice Harvest Area

Rice harvest area is the amount of land used to produce rice and rice each year obtained from the annual publication report of the Badan Pusat Statistik (Badan Pusat Statistik, 2022).

3.3.5. Rice Availability Ratio

The rice availability ratio is a comparison of the amount of rice production and consumption (Prabayanti, 2022).

4. Results

The results of this study present several parts. First, the selection of panel models. Followed by classical assumption tests, and finally statistical tests..

4.1 Selection of Panel Models

4.1.1. Chow Test

The Chow test aims to select the mode used between the common effect model and the fixed effect model, with the following decision-making provisions;

- If the probability value of error is $\geq \alpha$ (5%), then the common effect model is selected
- If the probability of error value $< \alpha$ (5%), then the fixed effect model model is selected

Based on the results of the chow test conducted in this study, a probability of Chi-square Cross-section of 0.0000 was obtained, which means that the p-value is smaller than α 5%, so it can be concluded from the results of the chow test rejects H_0 , so that the best model that can be chosen is the fixed effect model.

4.1.2. Hausman Test

The Hausman test aims to select the mode used between the random effect model and the fixed effect model, with the following decision-making provisions;

- If the probability value of error is $\geq \alpha$ (5%), then the random effect model is selected
- If the probability value of error $< \alpha$ (5%), then the fixed effect model is selected

Based on the results of the hausman test, a random cross-section probability of 0.0000 is obtained, which means that the p-value is smaller than α 5%, so it can be concluded from the results of the hausman test that it rejects H0. So that the best model that can be chosen is the fixed effect model.

4.2 Classical Assumption Test

Analysis on panel data using classical assumption tests of multicollinearity and heteroscedasticity (Basuki & Yuliadi, 2014) and (Napitupulu et al., 2018).

4.3 Tables Classical Assumption Test

Table 1. Uji Multicollinearity

Variables	GDP per capita	Rice prices	In-migration	Rice harvest area
GDP per capita	1,000000	0,019921	0,355644	0,396897
Rice prices	0,019921	1,000000	0,136144	-0,346005
In-migration	0,355644	0,136144	1,000000	0,212890
Rice harvest area	0,366897	-0,346005	0,212890	1,000000

Based on the results of the multicollinearity test in the study, the correlation coefficient between independent variables GDP per capita, rice prices, in-migration, and rice harvest area is less than 0.80, so it can be concluded that the model is free from multicollinearity problems.

Table 2. Uji Heteroscedasticity

Variables	Probability
GDP per capita	0,3658
Rice prices	0,0558
In-migration	0,6352
Rice harvest area	0,1666

Based on the results of the glacier test above, the probability of all variables of GDP per capita, rice prices, in-migration, and rice harvest area shows a number greater than 0.05 so that it can be concluded that there is no heteroscedasticity problem in the panel data regression model.

4.4 Statistics Test

This test was conducted to find out how the relationship between the dependent variable and the independent variable in the study. This research uses statistical tests in the form of F tests, t tests, and coefficients of determination.

4.5 Tables Statistics Test

Table 3. F- Test

Statistics Test	Value
Value F-Statistic	169,6530
Prob(F-statistic)	0,0000
Result	Significant

Based on the results of the F test above, obtained F Statistic 169.6530 and probability (F-Statistic) of 0.0000 which means smaller than α 5%, thus rejecting H_0 . So it can be concluded that the variables of GDP per capita, rice prices, in-migration, and rice harvest area together have a significant effect on the variable ratio of rice availability.

Table 4. t – Test

Variables	Coefficient	Std. Error	t-Statistic	Prob.
GDP per capita	- 1,260125	0,534432	-2,357880	0,0239
Rice prices	-2,645434	0,587043	-4,506368	0,0001
In-migration	0,003473	0,022272	0,155948	0,8769
Rice harvest area	0,377305	0,081023	4,656775	0,0000

Based on the results of the t-test above, the equation in this study is $\ln[\ln RICE_{it} - (\ln RICE_{it-1})] = 42,34313 - 1,260125 \ln INC_{it} - 2,645434 \ln P_{it} + 0,003473 \ln MIG_{it} + 0,377305 \ln LAND_{it}$

The interpretation of the equation is

- GDP per capita
The t-statistic value of the GDP per capita variable is -2,357880 and the probability result is 0.0239. From these results it can be seen that the t-statistic number within the rejection region H_0 with a probability of $0.0239 < \alpha$ 5%.
- Rice prices
The t-statistic value of the rice prices variable is -4.506368 and the probability result is 0.0001. From these results it can be seen that the t-statistic number within the rejection region H_0 with a probability of $0.0001 < \alpha$ 5%.
- In-migration
The in-migration variable has no significant effect on the rice availability ratio in the ten highest rice-producing provinces in Indonesia in 2022.
- Rice harvest area
The variable t-statistic value of rice harvest area is 4.656775 and the probability result is 0.0000. From these results it can be seen that the t-statistic number within the rejection region H_0 with a probability of $0.0000 < \alpha$ 5%.

Table 5. Coefficient Determination

Weighted Statistics	
R-squared	0,983939
Adjusted R-Squared	0,978140

Based on the results of regression data testing, an Adjusted R-square (R^2) figure of 0.978140 was obtained, which means that the independent variables consisting of GDP per capita, rice prices, in-migration, and rice harvest area can explain their effect on the dependent variable, namely the rice availability ratio of 97.81 percent, while the other 2.19 percent can be explained in other independent variables outside the study.

5. Discussion

This study was conducted to analyze the factors that affect food security in the ten highest rice-producing provinces in Indonesia, the results show that the influence of GDP per capita is in line with research from Saputro & Fidayani (2020), which states that income has a negative and significant effect on food security as a proxy for the share of food expenditure. Indonesia is a developing country with an average income of the lower middle population. This causes the income of the population tends to be used for food fulfillment.

Therefore, if there is an increase in income, the Indonesian people will increase their food consumption. This is supported by data from the Badan Pusat Statistik (2022) stating that the expenditure of the Indonesian population per month on food has increased from 49.22 percent in 2020 to 49.25 percent in 2021, which means that the greater the share of food production, it indicates declining food security, so that an increase in income will affect the increase in rice food consumption, where increased consumption indicates a ratio of rice availability is declining.

From the fixed effect model, rice prices are the variable that most affects food security in the ten highest rice-producing provinces in Indonesia. The results of this study are in line with research by Yosmar et al (2016) which states that prices negatively affect food security. In certain conditions such as when there is a change in consumer behavior due to external factors, the actual conditions will be different from the initial theory.

As was the case during the pandemic, this study used the period from 2017 to 2021, so the pandemic phenomenon was quite influential on people's consumption patterns, this condition is in line with the Central Statistics Agency report which stated that since the pandemic rice consumption has increased, judging from the trend of increasing rice consumption during the pandemic from 1,379 kg per capita per week which increased to 1,451 kg per capita per week in 2021 (Badan Pusat Statistik, 2022). Where the increase in rice prices in this condition increases rice consumption, which means reducing the ratio of rice availability.

The results showed that in-migration had no effect and was not significant on the ratio of rice availability, this is because the percentage of the number of migrant population in risen and lifetime is relatively small compared to the non-migrant population in the ten highest rice-producing provinces in Indonesia, supported by the percentage of the population of risen in-migration and lifetime in-migration in 2020 in almost ten provinces is below ten percent (Badan Pusat Statistik, 2021a).

Another factor is that most of the migrant population's household funding comes from livelihoods as domestic helpers, recorded that in 2021, 89.4 percent of migrant residents received funding sources from work as domestic helpers with an average income of IDR 396,827 per month (Badan

Pusat Statistik, 2021). Therefore, even though the migrant population is in productive age. However, migrant residents tend to have lower incomes than non-migrant residents,

The variable area of rice harvest in showing a positive and significant influence on the ratio of rice availability. These results are in line with research by Juliprijanto et al (2018) which states that rice harvest area will affect rice production which will also affect rice production. Therefore, increasing the area of rice harvest will increase rice production which will then increase the ratio of rice availability due to the surplus of rice production, this condition can be interpreted as increasing resilience.

6. Conclusion

Food security in a region is mainly driven by the role of the agricultural sector, in various countries including Indonesia the agricultural sector is a vital sector in achieving food security. The symbol of food security in Indonesia is seen from the availability of rice, most of which is supported by the ten highest rice-producing provinces in Indonesia. Despite having the highest rice production, the ten provinces have varying food security scores or it can be said that food security in the region is not evenly distributed. Therefore, this research is carried out to determine the factors that affect food security and relevant policy suggestions.

Rice prices, in-migration, and rice harvest area together have a significant effect on the rice availability ratio in the ten highest rice-producing provinces in Indonesia in 2022. Partially, the GDP variable partially has a negative and significant effect on the rice availability ratio, the rice price variable partially has a negative and significant effect on the rice availability ratio, the in-migration variable has no significant effect on the rice availability ratio, and the rice harvest area variable partially has a positive and significant effect on the rice availability ratio in the ten highest rice-producing provinces in Indonesia this year 2022.

Based on the conclusions obtained in this study, relevant policy suggestions were formulated, namely the government's efforts are needed to foster awareness of food diversification, intensify food price control policies to protect consumers, producers or farmers, and optimize rice agricultural land, and support agricultural land protection to increase rice productivity.

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