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Article

Exploring the Social-Economic Approach on the Production Level of Rice: Panel Data Analysis from 34 Province in Indonesia

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Abstract: The social-economic approach in rice production emphasizes the importance of understanding and solving social and economic problems related to the agricultural sector. The Ongoing economic changes, competition for resources from other sectors, environmental changes and the increasing commercialization of rice farming mean that the way rice is produced in the future will be very different. The aim of this research is to determine the influence of the relationship between rice productivity and economic indicators on maintaining sustainable food security. This research uses the HDI variable instrument as an intervening variable using panel data from 34 provinces in Indonesia in 2018-2023, which was tested using the REM, CEM, and FEM models. It is known that simultaneously, economic indicators, namely land area, productivity, inflation, poverty index, rice consumption, and population, have an effect on the amount of rice production; however, in partial testing through sub structural model 1 testing, it was found that productivity and rice consumption had no impact on the intervening variables HDI and sub structural test 2 found that partial inflation, poverty index, rice consumption, and population had no effect on the amount of rice production. Despite a series of tests, the results remained consistent. In the future, it is necessary to develop a new vision for rice farming, such as exploring food security and technology, and drafting strategic policy reforms, considering global trends and the unstable economic scenario.

Keywords: Food Security, Economic Development, Panel Data, Indonesia,

Classification JEL: O13; O44

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INTRODUCTION

Indonesia is the develop country in Southeast Asia with the fourth largest global rice consumption in the world, with consumption reaching 35.3 million metric tons throughout 2022/2023 (USDA). Based on data from BPS (Central Statistical Agency) in 2023, the rice harvest area is estimated at 10.20 million hectares, with rice production of around 53.63 million tons of milled dry grain (GKG). If converted into rice for food consumption for the population, rice production in 2023 is estimated at 30.90 million tons and will experience a decrease of 645.09 thousand tons or 2.000 tons. Rice production in Indonesia significantly impacts the country's economic indicators and food security. As one of the leading food commodities, rice production is crucial in providing food for Indonesia's large population. With an expanding population driving up demand, the primary factors influencing rice production must be identified (Milovanovic & Smutka, 2017). As the world's largest archipelagic country, its strategic location contributes to the diversity of rice varieties that can grow in various climatic and soil conditions. The land area has a very significant role in rice production, and this factor plays a crucial role in determining the availability and amount of rice production (Rahman & Parkinson, 2007),and facilitating the redistribution of agricultural land (Do et al., 2023). Based on research (Bandumula, 2018) it is confirmed that rice production is largely determined by land area and investment in agricultural land in developing Asian countries. Land management must be balanced with good governance; for this reason, input efficiency in direction, such as labor and capital is needed so that rice production productivity can be maximized, one of which comes from the government. Research (Laiprakobsup, 2019) shows that the government's role is very influential in increasing rice production in Southeast Asia. In Indonesia, the government's role is manifested, namely improving cultivation and post-harvest technology packages, improving the quality of intensification, increasing the cultivation area, and land rehabilitation. Meanwhile, other factors such as inflation are still a concern for farmers in Indonesia. The price of rice and grain was observed to continue to increase until it experienced inflation of 5.61% in September 2023, at the wholesale level it rose 6.29% on a monthly basis and on an annual basis, it rose 21.02% (BPS). This means that the price policy is aimed at stabilizing prices at the retail level it would be more effective if price stabilization was focused at the wholesale level by considering the relationship between different qualities and prices of rice to avoid the influence of inflation (Feryanto et al., 2023), and the effects of persistence, endogeneity and conditional heteroscedasticity (Tule et al., 2019). The impact of inflation on the agricultural sector which continues to increase has resulted in the emergence of new problems, namely increasing poverty rates, because the inflation rate can affect people's purchasing power and income distribution, including the costs of producing rice, for fertilizer, pesticides, fuel and labor. Poverty is an important problem that hampers development in several developing countries, which can massively affect food security and sustainability of rice production (Kakar et al., 2019); this is in line with research by (Rahmawati et al., 2023) revealed a positive and significant relationship between poverty and agricultural productivity growth, however, the support provided by the government is very important to reduce poverty and improve socio-economic status(Uddin & Dhar, 2018). Other factors used as variables in this research are rice consumption level and number of population in 34 provinces in Indonesia. Thus, rice consumption reflects how much people consume rice as part of their diet, malnutrition and can lead to reduced worker capacity and low productivity (Tiwasing et al., 2019); while population size has a direct impact on food needs, the greater the population, the greater the food needs, including rice production, which is needed to meet energy and nutritional needs(Bashir & Yuliana, 2019), and shows the gap between food availability and food access for vulnerable groups (Britwum & Demont, 2022). By understanding and managing the complex relationship between rice consumption, population, and rice production, a country can develop a sustainable food strategy, meet community needs, and ensure food security. Meanwhile, in several previous studies (Tang et al., 2009), (Paltasingh & Goyari, 2018), (Rajindra et al., 2021) future economic development is determined by increasing HDI and can change food production and consumption patterns because developing investment in human resources in developing countries will provide economic benefits by emphasis on education and understanding technology, as well as increasing the capacity of the agricultural sector to encourage development (Arshed et al., 2022). Therefore, validating the stability and consistency of the relationship between the above-mentioned economic indicators and rice production levels in Indonesia will provide additional enlightenment to the growing literature. The explicit objectives of this research a to determine the relationship between land area, productivity, inflation, poverty index, rice consumption and population on HDI as an intervening variable as sub-structural models 1 and to determine the relationship between land area , productivity , inflation , poverty index , rice consumption and population on food production as an dependent variable as sub structural model 2 in 34 provinces as a sample during the 2018–2023 period. We rely on multiple regression models with the selection of REM, CEM, and FEM models. The results of our research show that simultaneously economic indicators, namely land area, productivity, inflation, poverty index, rice consumption, and population influence the amount of rice production; However, in partial testing through sub structural testing of model 1, it was found that productivity and rice consumption had no effect on HDI and sub structural test 2 show that partial inflation, poverty index, rice consumption, and population have no effect on the amount of rice production. Future research should expand our findings by exploring the role of HDI in food security.

BACKGROUND INFORMATION AND LITELATURE REVIEW

Indonesia has extensive agricultural land, but there are challenges related to optimal land use and sustainability. BPS noted that the majority, or 15.89 million farmers, only have a farming land area of less than 0.5 ha. As many as 4.34 million farmers only have agricultural land ranging from 0.5 to 0.99 ha. Then, there are 3.81 million farmers whose agricultural land area is 1-1.99 ha in 2023. This condition is also worsened by the shrinking area of agricultural land in the country because land conversion will continue to occur due to the increasing need for land, such as residential areas, industry, offices, tourist attractions, roads, and other infrastructure to support community development. This controversy is important because it provides information about the existence of economies of scale in agriculture and in this field, the choice of measures shows that there is an inverse relationship between agricultural land area and agricultural production in developing countries (Cornia, 1985). Several factors contribute to the decline in production yields, namely productivity in intensive rice production systems(Van Nguyen & Ferrero, 2006), econometrics shows that losses in profitability are generally greater on small farms than on large farms because small farms use more labor and other inputs than large farm households to earn higher income and profits on rice(Mottaleb & Mohanty, 2015). High inflation is an undesirable phenomenon, the factors causing high inflation cannot yet be concluded either by monetary or fiscal perception, the government has managed rice prices (administered prices) to contribute to high inflation which exacerbates high poverty rates (Hochman & Rajagopal, 2011).Over the past four decades, as food security in Indonesia has generally improved, the most important challenge today for the country's food security is to restart rapid, pro-poor growth (Mottaleb & Mohanty, 2015). This was made clear by the fact that in 2008, when the global financial crisis occurred, the price of rice jumped more than three times due to high import costs and system inefficiencies which had a negative impact on poor communities, especially in Asia (Muthayya et al., 2014). Even though Indonesia is the third largest country that produces the most rice in the world, Indonesia still needs to import rice almost every year. Because Indonesia's population continues to grow and consumes rice in large quantities there is a risk of becoming a rice importer, for this reason, the Indonesian Chamber of Commerce and Industry (KADIN) and several large companies in Indonesia have recently started partnership programs with small farmers who produce rice with the aim of increasing rice production through funding programs for the use of new and innovative technologies thought rice self-sufficiency program, in line with research by (Peng et al., 2009) the application of integrated crop management to increase sustainable rice production can be achieved by developing new technology through rice research. Economic development through rice self-sufficiency or more precisely economic growth is a prerequisite for achieving human development because economic development guarantees an increase in food productivity, especially rice production. However, the relationship between economic growth and human development has been empirically proven not to occur automatically (Krishna Bahadur & Fraser, 2017). Moreover, research results by empirically confirm the positive correlation between food availability, calorie and protein supply, and human development, considering that rice is the staple food of the Indonesian population (Gani & Chand Prasad, 2007). In the case of Indonesia, this study highlights questions regarding the relationship between the variables of land area, productivity, inflation, poverty level, rice consumption; population, HDI, and rice production have not been answered, considering that resource availability is inversely proportional to resource availability. We enrich the existing literature by examining the impact of the above economic factors on increasing rice production and emphasize the importance of using REM, CEM, and FEM model in this type of research with HDI as an intervening variable which is conceptualized in sub-structural 1 and sub-structural 2 models by figure 1. Future study should extend our findings by exploring the role of economic indicator in other to measure production of rice.

Based on the research model in Figure 1, this research specifically aims to:

- Identify variables that influence rice production in 34 provinces in Indonesia during the 2018-2023 period
- Estimate the magnitude of changes in rice production caused by HDI as an intervening variable
- Highlight important outputs for creating specific policies or assessment measures for government programs on food security

METHODOLOGY AND DATA

The focus of this research is to examine the relationship between land area, productivity, inflation, poverty level, rice consumption; population, HDI, to the rice production in 34 province in Indonesia during 2018-2023 period, which is obtained by the author from BPS. Table 1 show the sources and definition of the panel data use in this research along with hypothesis.

There are several debates in literature studies regarding how to measure rice production levels in the context of food security in various levels of academic science. According to (Cafiero, 2019) food security is commonly conceptualized as resting on three pillars: availability, access, and utilization. This concept is an elaboration and simplification of studies by (Chandre Gowda & Jayaramaiah, 1998) developed an index to measure the sustainability of rice production systems by identifying nine indicators grouped into three dimensions of sustainability, namely ecological, economic and social, which is a response to critical research by (Tisdell, 1996) stated the complex problem of assessing and evaluating food security sustainability criteria in the five pillars of the FAO/IBSRAM (International Agency for Research and Land Management) Evaluation Framework for Sustainable Land Management (FESLM). Along with the development of research in the field of rice production, several studies have emerged that focus on the socio-economic dimension, research by (Krishna Bahadur & Fraser, 2017), (Rahmawati et al., 2023) put income distribution variables, gross domestic product/capita, and human development index (HDI) and fertilizer use as measurement dimensions of rice productivity, although this cannot be separated from technical efficiency factors such as irrigation, production techniques, and supporting staff which greatly influence the level of crop production(Kea et al., 2016). Other findings were made on (Roy et al., 2016) research which is focusing on economic variables by examining 12 economic indicators, which were combined with a top-down and bottom-up approach to increasing rice productivity sustainability. Moreover, considering this research uses panel data as suggested by (Devkota et al., 2019) the sustainability of rice production systems, it can be measured based on economic, environmental, social, and institutional indicators. In this study, researchers collaborated on these variables more complexly to capture dimensional variables of food security measurement using different research methodology techniques. Therefore, in this study, we use land area, productivity, inflation, poverty index, rice consumption, and population as independent variables, HDI as an intervening variable, and rice production as the dependent variable, but the available data comes from BPS (Central Agency Statistics) only in 2018-2023 with justification for the addition of four new provinces in Indonesia in the 2022-2023 periods to continue previous research by (Mariyono, 2014) that focused on the efficiency of rice production using panel data in 23 provinces in Indonesia during 1993-2013. Summary statistics for the main variables we used in this study are reported in Table 2.

To assess the relationship between economic indicators and rice production, we estimate the following regression model into two sub-structural models.

$$(1)\quad ZHDI = \alpha + \beta 1 lLAit + \beta 2 lnProit + \beta 3 lnINFit + \beta 4 lnPIit + \beta 5 lnCRit + \beta 6 PRit + \varepsilon\, i$$

$$(2)\quad YRp = \alpha + \beta 1 lLAit + \beta 2 lnProit + \beta 3 lnINFit + \beta 4 lnPIit + \beta 5 lnCRit + \beta 6 PRit + \varepsilon\, i$$

By taking into account several aspects of problems related to panel data such as causality, characteristics of unobserved variables, and the presence of influential observations, in this research, we use the REM, CEM, and FEM model tests to find the right pattern. Next, a Normality Test is carried out to determine whether the standardized residual values in the regression model are normally distributed or not. How to carry out a normality test can be done using a normal probability plot graphical analysis approach. By looking at the results shown in Figure 2, it can be concluded that the data in this study is normally distributed using the *Jarque-Bera* (J-B) test with the assumption that the *Jarque-Bera* value is greater than 0.05 then it can be concluded that the data is normally distributed and the normality test is met (Thadewald & Büning, 2007).

RESULTS

Sub structural model 1 selection test

There are three testing methods carried out in this research, namely the Chow test to select the common effect model (CEM) or fixed effect model (FEM), the Hausman test to select the fixed effect model (FEM) or random effect model (REM), and the Legrange Multiplier test to choose the common effect model (CEM), or random effect model (REM), consider a two-way error component model (Baltagi, 1981). Table 3 shows results from the model selection analysis carried out, starting with testing the sub-structural model 1 by using Chow test.

Based on the probability value of the Chow test in table 3, the model chosen is FEM ($p < 0.05$), the next step is to carry out the Hausman test to determine the best method between fixed effect or random effect, detecting endogenous regressors if the regression coefficient is not stationary (Ahn & Low, 1996). Results of the test Hausman can be seen in table 4.

The results of the analysis in Table 4 show that the random cross-section probability for the Hausman test is p <0.05, so the method chosen is FEM for sub structural model 1, so the Legrange Multiplier test does not need to be carried out.

Sub structural model 2 selection test

The next stage is to select a model for sub structural 2, by carrying out testing methods as carried out for sub structural model 1, which is summarized in table 5.

Table 5 show that the random cross-section probability for the Chow test is p <0.05, with 0.7419 probability value, means that in sub-structural model 2 the selected one is CEM (p > 0.05). This means that in substructural model 2, the chosen one is CEM (p > 0.05). Because the Chow test chosen is CEM, the Hausman test does not need to be carried out as long as the sample size in both models is the same and both models show the same shape (Ghilagaber, 2004). Therefore, the next stage is to carry out the Legrange Multiplier test, which is one method that can be used to identify stationary points. of the optimization problem with equality constraints shown by table 6.

Table 6 show that the random cross-section probability for the Legrange Multiplier is p <0.05, with 0.1035 probability value, means that in sub-structural model 2 the selected one is CEM (p > 0.05). This means that in sub structural model 2, the chosen one is CEM (p > 0.05).

Classic Assumption Test

This study considers the multicollinearity and heteroscedasticity tests on the CEM model selected in substructure model 2. In contrast, for substructure model 1 there is no need to test classical assumptions. Table 7 shows the results of the multicollinearity test and table 8 shows the results of the Heteroscedasticity test. The testing procedure is carried out by absolutizing the regression residuals. We noticed that the purpose of this classical assumption is to provide a guarantee that the regression equation obtained is accurate in estimation, unbiased, and consistent (Debarsy & Ertur, 2010). Table 7 shows the indicator's correlation coefficient r < 0.80 and Table 8 shows the significance value of the test p > 0.05.

Main Result

Finally, by reviewing the main results reported in table 9 carry out an f-test to see how all the variables influence together (simultaneously test), and a t-test (partial test) to test how each independent variable influences the dependent variable individually, and shows how much influence the independent variable (exogenous) has on the dependent variable (endogenous) through the R square value.

In sub-structural model 1 land area, inflation, poverty level, and population have a positive association with HDI as an intervening variable, while productivity and rice consumption have no effect, simultaneously through the f test all variables have an influence with a probability value of 0.000 < 0.05, all variables are able to explain The remaining 97% of the HDI (Z) variable is explained by other variables. Furthermore, in sub structural model 2 land area, productivity, rice consumption, and population have a positive relationship with rice production as the dependent variable (Y), while inflation, poverty index, and HDI have no effect, simultaneously through the f test all variables have a positive relationship effect with a probability value of 0.000 < 0.05 then all variables are able to explain the rest. All variables are able to explain 99% of variable Y, the rest is explained by other variables. Thus it can be concluded that the equation for sub structure model 1 is

$$Z = 1.70495 - 0.00471*X1 + 0.06437*X2 - 0.01427*X4 + 0.00378*X3 + 0.04537*X5 + 0.023800*X6$$

And sub structural model 2 is

$$Y = -1.00197 + 0.9995*X1 + 0.99855*X2 + 0.00211*X3 + 0.00070*X4 + 0.00417*X5 + 0.00089*X6$$

DISCUSSION

Rice is a source of life in the Asia-Pacific region, including Indonesia. Where 56 percent of humanity produces and consumes more than 90 percent of the world's rice. Most of the Indonesian population in 34 provinces is very dependent on rice as a basic need. Based on the results of the analysis of sub-structural 1 and sub-structural 2 models, it can be seen partially and simultaneously, showing that the relationship between variables is very close. With the increase in the population of an area, the amount of food consumption in an area will increase, while the reduction in rice fields has changed its function to housing or industrial areas and also the economic transformation from agrarian to non-agrarian resulting in a decline in rice production, in line with research by (Cornia, 1985), (Chandre Gowda & Jayaramaiah, 1998), (Krishna Bahadur & Fraser, 2017), (Laiprakobsup, 2019), (Rahmawati et al., 2023) . Recently, Indonesia has not been able to meet its domestic rice needs and still depends on imports. Moreover, inflation can affect the prices of agricultural inputs such as fertilizer, pesticides, and fuel, which in turn can affect the cost of rice production. If inflation is high, production costs increase, and this can affect farmers' income, resulting in high poverty rates in line with research by (Hochman & Rajagopal, 2011), (Tule et al., 2019). Poverty levels often reflect people's low income. In the context of rice production, farmers or agricultural sector workers may be at risk of experiencing poverty if their income is low. Communities living in poverty may face obstacles in accessing the infrastructure and resources needed to increase rice production. For example, limited access to irrigation, agricultural technology, or capital can limit agricultural productivity potential and indirectly affect income and welfare. For this reason, Indonesia should concern on education and technology adoption as a form of HDI as an intervening variable, in line with research by (Arshed et al., 2022). Thus, increasing HDI can be a catalyst for increasing rice production through increasing farmer income, access to technology, and community welfare. However, to achieve a sustainable increase in production, it is necessary to have policies that support agriculture, manage natural resources, and control inflation. By using a social-economic approach, the conclusion can be drawn that sustainable and inclusive agricultural development can create a positive impact on social welfare and the community economy. Efforts to reduce social disparities, ensure economic inclusion, and increase access to resources are key to achieving sustainable development goals, including increasing rice production. Therefore, policies and intervention programs must be designed by considering these aspects holistically to achieve a sustainable impact on rice production and community welfare.

CONCLUSIONS

Estimating the magnitude of changes in rice production specifically attributable to changes in HDI would require statistical analysis, potentially using econometric models or time-series data. It's important to control for other variables that could influence rice production, such as climate conditions, government policies, and global market trends. Additionally, regional variations and specific contextual factors should be taken into account. In summary, while a higher HDI is generally associated with positive developments that can contribute to increased rice production, isolating and quantifying its direct impact requires a comprehensive and context-specific analysis. The socio-economic approach pays attention to social inclusion, ensuring that farmers from various levels of society can manage resources including agricultural land efficiency to encourage equal distribution of agricultural benefits through managing productivity and access to resources (HDI), to reduce inflation, anticipate population growth and prevent high poverty and balanced consumption patterns can be achieved. This can reduce economic disparities between farmers and encourage inclusive economic growth. A socio-economic approach can increase farmers' resilience to climate change and economic crises by strengthening community resources, reducing disparities, and building a rice farming system that is more resilient to external shocks.

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LIST OF FIGURES

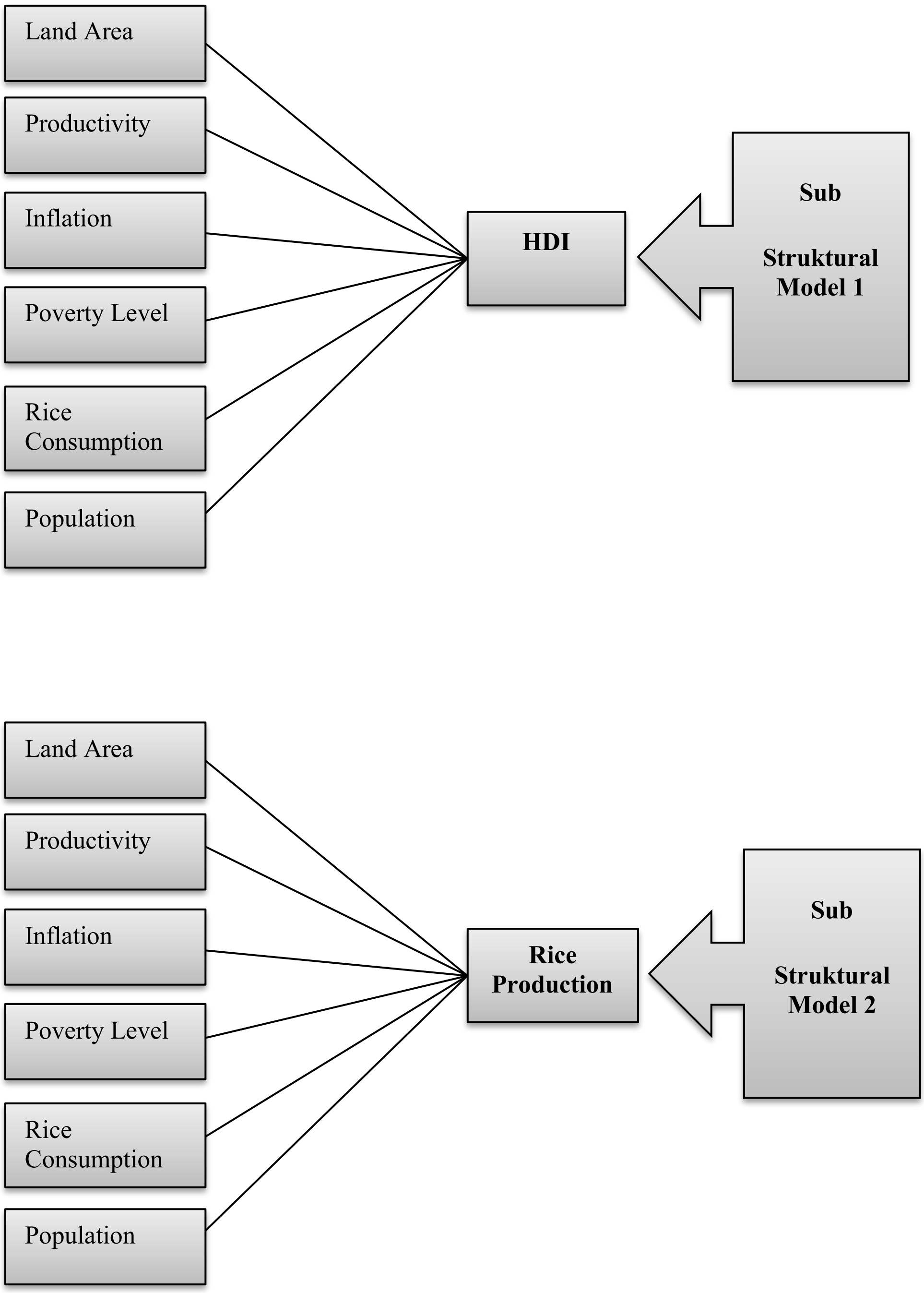
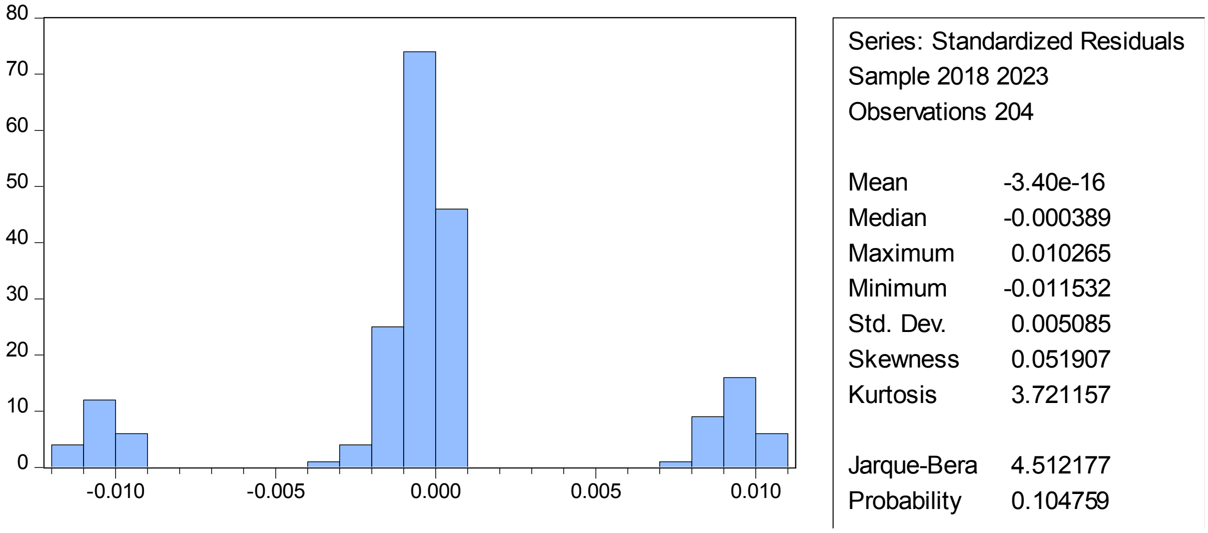


Figure 1.
Conceptual Framework



Source: Eviews result 2023
Note: Jarque-Bera > 0, 05 (4.512177 > 0.05)

Figure 2.
Normality Test

LIST OF TABLES

Table 1.
Data Source and Definition

Variable	Acronym	Unit	Source	Definition
Land area	land	m^3	BPS	land which includes soil, climate, hydrology and air conditions used to produce agricultural crops or raise animals
Productivity	prod	kw	BPS	the ability of any person, system, or company to produce goods or services
Inflation	inf	%	BPS	a general and continuous increase in the prices of goods and services over a certain period of time
Poverty level	pov	%	BPS	the percentage of the population that is below the poverty line, which is the minimum to obtain an adequate standard of living in a country
Rice consumption	consumption	kg	BPS	the arrangement of rice or rice meals that a person consumes in one day
Population	population	%	BPS	a generalized area which consists of objects or subjects and has certain quantities or characteristics
HDI	HDI	%	BPS	measuring tools that can reflect the status of human development
Rice production	Rice production	Ton	BPS	activities or processes of producing, preparing, processing, making, preserving, packaging, repackaging, and/or changing the form of Rice, excluding cultivation production processes.

Table 2.
Summary Statistic

Variable	Number of Observation	Mean	Median	Maximum	Minimum	Std.Dev.
Land area	204	4.97	5.05	6.26	2.14	0.85
Productivity	204	1.64	1.66	1.86	1.42	0.08
Inflation	204	0.33	0.33	1.40	0.00	0.21
Poverty level	204	2.61	2.55	3.66	1.68	0.46
Rice consumption	204	0.24	0.26	0.41	0.05	0.07
Population	204	3.67	3.64	4.70	2.83	0.42
Rice Production	204	5.61	5.72	7.02	2.63	0.90
HDI	204	1.85	1.85	1.91	1.77	0.02

Table 3.
Chow Test sub structural model 1

Effect Test	Statistic	d.f	Prob
Cross-Section F	145.92	-33.164	0.000
Cross-section Chi-square	696.29	33	0.000
R-squared 0.26			
Total panel (balanced) observations 204			

Source: Eviews result 2023
Notes: Provisions of the Chow test method if p > 0.05, then the model chosen is CEM, and if p < 0.05, then the model chosen is FEM.

Table 4.
Hausman Test sub structural model 1

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob
Cross-section random	39.64	6	0.000
R-squared 0.97			
Total panel (balanced) observations 204			

Source: Eviews result 2023
Notes: Provisions of the Chow test method if p > 0.05, then the model chosen is REM, and if p < 0.05, then the model chosen is FEM.

Table 5.
Chow Test sub structural model 2

Effect Test	Statistic	d.f	Prob
Cross-Section F	0.71	-33.163	0.8763
Cross-section Chi-square	27.39	33	0.7419
R-squared 0.99			
Total panel (balanced) observations 204			

Source: Eviews result 2023
Notes: Provisions of the Chow test method if p > 0.05, then the model chosen is CEM, and if p < 0.05, then the model chosen is FEM.

Table 6.
Legrange Multiplier test sub structural model 2

Null (no rand. effect)	Cross-section	Period	Both
Alternative	One-sided	One-sided	
Breusch-Pagan	2.651268	0.006953	2.658221
	(0.1035)	-0.9335	-0.103
Honda	-1.628271	0.083386	-1.092399
	-0.9483	-0.4668	-0.8627
King-Wu	-1.628271	0.083386	-0.51293
	-0.9483	-0.4668	-0.696
GHM	--	--	0.006953
	--	--	-0.7159

Source: Eviews result 2023

Table 7.
Multicollinearity Test

	Land area	Productivity	Inflation	Poverty level	Rice consumption	Population
Land area	1.000000	0.477720	0.010558	0.673658	0.018030	0.190279
Productivity	0.477720	1.000000	-0.171031	0.601710	0.299018	0.483681
Inflation	0.010558	-0.171031	1.000000	-0.075537	-0.190280	-0.156194
Poverty level	0.673658	0.601710	-0.075537	1.000000	0.081797	0.469739
Rice consumption	0.018030	0.299018	-0.190280	0.081797	1.000000	0.086402
Population	0.190279	0.483681	-0.156194	0.469739	0.086402	1.000000

Source: Eviews result 2023

Table 8.
Heteroscedasticity Tests

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000164	0.00609	0.026925	0.9785
Land area	0.00021	0.000473	0.443505	0.6579
Productivity	-0.001765	0.004667	-0.378163	0.7057
Inflation	0.001003	0.001353	0.741197	0.4595
Poverty level	-0.000575	0.000981	-0.586118	0.5585
Rice consumption	0.005283	0.003969	1.331236	0.1846
HDI	0.001252	0.000817	1.5324	0.127

Source: Eviews result 2023

Table 9.
Robustness Model

Variables	Model Sub Structural 1	Model Sub Structural 2
	Probability	Probability
C	0.0000	0.0000
Land area	0.0000	0.0000
Productivity	0.1981	0.0000
Inflation	0.0465	0.2259
Poverty level	0.0257	0.5112
Rice consumption	0.2616	0.0093
Population	0.0000	0.0393
HDI		0.6007
	Cross-section fixed (dummy variables)	
Prob (*F*-stat)	0.0000	0.0000
R-squared	0.975776	0.999968
Adjusted *R*-squared	0.970016	0.999967
Number of observation	204	204

Source: Eviews result 2023
Note: $p < 0.05$ (has an effect), $p > 0.05$ (no effect), applies to f and t tests