Article

Investigating the Effect of Rice Commodity Price Volatility on Provincial Capital Poverty: An Evidence from Indonesia

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Abstract: Poverty is one of the macro problems faced by all countries. These problems have different solutions depending on the character of the poor population in the country. One of the proposed solutions is to control prices so that the level of public consumption is maintained. The purpose of the study was to analyze the effect of rice prices on poverty and to map the condition of rice price movements related to poverty in provincial capitals in Indonesia. This study uses panel data from 34 provincial capitals in Indonesia from 2011 to 2020. The data was collected from the Central Bureau of Statistics of Indonesia and uses a panel regression model and important performance analysis (IPA). The results of this study indicated that the price of rice positively affects poverty in provincial capitals in Indonesia. The IPA results show that most provincial capitals in Indonesia are in areas with low poverty rates accompanied by low rice prices and areas with poor people but tend to have high rice prices compared to the average price of rice. It concludes that rice greatly influences the consumption needs of the people of provincial capital cities in Indonesia. This finding shows the importance of maintaining the stability of rice prices due to the large influence of rice price movements on the increase in the percentage of poor people. Suggestions should be given for subsidized rice distribution in areas with high prices.

Keywords: rice commodity; price volatility; capital poverty; Indonesia context

1. Introduction

One of the macro problems that occur in every country is poverty (World Bank, 2020). These problems differ depending on the character of the poor population in the country concerned. Indonesia is also inseparable from the problem of poverty. The Indonesian government has carried out various programs to alleviate poverty, such as providing consumptive and productive assistance (Banerjee et al., 2006; Hatta & Ali, 2013). The assistance included helping in the form of food and cash assistance (Galli et al., 2018). Indonesia's abundant natural resources are one the great potentials in increasing people's income and welfare

through production. The welfare of the state and the region can be described from the conditions of poverty. When poverty increases, society's welfare decreases. Welfare decreases due to a decrease in per capita income in a country (Nugroho et al., 2020). Increased community income will encourage demand for household products such as food, clothing, and other necessities. This need must be met for survival so that when a price shock occurs in the main commodity, households will find it difficult to meet their needs due to decreased purchasing power. Walelign et al. (2016) stated that income reduces poverty in an area or country. The development of the poverty rate and the increase in per capita income in Indonesia is shown in **Figure 1**.
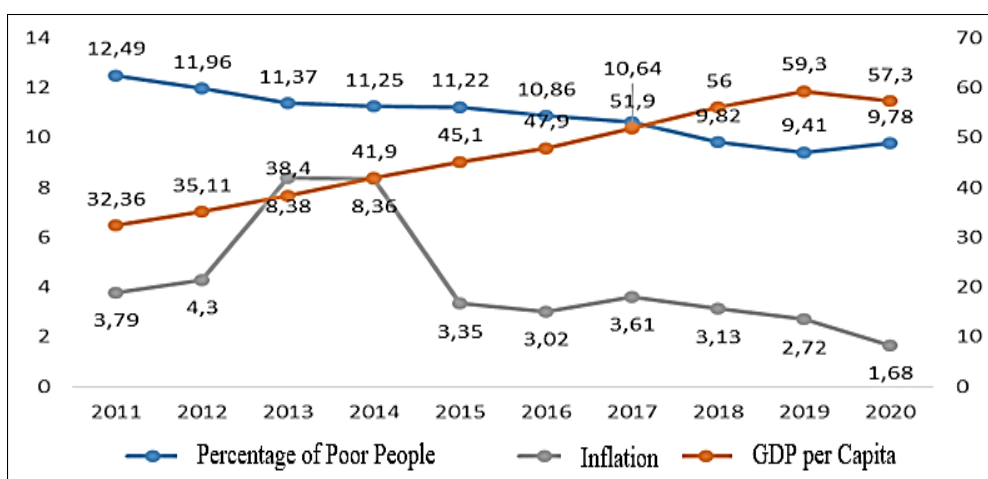

Figure 1. Percentage of poor population, GDP per capita, and inflation in Indonesia from 2011 to 2020.
Source: Central Bureau of Statistics of Indonesia (2022).

Figure 1 shows the trend of the poor population in Indonesia, which tends to decrease and GDP per capita, which tends to increase. The movement of GDP per capita in Indonesia is negatively correlated with the level of poverty, where an increase in GDP per capita tends to reduce the poverty level in Indonesia. In 2011, the poorest population in Indonesia was 12.49 percent and had the lowest GDP per capita (32.36 million rupiah) during the study period. The level of GDP per capita showed an increasing trend until 2019 to 59.30 million rupiah, resulting in a decrease in the poverty rate to 9.41 percent. In 2020, there was an increase in poverty caused by the COVID-19 pandemic to 9.78 percent.

In all the provincial capital areas in Indonesia, in 2011, there were 13 regions with poor people above the average poor population in urban areas in Indonesia, but in 2020 there were 11 regions. The worst areas with the poverty of more than 20 percent in 2011 were Manokwari City and Bengkulu City, while the lowest poverty rate was Denpasar City. In 2020, the highest poverty still occurred in Manokwari City and is the only area with a poor population above 20 percent, and the lowest is still in Denpasar City. Other factors besides income that because poverty are inflation and commodity prices. According to research by Shahidur & Talukdar (2012), an increase in prices causes a decrease in the level of public consumption to increase poverty. This finding is also reinforced by the study results of Suryahadi et al. (2012) that the movement of the inflation rate can suppress purchasing power to reduce consumption levels.

Labonte & Makinen (2008) state that price movements for strategic food commodities cause movements in the inflation value in a region. The inflation movement causes changes in the quantity of food consumed by the public so that it affects the number of calories consumed and changes the poverty line. These changes can cause a movement in Indonesia's percentage of poor people. The strategic food price movement that has a big impact is the food group because the food ingredient that has a big contribution to inflation is rice. Rice is the main staple food for most of Indonesia's population so rice price movements can affect the number of poor people. Therefore, rice contributes the most to inflation compared to other commodities (Central Bureau of Statistics, 2022). This condition illustrates how the economy and the poor will be affected when there is a movement in rice prices. Therefore, rice and poverty are more closely related when compared to other commodities that can affect poverty (McCulloch & Peter Timmer, 2008). The movement of rice prices in provincial capitals in Indonesia in 2011 and 2020 is shown in Figure 2.
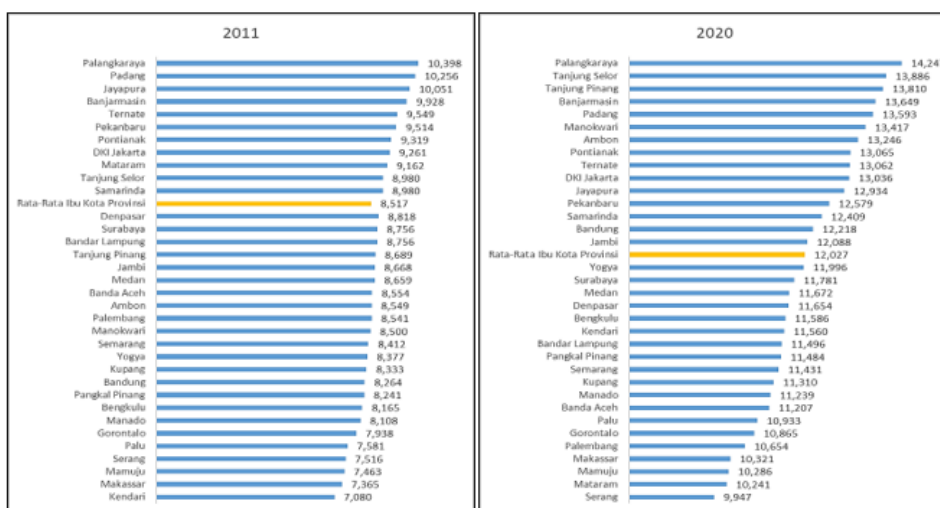
Figure 2. Rice price movements by capital of provinces in Indonesia for 2011 and 2020.

Figure 2 shows that 19 regions have rice prices below the national average price while the other 15 regions have rice prices above the national average price. In 2020 19 regions will have rice prices below the national average while others have higher prices. The areas with a stable level of rice prices below the national average are Kendari City, Makassar City, Mamuju City, and others. In contrast, areas with consumer prices above the national average price are Tanjung Pinang City, Tanjung Selor City, Palangkaraya City, and others. The description of the price of rice can explain the difficulty of the population in meeting their varied basic needs. Weiss & Khan (2006) states that when the price of rice increases, it impacts increasing poverty due to a decrease in the amount of rice consumed. This finding is supported by various other studies conducted by Respati et al. (2017) and Tsimpo & Wodon (2008). Meanwhile, Sayeed & Yunus (2018) state that the price of rice does not affect the price of rice in poverty.

Variations in the price of rice cannot be separated from the different production and demand levels in a region. Regions that have higher production will have lower prices due to excess stock of food availability in their area, and vice versa. It is an important issue to be investigated as an anticipatory step and a reference material for carefully distributing rice carefully and precisely so that there is no slow economic growth in an area due to low prices and food availability (Supriadi & Sejati, 2018). Therefore, this study will examine how to map the relationship between rice prices and poverty in provincial capitals in Indonesia, which will be analyzed descriptively using importance-performance analysis (IPA).

Changes in prices of strategic commodities in Indonesia cause consumption of these commodities to decline because changes in food prices have a close relationship with rice. The price increase will greatly affect people's purchasing power which will decrease (Abdlaziz et al., 2016; Silvia et al., 2016). The decrease in purchasing power will certainly affect the level of consumption which impacts the increase in the poor, so it is important to conduct research related to the Effect of Rice Price Volatility on Poverty in Indonesia. This study aimed to analyze the effect of rice commodity price movements on poverty and map the conditions of rice price movements related to poverty in the capitals of all provinces in Indonesia.

2. Literature Review

Poverty is one indicator to see the success of development in a country and describes the level of welfare (Kis-Katos & Sparrow, 2015). Diwakar & Shepherd (2018) state that there are two kinds of poverty: absolute poverty and relative poverty. First, absolute poverty is measured by comparing a person's income level with the level of income needed to obtain his basic needs. Second, relative poverty occurs when a household that already has a level of income that can meet the minimum basic needs cannot be said to be not poor. Central Bureau of Statistics (2006) uses the concept of the ability to meet basic needs to measure poverty levels. The concept states that poverty is an economic inability to meet basic food and non-food needs measured from the expenditure side. The population is said to be poor if the average per capita monthly expenditure is below the poverty line. Several measures include the number of poor people, the percentage of poor people, the depth of poverty, and the severity of poverty (Gordon, 2006). The number of poor people is the population whose expenditure is below the poverty line. In contrast, the percentage of poor people is the ratio between the number of poor people and the total population in one period.

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The poverty depth index measures the average expenditure gap of each poor person from a region's poverty line. In contrast, the poverty severity index measures the size of the expenditure gap between residents. In addition, Cornwall & Brock (2005) state that poverty is also referred to as a situation with various limitations but not the will of the person concerned. The poor tend to have several characteristics, such as low levels of education and health, poor work productivity and welfare, and low-income levels. Oktaviani & Ayun (2021) said that the existence of backwardness, uneven distribution of goods, and limited investment caused low productivity, so the income received tended to be low. The low income will impact the limited expenditure that can be issued, especially for meeting daily needs such as food, clothing, and so on (Sari et al., 2021). These limitations have caused many groups of the poor and vulnerable to poverty to rely heavily on the low prices of various commodities to maintain the quantity of consumption that they can experience at a certain period (Ridha et al., 2022).

Volatility comes from the word volatile, which means the condition of a situation that tends to be unstable and difficult to predict. Volatility is the movement given by a commodity's price based on the fluctuations given by economic conditions in a region at a certain time. Price variations can have a positive effect but also often have a negative effect on the economy. Rizaldy (2017) states that changes and volatility in basic commodity prices affect inflation, and high inflation will affect people's purchasing power and poverty where income is fixed. In addition, Isnaini (2016) states that commodity price volatility increases poverty through inflation. Stroh et al. (2003) relate the movement of food commodity prices to the poverty level through purchasing power theory. Howitt (1991) states that purchasing power is the ability of consumers to obtain goods in a certain quantity demanded at prices and incomes within a certain period. Therefore, the higher the purchasing power will increase the demand for food and other needs to reduce poverty.

It describes biased anticipatory steps, especially when an unprecedented condition occurs. The price movement studied in this study focuses on a commodity that impacts the consumption of all people, namely rice. This commodity was selected based on an analysis by the Central Statistics Agency, which included rice as a commodity whose prices must be monitored every week. It illustrates that it is important to maintain the price movement of these commodities as the basis for various policies that have a wide influence, one of which is poverty in an area. One theory that regulates price management is supply chain management, where this theory aims to regulate the distribution of goods based on supply chain flows (Stadtler, 2008). The theory can describe how production activities accompanied by goods distribution policies can work together to meet consumer needs effectively and efficiently.

Rice is a commodity that is a staple food source for most of the world's population, including Indonesia. World rice consumption compared to its total production is 96.96 percent, so rice is very vulnerable to spikes in demand for both local and imported markets. It will impact the volatility of rice prices (Setiyanto et al., 2021). Indonesia is one of the countries that consume rice quite high, which is 98 percent of the population (Santosa et al., 2015). Mardianto et al. (2019) state that several areas of rice production in Indonesia include North Sumatra, South Sumatra, West Java, Central Java, East Java, and South Sulawesi. The limited area of rice centers makes it difficult to arrange a policy strategy for the distribution of rice so that it can reach various areas that do not produce rice. These various policies aim to stabilize rice prices in the local market so that residents can get the same real quantity of rice at the same price every period. This can be a reason to maintain rice consumption for the population so as not to be disturbed.

3. Materials and Methods

The data structure used is the percentage of poor people and the price of rice, in the form of secondary data in the form of panel data consisting of 34 provincial capitals in Indonesia as a cross-section and time series for 2011-2020, with a total of 340 observations sourced from the Central Statistics Agency (BPS). Both the BPS website for all provinces and the BPS Republic of Indonesia. Maulana et al. (2020) stated that panel data combines time-series data and cross-section data. Panel data is the same cross-sectional data measured at different times, where panel data has space and time dimensions. If each cross-section has the same unit of time series observation, it is called a balanced panel. However, if each time series observation and unit cross-section is different, it is called an unbalanced panel. Regression analysis using panels is divided into three models: the common effects model, fixed-effects model, and random effects model (Baltagi & Baltagi, 2008). The model is mathematical as follows:

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The common Effects Model assumes that individual behavior over time is stagnant or tends not to change.

$$y_{it} = \alpha + \mathbf{X'_{it}}\beta + \varepsilon_{it} \tag{1}$$

Fixed Effects Model - this model assumes differences in intercepts between individuals but the intercepts between times are of the same value.

$$y_{it} = \alpha_i + \mathbf{X'_{it}}\beta + \varepsilon_{it} \tag{2}$$

Random Effects Model - this model assumes that the value of the intercept both between individuals and between times is stochastic/random

$$y_{it} = \alpha + X'_{it}\beta + \varepsilon_{it} + u_i \tag{3}$$

Where y_{it} is individual dependent variable-i year-t, a is the intercept, β is a parameter of size $K \times 1$, K is the independent variables, X_{it} is the column vector of the ith observation of K independent variables, E_{it} is an error, i is the capital of the province in Indonesia, t is time 2011, 2012,…, 2020. For determining the right estimator, model testing is carried out. Model selection, namely: Chow test, to choose the best model between common effects and fixed effects; Hausman test, to choose the best model between fixed effects and random effects; and the Breush-Pagan Lagrange Multiplier (LM) test, to choose the best model between common effects and random effects. A good regression model requires that it does not violate classical assumptions, with the aim that the estimator used is Best Linear Unbiased Estimator (BLUE). The classical assumptions that must be fulfilled are the assumption of normality, the assumption of multicollinearity, heteroscedasticity, and the assumption of autocorrelation. The basic model for analyzing commodity price volatility on poverty is formulated as follows:

$$y_{it} = \alpha + X'_{it}\beta + \varepsilon_{it} + u_i \tag{4}$$

Where α is a slope, β is parameters, y_{it} is a dependent variable, X_{it} is the independent variable, i is the capital of the Province in Indonesia, and t is the time from 2011, 2012, ..., 2020.

The second analysis is mapping rice price movements and the poor in provincial capitals in Indonesia through important performance analysis (IPA), which describes the relationship between rice price movements and poverty levels in a region descriptively. IPA divides the entire area into 4 quadrants, referring to the reference value as a coordinate point. The reference value is the average national rice price and the percentage of poor people in Indonesia. Quadrant I consist of areas where rice prices are below the national average and the percentage of poor people is lower than that of poor people in Indonesia. Quadrant II consists of areas with a low percentage of poor people compared to Indonesia but with a rice price level above the average national rice price. A region with a high poverty rate but a rice price level below the average national rice price is in quadrant III. In contrast, if the rice price level is above the average national rice price, it is classified as quadrant IV.

4. Results

The percentage of poor people in Indonesia in 2021 is 9.71 percent. Most of the percentage of the poor are in rural areas. As many as 12.53 percent of the total population of rural areas are poor. Meanwhile in urban areas, the percentage of poor people is 7.60 percent. The region with the highest percentage of poor people in Indonesia in 2021 is Papua Province, which is 27.38 percent or 1 in 4 residents of Papua Province are classified as poor. Meanwhile, the region with the lowest percentage of poor people in Indonesia is South Kalimantan Province, which is 4.56 percent. The best panel data model was obtained by selecting either the common effect model, the fixed-effect model, or the random effect model—test results with Chow Test, Breusch-Pagan Langrange Multiplier Test, and Hausman Uji Test.

Table 1. Results of model selection criteria.

No.	Test type	Prob.	Decision	Conclusions
1.	Chow test	0.0000	Reject H_0	The fixed effect model is better than the common effect model
2.	Hausman test	0.3157	Accept H_0	The random effect model is better than the fixed effect model

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Table 1 displays that the right model is the random effect model. The random effect model is one of the panel data regression approaches which assumes that the influence exerted by the independent variables differs between individuals and over time. Then, the classical assumption is tested, namely the assumption of normality and multicollinearity. The assumption of heteroscedasticity and autocorrelation does not need to be carried out. It's because the random effect model can accommodate violations of these assumptions. The assumption of normality was tested using the Jarque-Bera test. The probability of the Jarque-Bera test of 0.057476 is greater than the alpha value of 0.05, so it can be concluded that the model used is normally distributed. Next, test the assumption of multicollinearity using panel data regression with random effects model approach, as shown in Table 2.

Table 2. Panel data regression with random effects model approach.

Variable(s)	Model 1 (CCM)	Model 2 (FEM)	Model 3 (REM)
Rice Commodity Price	2.944*	5.018***	5.008***
Constant	34.848**	54.075**	53.971***
R^2	0.009	0.968	0.316
Chow test	-	276.76***	-
Hausman test	-	-	0.417

Note: Dependent variable: provincial capital poverty; *,**,*** significant at the level 10%, 5% and 1%.

The model formed is fit where the probability of F-statistics or t-statistics is 0.000 and is smaller than the alpha value of 5 percent, so it can be concluded that the price of rice has a significant effect on the percentage of poor people in Indonesia. The value of R-squared indicates that the independent variable can explain the variation of the value of the poor by 96.8 percent. Other variables outside the model explain the other value variations. The price of rice positively affects poverty in the provincial capitals of Indonesia. Every 1 percent increase in the price of rice can increase poverty by 5.018 percent. Likewise, when there is a decrease in the price of rice by 1 percent, it will reduce poverty by 5.018 percent. This finding shows how important it is for the government to maintain rice price stability because rice plays a very large role in public consumption expenditure in every provincial capital in Indonesia. It is following the findings of Villamor et al. (2015) and Rachmawati et al. (2021) show that an increase in rice prices can increase the percentage of the poor population caused by a decrease in the number of public consumption so that it can increase the percentage of poor people in general in provincial capitals in Indonesia.

The next analysis is the IPA analysis which aims to analyze the relationship between rice prices and the percentage of poor people. Mimbs et al. (2020) stated that IPA is easy to use but has very good results for determining performance improvements. Ormanovic et al. (2017) stated that IPA consists of a two-dimensional coordinate graph that divides individuals based on their characteristics. Furthermore, Suhendra & Prasetyanto (2016) said that the distribution of these characteristics could determine policy priorities. Policy priorities will be based on available resources (Rachmawati et al., 2021). (Ali et al., 2021) used IPA analysis to determine the performance scale and importance of a condition. Indrayani (2019) and Tjitrohartoko & Saraswati (2020) argue that using scientific analysis is very effective and efficient in determining policy directions.

Figure 3 classifies all provincial capitals in Indonesia based on poverty levels and rice prices in the region in 2011. Most provincial capitals in Indonesia have poverty levels below urban poverty in Indonesia, which are in quadrant I and quadrant II only. Meanwhile, areas with a higher poverty rate than urban areas in Indonesia are Palembang City, Bengkulu City, Manokwari City, Bandar Lampung City, Mataram City, and Jayapura City which are in quadrant III and quadrant IV. Comparability between regions tends to be more influenced by the price of rice so that regions classified in quadrant II and quadrant IV can maximize poverty alleviation programs by reducing rice prices in these regions.
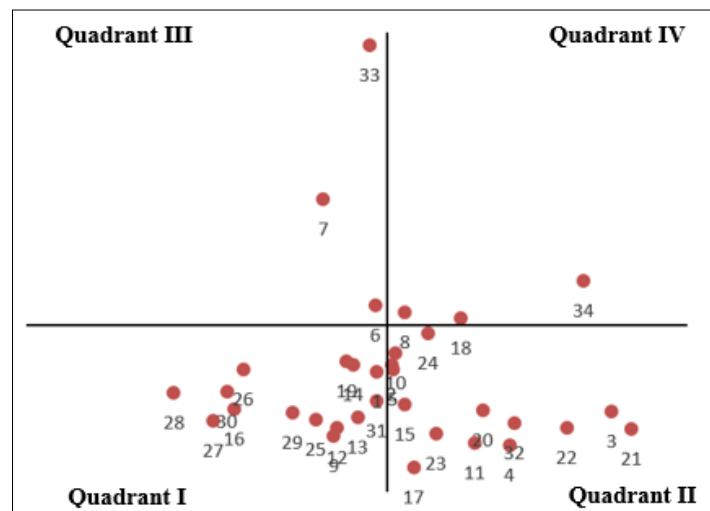
Figure 3. Result of importance performance analysis in 2011.

Most areas classified in quadrant I have rice centers around their territory, such as Banda Aceh City, Semarang City, Mamuju City, and so on. Meanwhile, many areas in quadrant II can maintain the level of food security so that the available rice stock can maintain food needs in the area, such as DKI Jakarta, Samarinda City, Ternate City, and so on.
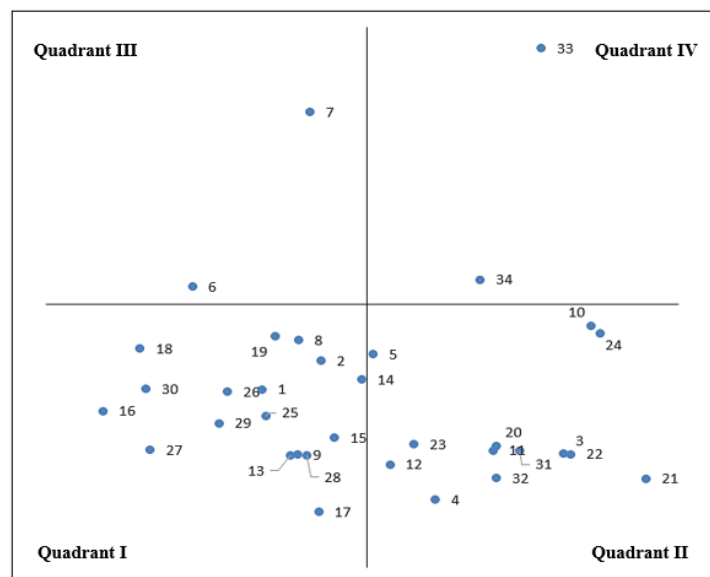

Figure 4. Result of importance performance analysis in 2020.

Note:

1	Banda Aceh	13	Semarang	25	Manado
2	Medan	14	Yogyakarta	26	Palu
3	Padang	15	Surabaya	27	Makassar
4	Pekanbaru	16	Serang	28	Kendari
5	Jambi	17	Denpasar	29	Gorontalo
6	Palembang	18	Mataram	30	Mamuju
7	Bengkulu	19	Kupang	31	Ambon
8	Bandar Lampung	20	Pontianak	32	Ternate
9	Pangkal Pinang	21	Palangkaraya	33	Manokwari
10	Tanjung Pinang	22	Banjarmasin	34	Jayapura
11	DKI Jakarta	23	Samarinda		
12	Bandung	24	Tanjung Selor		

Figure 4 shows most provincial capitals in Indonesia were in quadrants I and II. Regions in quadrants I and II are 50.00 percent and 38.24 percent, respectively. Regions classified in quadrant III (5.88 percent) and IV (5.88 percent) in Indonesia are Palembang City, Bengkulu City, Manokwari City, and Jayapura City. The high level of rice prices and the level of poverty in the region is caused by the difficult distribution of rice or the unstable level of demand and supply for rice in the region (Suryana et al., 2014). In 2020, there were several changes in the quadrant category compared to the conditions in 2011 for areas such as Mataram City and Bandar Lampung City. The areas in quadrant I where this condition illustrates that the handling of poverty alleviation in this region tends to be very good, accompanied by a decline in rice prices. The Manokwari City and Jayapura City areas need various handlings for more optimal poverty alleviation.

5. Conclusions

In conclusion, this study found that the rice price factor positively and significantly affected poverty in provincial capitals in Indonesia. It illustrates that the rice commodity greatly influences the consumption needs of the people of the provincial capitals in Indonesia. The relationship between rice price movements that impact poverty levels in several areas, such as Mataram City and Bandar Lampung City, areas with rice price characteristics and the poor tend to be low. This condition illustrates that the handling of poverty alleviation in this region tends to be very good, accompanied by a decrease in rice prices. Meanwhile, the areas of Manokwari City and Jayapura City are characterized by areas with rice prices and poverty tends to be high. These areas require various treatments related to more optimal poverty alleviation.

On the basis of research findings, this study suggests that for areas such as Palembang City, Bengkulu City, and Manokwari City, which are in the quadrant that has a low rice price level but has a high poverty rate, so further research is needed to obtain a dominant influence on the percentage of the poor population in the region apart from the price of rice. Manokwari City and Jayapura City are in the quadrant where the region has high rice prices and poverty in 2020 in Indonesia. Therefore, various treatments related to poverty alleviation are needed that are more optimal in the region by maintaining rice stocks and increasing production that the region can own. It is necessary to carry out various supervisions so that the application of the maximum price of this commodity can be realized to the maximum.

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