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Vertical Integration of the Rice Market in Lampung Province

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ABSTRACT

Rice prices in Indonesia rose significantly in early 2024, with premium-quality rice reaching IDR 16,410 per kilogram—a 21.3% increase compared to the previous year. These disparities stem from weaknesses in the agribusiness structure, poor market integration, and insufficient market information. This study aims to analyze rice market integration at the farmer-producer and consumer levels in Lampung Province. Secondary time-series data on grain prices at the producer level and retail rice prices at the consumer level from 2018 to 2023 were analyzed using price correlation, price transmission elasticity, and the IMC method. Results indicate a consistent upward trend in both retail rice and farmers' grain prices, which are positively correlated. However, price transmission elasticity reveals that price changes at the farmer-producer level outpace those at the consumer level. The analysis concludes that rice market integration in Lampung is weak in the short term but demonstrates strong integration over the long term. These findings highlight the need for improved agribusiness structures and better market information systems to enhance market efficiency.

Keywords: Market Integration; Marketing; Price Disparities; Price Transmission; Rice

INTRODUCTION

Rice is the staple food consumed by the majority of the Indonesian population (Hidayat et al., 2022). Indonesia has a large population with increasing population growth, which is accompanied by a rise in people's consumption power, resulting in higher national rice consumption (Nurpalina et al., 2022). Indonesia's rice consumption in 2020 was recorded as the largest, with per capita rice consumption of 92.9 kg (Wahyuni et al., 2021). Rice consumption can be met through rice production and availability. Factors influencing production and rice supply include the price of rice (Minardi et al., 2016). Price formation is influenced by market players. Additionally, price stability for rice commodities needs to be maintained as it plays a central role in the national economy. The price level of staple food commodities greatly impacts food security, poverty levels, macroeconomic stability, and economic growth (Kusumaningsih, 2015).

Lampung is the sixth-largest contributor to rice production in Indonesia, playing a central role in both the regional and national economies. The results of rice production in Lampung are sold to collecting traders at the village/district level, typically rice milling factories, where the rice products are then marketed to consumers in sub-districts, districts, the province of Lampung, or to consumers outside Lampung. A primary issue with rice in Lampung is the low actual capacity in both the input flow for producing rice and the output flow of production results, namely in the form of grain/rice, which causes the production response to be relatively small (Noer, 2014).

Rice supply for meeting people's food needs, aside from the level of rice production, is also highly dependent on the form of rice marketing from the farmer-producer level to the final consumer. The rice marketing system has essential functions to connect producers with consumers. The role of price is critical in the marketing system (Noer, 2014). Commodity price instability is caused by factors such as issues in the production system, climate change disrupting production and trading systems, product distribution disruptions, and market structure problems within each trading system (Fitriani et al., 2011). The average development of retail rice prices in Lampung is described in Table 1 below:

Table 1. Average Price of Rice in Lampung Province 2013-2022

Year	Price (Rupiah)	Price Change Percentage (%)
2013	9,493	
2014	9494	0.011
2015	8,832	-6.973
2016	8,968	1.540
2017	9,155	2.085
2018	11,160	21.900
2019	10,725	-3.898
2020	11,313	5.483
2021	10,736	-5.100
2022	12,100	12.705
Average	10,198	3.084

Source: Dinas Ketahanan Pangan, Tanaman Pangan, dan Hortikultura (2023)

Table 1 above describes that the average change in rice price over the last ten years was 3.084%. The percentage price change was not significant, as the average change in retail prices also did not experience substantial variation. The highest retail price and percentage change occurred in 2022, at 12.705%.

The changes in rice prices were influenced by costs incurred during the processing of dry grain purchased from farmers. This is because the price structure at the factory and consumer levels is a function of the price at the farmer level plus commodity transfer costs (Noer & Unteawati, 2022).

Understanding market structure, effectiveness, and behavior involves analyzing market strength and the price transmission mechanism between markets through market integration studies. The transmission of rice commodity prices is crucial for achieving fair and accurate rice prices for economic actors, facilitating the integration of the rice consumer market with the grain producer market. Vertical market integration in the rice commodity occurs when changes in rice prices at the grain producer and wholesaler levels are followed by changes in rice prices at the consumer level. These interconnected markets ensure accurate price determination, resulting in efficient rice price movements (Kusumaningsih, 2015).

From these descriptions, the research objective is to analyze the trends in retail rice prices and grain prices at the farmer level and to identify the vertical integration of the rice market in Lampung.

LITERATURE REVIEW

Market integrity is an indicator of marketing price efficiency. The measure shows how far the price changes in a reference market cause changes in the following market (Asmarantaka & Oktaviani, 2009). Market integration analysis is closely related to market structure analysis.

Two market levels are said to be integrated if price changes in one market level are transmitted to another market. In a perfectly competitive market structure, price changes in the reference market are perfectly (100%) transferred to the follower market, such as the farmer level. Market integration is achieved when adequate market information is transmitted rapidly to other markets, ensuring that participants at both market levels (reference and follower markets) have access to the same information (Adiyoga et al., 2006).

Analysis of market integration is crucial because (1) knowledge of market integration facilitates monitoring price changes, (2) it helps improve government policy planning to avoid duplication of interventions, (3) it supports price prediction not only in local markets but also in world markets, and (4) it serves as a basis for formulating relevant marketing infrastructure types for agricultural market development.

Conceptually, market integration is categorized into two types: spatial market integration and vertical market integration. Spatial market integration refers to the interconnectedness between regional markets, while vertical market integration refers to the interconnectedness of relationships between marketing institutions in the marketing chain (Aryani, 2012). Vertical market integration is influenced by the distribution of price information across marketing institutions. If price information is not disseminated to consumers, the market price will not reflect a well-functioning vertical market.

Market structure, behavior, and effectiveness can be understood by analyzing market strength and the mechanism of price propagation from one market to another. Noer (2014) argued that a market is integrated if trading occurs between two or more spatially separated markets, with prices in one market correlated to prices in another market.

RESEARCH METHOD

This research was conducted in Lampung Tengah and Bandar Lampung. Lampung Tengah is considered the main area for rice production, while Bandar Lampung is the rice trading center. The research was carried out over six months, from November to May 2024.

Data is a collection of information that provides an overview of a situation (Kurniawan et al., 2024). The researcher utilized secondary data, which was obtained from the Food Crops Agriculture Service, Lampung Central Statistics Agency, Strategic Food Price Information Centre, Research Institute Reports, and other related services.

The secondary data used in this research is time series data, consisting of rice prices at the farmer producer level and consumer rice prices at the Bandar Lampung level, which serves as the rice marketing center in Lampung. Data was collected from June 2018 to October 2023, covering 70 months. The time series data collected include rice prices from the farmer level in Lampung Tengah and consumer rice prices in Bandar Lampung for the years 2018-2023.

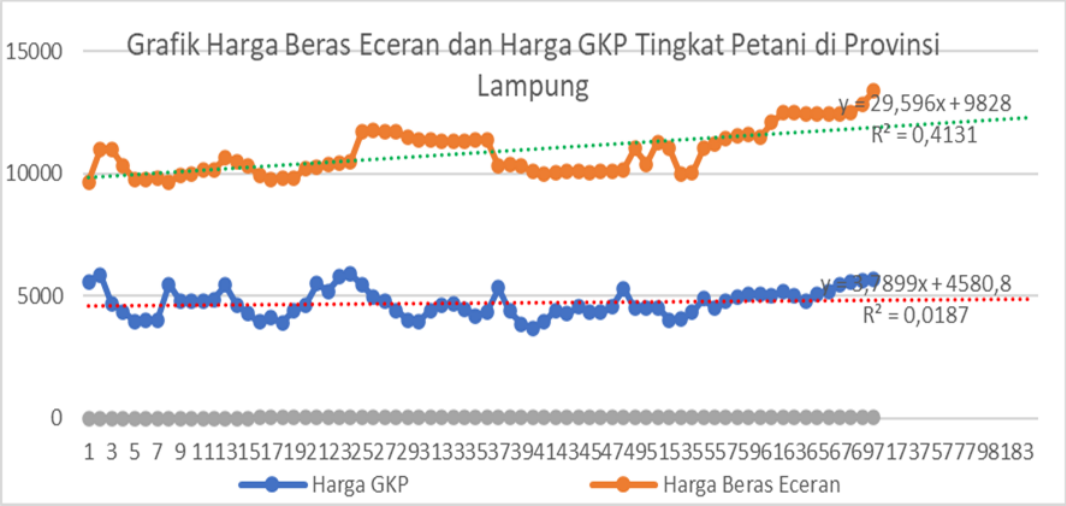
The data analysis in this research involves several methods. First, trend analysis is conducted using the equation Y' = a + bX, which helps to identify the overall direction and rate of change in the data. Price correlation analysis is then applied to examine the relationship between rice prices at different levels, specifically between the producer and consumer markets. The price transmission elasticity (ET) is calculated using the formula ET = Pf / b Pr, which measures the responsiveness of price changes at the producer level relative to changes at the consumer level. Additionally, the Index of Market Connection (IMC) is computed to evaluate the degree of integration between the producer and consumer markets. The IMC is calculated using the formula IMC = (1 + b1) / (B3 - b1), which assesses the connection and efficiency of price transmission between the two markets. These methods provide comprehensive insights into the dynamics of rice market integration and price behavior in Lampung.

RESULTS

Trend Analysis of Retail Rice Price and Grain Price of Farmer Level in Lampung

The researcher utilized the least square method for rice price retail in Lampung and gained equation Y= 9,828 + 29,596X. The intercept value was obtained in equation showed that the estimated rice price retail in January 2018 was IDR 9,828/kg. The trend coefficient showed the estimated average of rice price in Lampung increasing every month, namely IDR 29,596/kg. The results of trend analysis utilize the least squares method for the dry threshed paddy (GKP) price of the farmer level in Lampung obtained equation Y= 4,580.8 + 3,790X. The trend coefficient showed an estimated average expansion in the price of GKP at the farmer level in Lampung every month, namely IDR 3,790/kg. Trend analysis of rice price retail and grain prices at the farmer level in Lampung is shown in Figure 1.

Figure 1. A Graph of Rice Price Retail and GKP Price in Lampung Farming Province



Correlation of Rice Price in Producer and Consumer Markets in Lampung

Price correlation analysis aims to determine how far the price of an item has developed at two locations or levels, either at the same or different levels, interconnected through trade. These two locations or levels can be between regions within a country or between countries. Price correlation was measured by applying the Product Moment correlation coefficient from Pearson using time series data of rice prices at the producer level and retail level in Lampung. The results of the price correlation analysis are described in Table 2.

Table 2. Rice Price Correlation Coefficient at Two Market Levels (Producer and Consumers) in Lampung

Correlation		Pf (Producer Price)	PrL (Consumer Price)
	Pearson correlation	1	0. 404
Pf	Sig. (2-tailed)		0. 001
	N	70	70
	Pearson correlation	0. 404	1
PrL	Sig.(2-tailed)	0. 001	
	N	70	

Source: Processed data (2024)

Rice Price Transmission Elasticity Analysis in Producer and Consumer Markets in Lampung

The data is a time series from 2018 to 2023, representing rice prices at the producer level and the consumer level in Lampung. From the results, the researchers determined the average rice price from 2018 to 2023, as described in Table 3.

Table 3. Average Price of Rice at Producer and Consumer Level from 2018 – 2023 (in IDR/kg)

Year	Average Price Manufacturer Level	Average Price Consumer Level	Price Gap
2018	IDR 4,769	IDR 10,106	IDR 5,337
2019	IDR 4,811	IDR 10,223	IDR 5,412
2020	IDR 4,528	IDR 11,499	IDR 6,971
2021	IDR 4,415	IDR 10,148	IDR 5,733
2022	IDR 4,599	IDR 11,012	IDR 6,413
2023	IDR 5,261	IDR 12,565	IDR 7,304

Source: (Processed data, 2024)

From these descriptions, it can be concluded that the average price of rice at the consumer and producer levels has fluctuated. The price difference between 2018 and 2019 is not significant, with an increase of only 1.38%. However, in 2020, the price difference increased by 22.36% from the previous year. Similarly, in 2022 and 2023, the difference in rice prices also increased by 12.20%. The aim of multiple regression analysis is to determine the elasticity of rice price transmission between producers and consumers in Lampung, as described in Table 4.

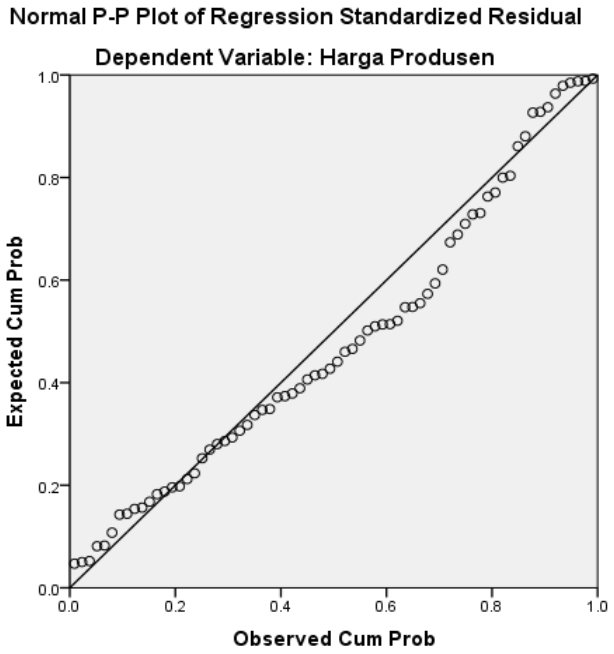
Table 4. The Result of Multiple Regression Analysis for Elasticity of Rice Price Transmission

Variable	Regression coefficient	Sig. t-count	VIF
(Constant)	2071,878	0.006	
Pr	0.243	0.001	1,000
R- Square	0. 163		
Adjust R-Square	0. 151		
Durbin Waston	1,777		
dL	1.4943		
dU	1.7351		
Significance	0.065		

Source: Processed data (2024)

The results of the classical assumption tests, including normality, multicollinearity, heteroscedasticity, and autocorrelation tests for the research data on the elasticity of rice price transmission, are described in Table 4 above. The figure below shows the result of the normality test:

Figure 2. The Result of Normality Test for Price Transmission Elasticity



From the results in Figure 2 above, it can be described that the plots follow a straight line (fit line), so it can be said that the research variable is normally distributed. The VIF value in this study is 1.000, where this value is smaller than 10, indicating that the data in this study is free from symptoms of multicollinearity. The heteroscedasticity test can be

described by a significance value of 0.065, which is greater than 0.05, so this research data is free from symptoms of heteroscedasticity. The autocorrelation test can be seen from the Durbin-Watson (dW) value, with the condition that if dU < dW < 4-dU, the data is free from autocorrelation symptoms. The dW value in this research is greater than dU and smaller than 4-dU, so the data used in this study is free from autocorrelation symptoms.

The price relationship at both market levels, namely the producer and consumer markets, is estimated using the model contained in the estimation results of the equation listed in equation (1) as follows:

$$Pf = a + bPr$$
$$Pf = 2071.878 + 0.243Pr$$

From this equation, the price transmission elasticity value can be calculated using the formula below:

$$ET = x\frac{1}{b}\frac{Pf}{Pr}$$

The Vertical Integration of the Rice Market in Lampung

Multiple regression analysis needs to be carried out before calculating the IMC value. Apart from that, it is also necessary to conduct assumption tests consisting of a normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test to ensure that the data used meets the requirements for good data. The research results showed that the data used in the research on the vertical integration of the rice market in Lampung were free from the classic assumption test issues, meaning that the data met the requirements.

Multiple regression analysis to calculate the IMC value and determine market integration between producers and consumers in Lampung can be carried out after passing the classical assumption tests. Market integration is an indicator of marketing efficiency. Market integration measures how far price changes in the reference market will cause changes in subsequent markets (Asmarantaka & Oktaviani, 2009). The results of market integration at the farmer (Pf) and retailer (Pr) levels are described in Table 5.

Table 5. Market Integration Results of the Farmer and The Retailer Levels

Variable	Coefficient (β)
(Constant)	1661,067
LPf	0.513
LPr	0.397
PrLPr	-1,988

Source: Processed data (2024)

The data processing results show that the regression coefficient (β1) for the price lag variable in the farmer market is 0.513, the regression coefficient (β2) for the difference between the producer-level market price and the price lag in the consumer market level is -1.988, and the regression coefficient (β3) for the price lag variable at the consumer-level market is -0.397. Thus, the IMC value is calculated as follows:

$$IMC = \frac{\beta 1}{\beta 3}$$
$$IMC = \frac{0,513}{0,397}$$
$$IMC = 1.292$$

The IMC value indicator is used as follows: if IMC < 1 or is close to zero, it indicates a higher level of market integration. Conversely, if IMC > 1, the market is said to be less integrated. In the long term, market integration at the retailer and producer levels is determined by the magnitude of the influencing price difference at the producer level, as indicated by the coefficient β2. If β2 < 1, then the market at the producer and retailer levels has a high level of integration, and vice versa.

DISCUSSION

According to the analysis of rice retail prices and grain prices at the farmer level in Lampung, it can be concluded that both prices have an increasing trend every month. They do not tend to fluctuate; instead, both prices consistently show an increasing trend. The increase in rice price at the consumer level was followed by an increase in rice price at the farmer level. This is in line with the results presented by Kusumaningsih (2015), which showed that the retail trend of rice price and grain price at the farmer level has increased. Difah et al. (2019) added that the domestic rice price and the world price have a positive trend.

The GKP price at the farmer level in Lampung has a lower price level than the retail price price level in Lampung. This is in accordance with the thesis by Aryani (2012), which states that the price of producer grain is lower than the price of consumer rice. This occurs due to the processing pattern from grain to rice, which requires production costs.

The results of the price correlation analysis described that rice prices in the two market levels involved in the rice marketing system in Lampung are correlated and have a positive correlation. This is shown by the significance value being less than 0.05 and the value of the Pearson Correlation being positive. If we look at the Pearson Correlation value of 0.404, it shows that rice prices in the two market levels involved in the rice marketing system in Lampung have a moderate correlation.

A factor that causes the price of rice to increase is that grain prices at the farmer level also increase. This is due to the reduced supply of rice harvests caused by seasonal factors and the El Niño climate.

Price transmission analysis is an efficiency indicator that can show whether the rate of price change in a particular market level is smaller, similar, or greater than the rate of price change at another market level (Noer, 2014). One of the benefits of price transmission elasticity analysis is as a consideration in providing information and evaluation related to determining rice price policies.

Based on calculations using the price transmission elasticity formula, the result obtained in this study is 1.783, or ET > 1. This indicates that the rate of price change at the farmer or producer level (Pf) is greater than the rate of price change at the consumer level (Pr). A price transmission elasticity value greater than one means that a change in rice price at the retailer level by 1 percent will be followed by a change in rice price at the farmer level by 1.783 percent. Therefore, it can be said that rice marketing from the farmer to the consumer in Lampung is relatively efficient.

Vertical integration of the rice market is analyzed by applying multiple regression analysis and IMC analysis. The IMC value does not indicate the magnitude of the influence of prices in the reference market at a previous time on price formation in the local market but only shows the degree of integration between the two markets (Agung & Daryanto, 2017). This research analyzes the integration of the rice market between producers (Pf) and consumers (Pr) in Lampung Province. The dependent variable utilized is the rice

price at the producer level, and the independent variable is the retail price at the consumer level in Lampung.

According to the IMC value of 1.292 and β2 of -1.988, it can be said that the integration of the rice market at the farmer level and the retailer market is less integrated in the short term. This is described by the IMC value of 1.292, which is greater than one, meaning that in the short term, the rice market at the farmer level in Lampung is less integrated with the rice market at the retailer level. Sutisna (2021) explained that the rice market integration between districts in Lampung Province is less integrated in the short term but exhibits long-term integration. This is in line with the research results of Hermawan and Budiyanti (2020), which stated that the price of rice in Jakarta and several other large cities was very weakly integrated. Various factors are thought to have caused this, one of which is the inefficient distribution of rice.

In the long term, it can be defined that the integration of the producer rice market with the consumer rice market in Lampung is categorized as high or strong integration. This can be seen from the β2 value of -1.988, which is smaller than 1 or approaching 0. The closer the value is to 0, the higher the level of market integration. A high integration relationship assumes that the rice market is well integrated in the long term. The results of Sugiyanto and Hadiwigeno (2012) stated that the domestic rice market is integrated, but to ensure the flow of rice between markets, measures must be in place so that rice price fluctuations are not prolonged.

CONCLUSION

From the discussion results, it can be asserted that the trend of rice price and grain price at the farmer level in Lampung shows an increasing trend. The rice price at the producer level and the rice price at the consumer level are correlated and have a positive correlation. The rate of change in rice price at the producer level is greater than the rate of price changes at the consumer level. It can be defined that the rice marketing system in Lampung is categorized as efficient. The vertical integration of the rice market in Lampung has a relatively weak short-term balance relationship, meaning that in the short term, the rice market in Lampung is not well integrated. The weak integration relationship shows that the rice market is less integrated in the short term. Furthermore, in the long term, the vertical integration of the rice market in Lampung can be categorized as having high integration.

The advice that can be given is that rice, as a staple food commodity, has a strategic role and needs serious attention. Rice price stability is very important to sustain because fluctuations in rice prices can cause instability in the national economy. The vertical integration of consumers with the grain producer market in Lampung shows that there is a close relationship between the two markets. Price changes at the consumer level will influence the rice price at the farmer level, and changes in price at the farmer level will also influence price changes at the consumer level. Therefore, rice price stabilization policies must consider justice for both parties (consumers and farmers) as well as other related parties. Apart from that, providing digital-based basic price information is needed to minimize imbalances in market price information. The development of human resources toward digitalization regarding changes in market prices needs to be carried out so that the public accepts the price transparency that occurs. Price transparency can also be useful for producers in determining the prices of agricultural products that are marketed either to middlemen or to other market levels directly.

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DECLARATION OF CONFLICTING INTEREST

The authors declared no potential conflicts of interest

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