Price Fluctuation and Vertical Market Integration of Shallots in The Production Center of Central Java Indonesia

Susanawati[1,*], *Endang* Ayu Fitria[1], *Diah* Rina Kamardiani[1], and *Nadiah* Binti Zainal Abidin[2]

[1] Department of Agribusiness Universitas Muhammadiyah Yogyakarta, Brawijaya Street Tamantirto Kasihan Bantul, Yogyakarta, Indonesia
[2] Universiti Teknikal Malaysia Melaka, Jalan Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

Abstract. Shallots from Brebes production center are not only distributed in that region but also to all regions in Indonesia, including Beringharjo market in Yogyakarta. Therefore, this study aims (1) to analyze price fluctuations of shallots in producer and consumer markets in Brebes and Beringharjo Yogyakarta; (2) to analyze vertical market integration in Brebes and producer markets in Brebes with consumer market in Beringharjo. The data used is weekly price of shallots in producer and consumer markets in Brebes, as well as in Beringharjo during 2015-2019. Data were analyzed using the Engle Granger cointegration model. The results showed that the price of shallots in producer and consumer markets tends to fluctuate and has the same pattern of movement. Shallot price fluctuations in producer market in Brebes are higher than consumer market in Brebes and Beringharjo Yogyakarta [9]. Shallot price fluctuations between the three markets were highest in January, February and December and lowest in May and November. In the short and long term, there is weak integration between the producer market and consumer market in Brebes. In the short term there is no integration between the producer market in Brebes and consumer market in Beringharjo Yogyakarta, but in the long term there is weak market integration.

1 Introduction

Horticultural commodities are commodities with high economic value [1], but their development still faces major problems in the off-farm aspect, namely price. The disparity and uncertainty of horticultural commodity prices that occur between producers and consumers has hurt many parties. This is caused by production or harvest failure, speculation which is generally carried out by producers or traders, and weak distribution management. The effect of the weak distribution system has a simultaneous impact that will trigger price volatility [2].

Shallots are one of the horticulture crop commodities required daily for domestic and industrial consumption. Shallots are also available in processed forms such as shallot extract,

* Corresponding author: susanawati@umy.ac.id

powder, essential oils, fried shallots, and even as a pharmaceutical composition to lower cholesterol levels and blood sugar, prevent blood clots, reduce blood pressure, and promote blood flow. Due to the high demand for shallots in Indonesia, they are extensively farmed, including in Central Java.

Variations in shallot production impact the mismatch between supply and demand. In certain seasons, yields can improve, while in others, they are quite low. When the amount of shallot production exceeds market demand, its price will be low; conversely, when its production falls short of market demand, its price will be high. These constraints cause the price of shallots to fluctuate often, resulting in rapid price fluctuation. Rapid price fluctuation necessitates a prompt response for the market to become more efficient and allow for prompt decision-making [3]. Traders frequently utilize price variations in the shallot commodity to influence price information at the producer level; hence, price transfer from consumer to producer markets tends to be uneven. When there is a price rise at the consumer level, it is not promptly conveyed to the producer level, and vice versa.

To minimize the creation of information asymmetry, accurate and ongoing market data must be accessible. If consumers and producers can access precise and continuous market information, price changes can be reacted to instantly, allowing market players to make rapid and correct decisions. It indicates that markets have been well integrated. Market integration demonstrates how price changes in the reference market (consumer market) affect price adjustments in the follower market (producer market). With such an integrated market, information on any changes in the price of shallots at the consumer level can be followed by price adjustments at the producer level, thereby not affecting the marketing actors participating in shallot marketing].

2 Method

This research relies primarily on descriptive analysis and secondary weekly time series data from 2015 to 2019, encompassing shallot producer prices in Brebes Regency and shallot consumer prices in the Brebes Traditional Central Market and the Beringharjo Market in Yogyakarta. The Department of Agriculture and Food Security of the Brebes Regency, the Department of Industry and Trade of Yogyakarta, and the Department of Cooperatives, MSMEs, and Trade of the Brebes Regency contributed to research data [4].

A graphical method was applied to analyze the price behavior of shallots. All price series of shallots were analyzed graphically with Microsoft Excel. Meanwhile, shallot price changes were examined using a mathematical method. Using the coefficient of variation, a mathematical analysis was run. Following is the formula for the coefficient of variation in mathematics.

$$Coefficient\ of\ variation\ (CV) = \frac{s}{x} x100\% \quad (1)$$

The coefficient of price variation derived from time series data was utilized to calculate the fluctuation (difference from the mean) to measure the commodity's price stability [5]. The lower the coefficient of variation, the steadier the price movements of commodities, indicating low fluctuation. In line with the goal of the Indonesian Ministry of Trade until 2019, prices in a city or province are considered steady if the coefficient of fluctuation is less than 9% [6]. A coefficient of fluctuation of more than 9% indicates that the price varies significantly and is unstable.

Price correlation, simple regression, and the Index of Market Connection (IMC) are all ways that can be utilized to determine market integration. In this study, the IMC approach was developed by [7]. According to [8], autocorrelation denotes a relationship between members of one observation and additional observations made in various periods. The

autocorrelation test determines if the confounders in period t and the confounding error in period t-1 (previous) are correlated in the linear model. The autocorrelation test must be performed on time series data. Autocorrelation arises when the value of prior observations heavily impacts a value in a specific sample or observation.

There are several approaches for detecting autocorrelation issues. Durbin-Watson (d) is one of the most often employed tests. It was employed for first-order autocorrelation, needs constants, and no lag variable between independent variables in the regression model. The decision-making regarding the existence or lack of autocorrelation is depicted in the following table.

Table 1. Durbin-Watson (*d*) Statistical Test

***d* Statistical Value**	**Result**
$0 < d < dL$	Rejecting the null hypothesis, there is a positive autocorrelation
$dL < d < du$	Areas of doubt; no decision
$du < d < 4 - du$	Failed to reject the null hypothesis, no autocorrelation. positive/negative
$4 - du < d < 4 - dL$	Areas of doubt; no decision
$4 - dL < d < 4$	Rejecting the null hypothesis, there is a negative autocorrelation

Source: (Widarjono, 2016)

Description:
du: Upper Durbin-Watson
dL: Lower Durbin-Watson

Comparing the Durbin-Watson value of 1.943451 to the upper Durbin-Watson value (du) and the lower Durbin-Watson value (dL) aims to determine whether there is autocorrelation.

According to [8], the coefficient of determination (R^2) describes the connection between the dependent variable (Y) and independent variable (X) in a model. R^2 is the percentage of the total variance of the dependent variable Y that the regression line describes (independent variable X). The closer the R^2 value is to 1, the more effectively the regression line explains the actual data. The closer a regression line is to 0, the worse its quality. The formula for the coefficient of determination R^2 is as follows.

$$R^2 = \frac{\sum e_i^2}{\sum (Yi - \bar{Y})^2} \tag{2}$$

The F-test indicates that the null hypothesis is rejected, signifying that all independent variables impact the dependent variable. F-test was employed to evaluate the model's significance. This F-test can be interpreted by analysis of variance (ANOVA) [8] with the following formula.

$$F = \frac{R^2}{(k-1)} \Big/ \frac{(1-R^2)}{(n-k)} \tag{3}$$

Description:
R^2 = coefficient of variation
n = number of samples
k = number of variables

The t-test is an individual test designed to determine how one independent variable (X) influences the dependent variable (Y) [9]. For example, assuming the other variables are constant, it will be tested whether the X1 variable influences Y, which can be computed using the following formula.

$$t = \frac{\beta 1}{se(\beta 1)} \quad (4)$$

Description:
T = t-test value
β1 = parameter coefficient
se(β1) = standard error

The Index of Market Connection (IMC) model with the Autoregressive Distributed Lag Model approach was employed to determine the market integration between the producer market of Brebes Regency and the consumer market of the Brebes Traditional Central Market, as well as between the producer market of Brebes Regency and the consumer market of the Beringharo Market in Yogyakarta. [12].

The regression equation between the Brebes Regency producer market and the consumer market of the Brebes Traditional Central Market is as follows.

$$P_t = \beta 1\ P_{t-1} + \beta 2\ (R_t - R_{t-1}) + \beta 3\ R_{t-1} + \mu i \quad (5)$$

Description:
P_t = shallot price in the producer market of Brebes Regency in week t
P_{t-1} = shallot price in the producer market of Brebes Regency in week t-1
R_t = shallot price in the consumer market of the Brebes Traditional Central Market in week t
R_{t-1} = shallot price in the consumer market of the Brebes Traditional Central Market in week t-1
Mi = error term
β1 = regression coefficient P_{t-1}
β2 = regression coefficient $R_t - R_{t-1}$
β3 = regression coefficient R_{t-1}

The regression equation between the producer market in Brebes Regency and the consumer market in the Beringharjo Market is as follows.

$$P_t = \beta 1\ P_{t-1} + \beta 2\ (R_t - R_{t-1}) + \beta 3\ R_{t-1} + \mu i \quad (6)$$

Description:
P_t = shallot price in the producer market of Brebes Regency in week t
P_{t-1} = shallot price in the producer market of Brebes Regency in week t-1
R_t = shallot price in the consumer market of the Beringharjo Market in week t
R_{t-1} = shallot price in the consumer market of the Beringharjo Market in week t-1
μi = error term
β1 = regression coefficient P_{t-1}
β2 = regression coefficient $R_t - R_{t-1}$
β3 = regression coefficient R_{t-1}

The following IMC model was applied to evaluate vertical market integration in the short term.

$$IMC = \frac{\beta 1}{\beta 3} \quad (7)$$

Table 2. Market integration requirements

Description	Short Term	Long Term
Strong integration	IMC 0-1	β_2 close to 0.5-1
Weak integration	IMC > 1	β_2 close to 0 (<0.5)
Unintegrated	High IMC	β_2 highly close to 0

3 Results and discussion

3.1 Shallot Price Behavior

The shallot price behavior was determined using a graphical approach. All price series of shallots were analyzed graphically with Microsoft Excel. The price behavior was analyzed in the shallot producer market in Brebes Regency and the consumer market in the Brebes Traditional Central Market.

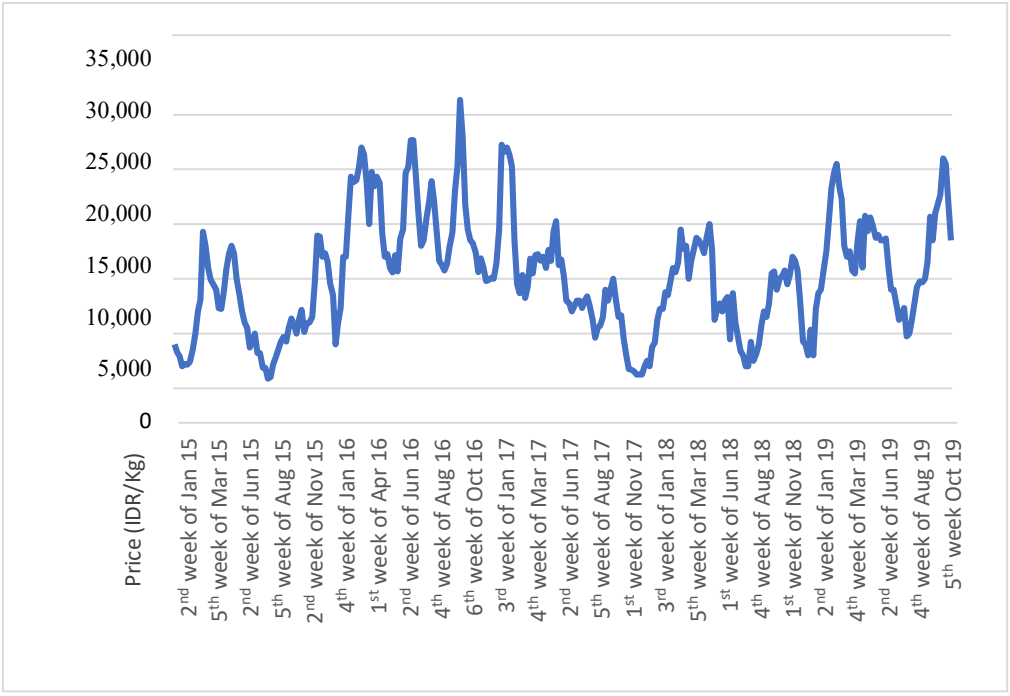

Fig. 1. Shallot Price Behavior in the Producer Market in Brebes Regency (2015-2019)

As displayed in Figure 1, during 2015-2019, the weekly prices in the producer market of Brebes Regency varied and fluctuated. During these years, the highest shallot price per kilogram happened in the second week of November 2016 at IDR 31,300. Conversely, the lowest price of shallots for the period 2015-2019 was IDR 6,000 per kilogram in the sixth week of August 2015. The highest price in the producer market in 2016 occurred during the wet season in the second week of November. Therefore, few farmers farmed shallots.

Consequently, the availability of shallots on the consumer market was diminished. Therefore, traders must import shallots from outside Brebes Regency. This circumstance

caused the market price of shallots to skyrocket. The lowest price in the producer market happened during the sixth week of August 2015, when the shallot crop was at its highest.

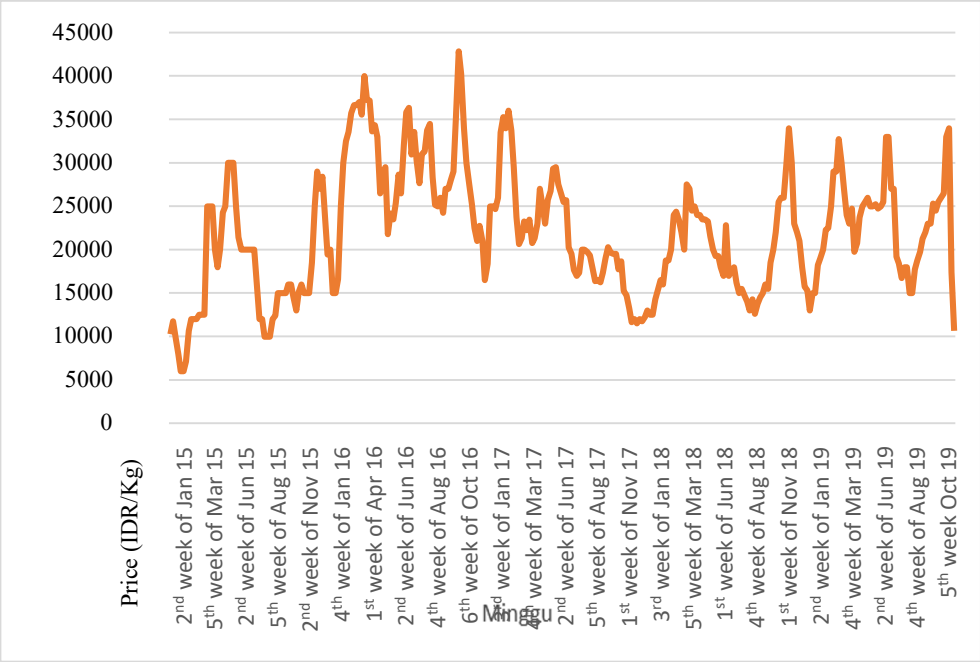

Fig. 2. Price Behavior of Shallots in the Consumer Market of Brebes Traditional Central Market (2015-2019)

During 2015-2019, the Traditional Central Market of Brebes encountered weekly fluctuation. It was evident from these variations that there was a substantial price disparity during some weeks. In the second week of November 2016, the price peaked at IDR 42,833 per kilogram. Moreover, during the third week of February 2015, the lowest price was IDR 6,000 per kilogram. Due to the limited supply of shallots in the local market, the price in the consumer market reached its peak. Accordingly, traders must import shallots from outside Brebes Regency. It generated cost increases, causing traders to pay more for transportation. Therefore, market participants raised the price of shallots.

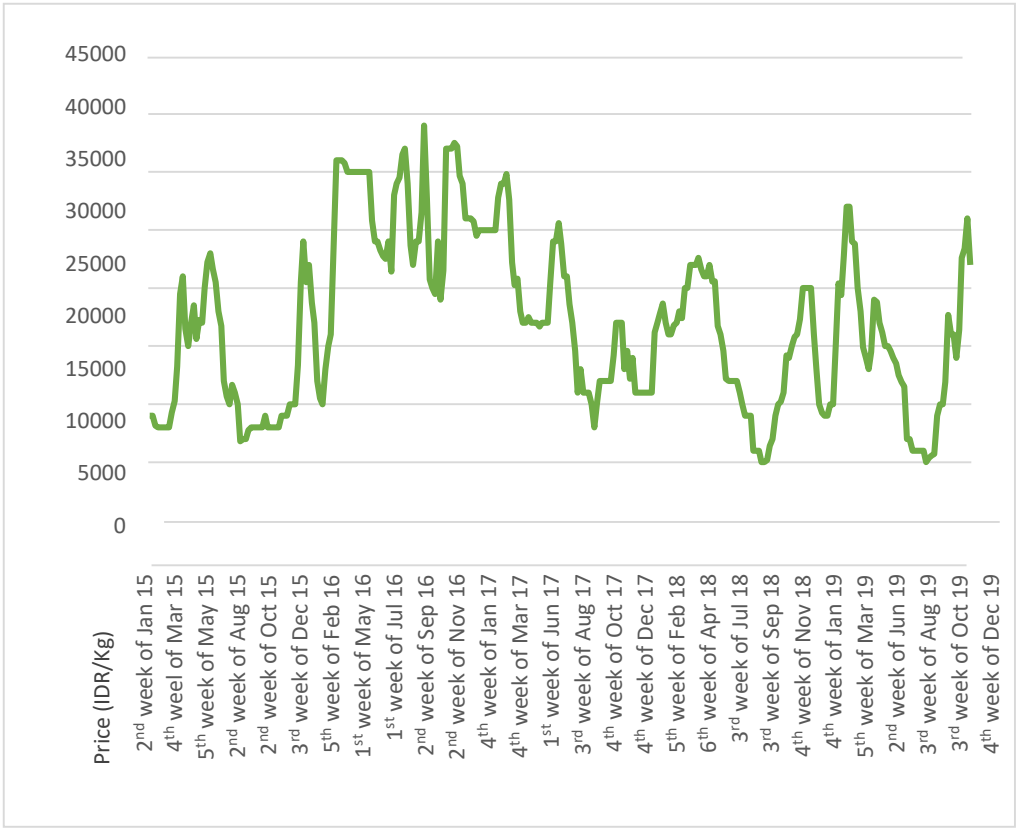

Fig. 3. Shallot Price Behavior in the Consumer Market of the Beringharjo Market (2015-2019)

Figure 3 shows the weekly changes in shallot prices in the Beringharjo Market's consumer market from 2015 to 2019. This fluctuation might be noticed as a considerable price difference in some weeks. The highest price was IDR 39,000 per kilogram in the third week of September 2016. In contrast, the lowest price was IDR 10,000 per kilogram in the second week of October 2018 and the sixth week of September 2019. The consumer market's highest price happened owing to a lack of shallot supply in the local market. As a result, businesses must import shallots from outside the Brebes Regency. Cost swelled, forcing traders to pay more for shipping charges, resulting in dealers raising the market price of shallots.

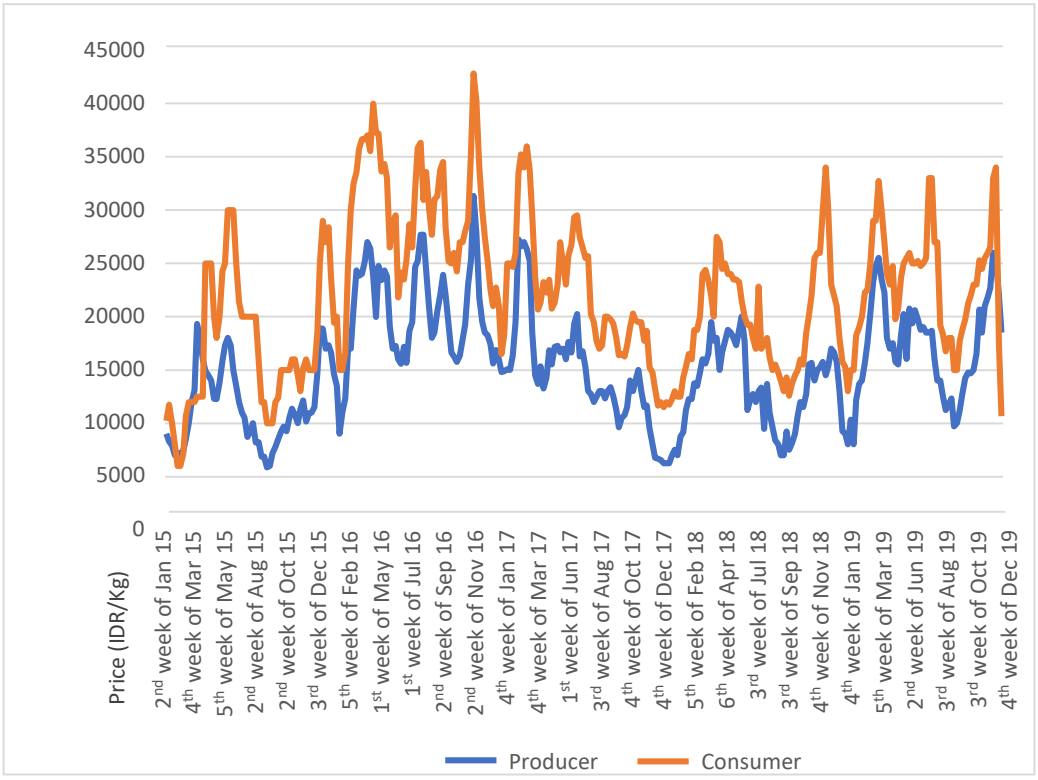

Fig. 4. Shallot Price Behavior in the Producer Market in Brebes Regency and the Consumer Market in the Brebes Traditional Central Market (2015-2019)

When consumer market prices were high, producer market prices were also high, and vice versa when consumer market prices were low. The producer market's fluctuations in shallot prices were similar to those in the consumer market. During 2015-2019, shallot prices fluctuated the most in the second week of November 2016, the third week of April 2016, and the fourth week of July 2016. Figure 4 demonstrates that throughout 2015-2019, the lowest shallot price fluctuation occurred during the sixth week of August 2015, the third week of January 2018, and the fourth week of September 2018.

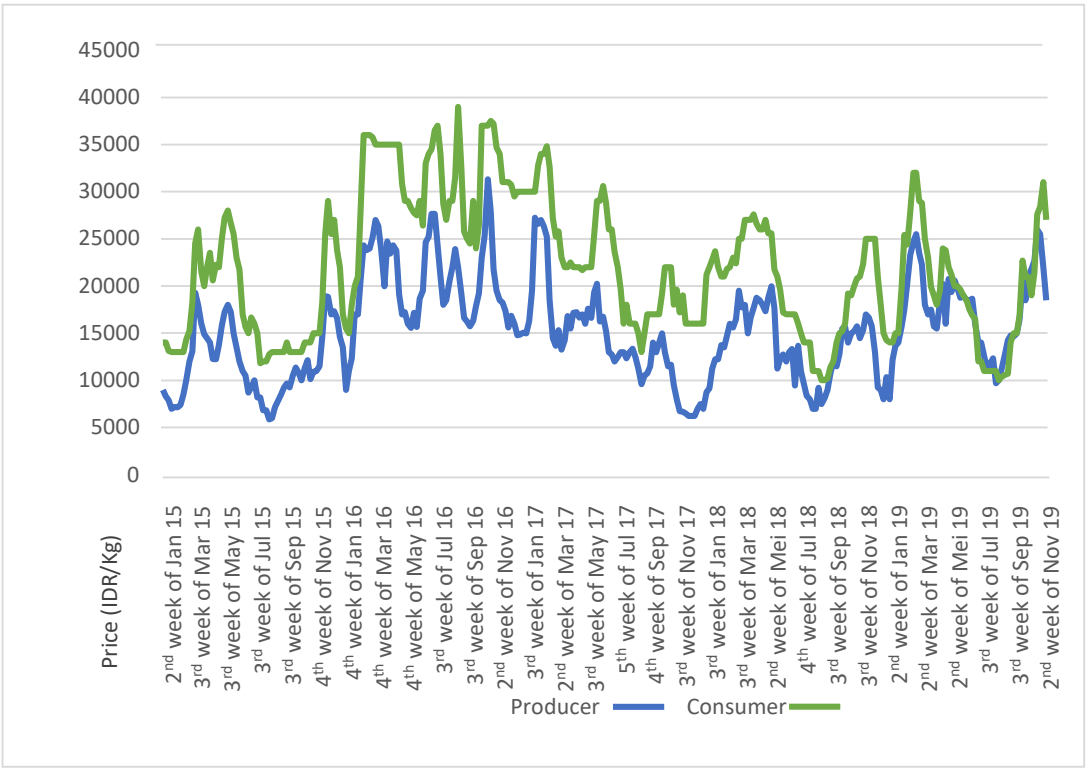

Fig. 5. Shallot Price Behavior in the Producer Market in Brebes Regency and the Consumer Market in the Beringharjo Market (2015-2019)

The producer market price was high when the consumer market price was high, and vice versa, as seen in Figure 5. The producer market price was also low when the consumer market price was low. The price of shallot in the producer market moved in tandem with the price fluctuation in the consumer market. The most considerable fluctuation in shallot prices occurred in the third week of September 2016, the fourth week of November 2016, and the third week of August 2016. Figure 5 further reveals that the lowest shallot price changes happened in the sixth week of August 2016, the second week of January 2018, and the third week of September 2018.

3.2 Shallot Price Fluctuation

Using the coefficient of variation, shallot price fluctuation was identified. The determined coefficient of variation is the time and place. Table 3 displays the results of the coefficient of variation for shallot prices. According to the Ministry of Trade criteria, it suggests large and unstable price changes in the producer and consumer markets due to the coefficient of variance across the three marketplaces exceeding 9%. The lesser the coefficient of variation, the more stable and less fluctuating commodity prices will be [6].

Table 3. Shallot Price Fluctuation in the Producer and Consumer Markets (2015-2019)

Description	Unit	Year					Average
		2015	2016	2017	2018	2019	
Producer Market in Brebes Regency							
a. Average Price	IDR/Kg	11,344	20,080	14,961	12,871	16,759	15,203
b. CV	%	32.09	22.62	31.07	30.84	27.54	28.83
Consumer Market in the Brebes Traditional Central Market							
a. Average Price	IDR/Kg	16,570	29,297	22,144	19,288	22,648	21,989
b. CV	%	37.75	21.14	25.60	27.57	23.48	27.11
Consumer Market in the Beringharjo Market							
a. Average Price	IDR/Kg	17,214	30,293	23,290	19,163	19,418	21,876
b. CV	%	29.74	19.51	25.04	26.93	31.25	26.49

Table 3 demonstrates that the average coefficient of variation in the producer market was more significant than in the two consumer markets, with a value of 28.83% for the producer market in Brebes Regency, 26.49% for the consumer market of the Beringharjo Market and 27.11% for the consumer market of the Traditional Central Market in Brebes. The increased value of the coefficient of variation in the producer market relative to the consumer market implies that the producer market in Brebes Regency accepted more risk than the consumer markets of the Beringharjo Market and Brebes Traditional Central Market. The risk at issue was the increased shallot price fluctuation in the producer market in Brebes Regency. As [4] discovered, the red chili price fluctuation in the producer market was more remarkable than in the consumer market. It was evidenced by the high coefficient of variation in the consumer market of 42.35 % and the production market of 64.41 %.

Table 4 summarizes the shallot price fluctuation in different locations from January 2015 to December 2019. The months with the most excellent average coefficient of variance were January, February, and December, with respective values of 28.19%, 28.01 %, and 28.40%. May and November had the lowest coefficient of variance levels, with 19.04% and 18.97%, respectively. A high coefficient of variance suggests a significant price disparity between the production and consumer markets for shallots. In specific markets, an increase in supply or a demand reduction caused the price to fall, whereas in other markets, a decrease in supply or an increase in demand caused the price to rise [9].

Table 4. Shallot Price Fluctuation in the Producer and Consumer Markets (2015-2019)

Month	Description	Year					Average
		2015	2016	2017	2018	2019	
January	Average (IDR/Kg)	10,529	20,845	22,075	11,583	17,981	16,603
	CV (%)	24.29	23.21	29.91	34.47	29.08	28.19
February	Average (IDR/Kg)	9,338	17,162	28,460	15,012	13,647	16,724
	CV (%)	31.69	30.94	19.10	35.54	22.76	28.01
March	Average (IDR/Kg)	15,650	31,022	26,384	18,370	21,461	22,577
	CV (%)	29.76	18.93	27.40	20.24	21.27	23.52
April	Average (IDR/Kg)	19,286	32,259	22,028	22,003	26,901	24,495
	CV (%)	24.20	18.91	20.54	18.99	15.37	19.60
May	Average (IDR/Kg)	22.205	28,357	20,722	22,919	19,696	22,780
	CV (%)	23.43	24.34	16.03	16.83	14.56	19.04
June	Average (IDR/Kg)	20,609	23,203	22,151	21,827	22,407	22,039
	CV (%)	30.05	22.83	18.95	14.72	13.42	19.99
July	Average (IDR/Kg)	15,000	30,049	23,973	16,626	21,280	21,386
	CV (%)	30.51	16.98	24.90	21.60	13.44	21.49
August	Average (IDR/Kg)	10,350	27,456	17,480	14,652	19,684	17,924
	CV (%)	28.88	21.33	24.96	19.05	35.49	25.94
September	Average (IDR/Kg)	11,516	27,226	16,036	11,477	12,989	15,849
	CV (%)	22.41	22.78	19.02	25.91	23.27	22.68
October	Average (IDR/Kg)	12,893	24,206	15,063	11,522	15,189	15,775
	CV (%)	16.71	22.67	20.36	21.84	25.61	21.44
November	Average (IDR/Kg)	13,443	32,780	17,496	16,688	20,638	20,209
	CV (%)	14.03	20.54	20.88	22.23	17.15	18.97
December	Average (IDR/Kg)	19,939	24,223	12,944	21,665	24,359	20,626
	CV (%)	29.31	25.80	35.79	27.12	23.96	28.40

3.3 Shallot Vertical Market Integration

Market integration aims to investigate if price changes in the consumer market can be transferred directly to the producer market. If there is a positive correlation between the prices of various markets, there is the same market information, it is sufficient, it is quickly disseminated to other markets, and it is all of these things. [14].

Table 5. Regression Results of Factors Influencing the Shallot Price in the Producer Market in Brebes Regency

No	Variable	Regressi Coefficient	t count	Signification
1.	Shallot prices in the producer market during the preceding time frame	0.781	19.191	0.0000**
2.	The difference in the price of shallots in the current period's consumer market with the previous period	0.385	11.200	0.0000**
3.	The price of shallots at the consumer level in the previous period	0.134	4.392	0.0000**
4.	**R^2**	0.903		
5.	**F**	923.772		0.0000**
6.	***d***	1.800		
7.	**N**	300		

Description:
** significant at 1% error rate

3.3.1 Autocorrelation Test

As displayed in Table 5, d= 1.800, N= 300, K= 3, and α= 5%, acquiring a dU value of 1.831 and a dL value of 1.800. Therefore, the Durbin-Watson value was between dL and dU ($dL < d < dU$), corresponding to 1.791 < 1.800 < 1.831, demonstrating no determination in the regression equation as to whether autocorrelation was positive or negative. It implies neither positive nor negative autocorrelation. It can be enhanced by checking the autocorrelation using the Runs Test to evaluate whether or not the model exhibited autocorrelation. The Runs Test was utilized to determine if there was a significant connection between residuals.

Table 6. Runs Test

	Unstandardized Residual
Test Value (a)	-29.38680
Cases < Test Value	150
Cases >= Test Value	150
Total Cases	300
Number of Runs	135
Z	-1.851
Asymp. Sig. (2-tailed)	0.064

The Asymp value was determined based on information in Table 6. Sig. (2-tailed) > 0.05, i.e., 0.064 > 0.05, denotes that the data utilized were relatively random. Hence, no autocorrelation was discovered in the tested data.

3.3.2 Coefficient of Determination Test (R^2)

R^2 indicates the proportion of the variance in the dependent variable that the independent variables can explain in the regression model. As displayed in Table 5, the regression analysis revealed an R^2 value of 0.903%, or 0.9003. In summary, changes in the price of shallots in the producer market during the current period, changes in the price of shallots in the consumer market during the current and previous periods, and changes in the price of shallots in the consumer market during the current period can all be used to explain 90.3% of the price variation. The remaining 9.7% was accounted for by fluctuation in variables excluded in the regression model.

3.3.3 F-Test

The F-test determines the combined influence of all independent variables on the dependent variable. The analysis findings by regressing the independent variables were the price variable in the producer market in the previous period, the price difference in the customer market between the current and previous periods, and the price variable in the producer market in the previous period. The F value was 923.772, and the significance level was 0.0000. With a significance value of less than 1%, Ho is rejected, and Ha is accepted. It signifies that with a 99% level of confidence, the independent variable of price in the producer market in the previous period, the price difference in the consumer market between the current and previous periods, and the price in the producer market in the previous period significantly affected the dependent variable of price in the producer market in the current period.

3.3.4 T-Test

The t-test was performed to examine the influence of the independent variables on the dependent variable. The preceding period's examination of the independent variable of price in the producer market yielded a t-count value of 19.191, with a significance level of 0.0000, as depicted in Table 5. As the significance value is less than 1%, Ho is rejected, and Ha is accepted. It implies that, with a 99% confidence, the independent variable of price in the producer market in the previous period considerably influenced the dependent variable of price in the producer market in the present period. When the price of shallots in the market increased by IDR 1,000 per kilogram during the previous period, the price of shallots on the producer market for the current period increased by IDR 781 per kilogram.

The independent variable analysis of the price difference between the present and prior periods in the consumer market generated a t-count value of 11.200 and a significance level of 0.0000. With a significance value of less than 1%, Ho is rejected, and Ha is accepted. It signifies that, with a 99% confidence, the independent variable of the price difference between the current period's consumer market and the previous period considerably influenced the dependent variable of price in the current period's producer market. The price of shallots in the producer market for the current period increased by IDR 385 per kilogram when the price difference between the consumer market for the current period and the previous period increased by IDR 1,000 per kilogram.

Table 5 reveals that the independent variable of price in the consumer market during the preceding period had a t-count value of 4.392 and a significance level of 0.0000. The significance value is less than 1%. Hence, Ho is rejected, and Ha is accepted. It indicates that, with a confidence level of 99%, the independent variable of price in the consumer market in the previous period significantly affected the dependent variable of price in the producer market in the present period. Then, whenever the price of shallots on the consumer markets

in the previous period increased by IDR 1,000 per kilogram, the price in the producer market also raised by IDR 134 per kilogram in the current period.

3.4 Short-Term Vertical Market Integration

The following equation was derived from Table 5 after regression.

$$Pt = 0.781(Pt - 1) + 0.385(Rt - Rt - 1) + 0.134(Rt - 1) \quad (8)$$

Description:

$\beta 1$ = 0.781
$\beta 2$ = 0.385
$\beta 3$ = 0.134

The IMC model was utilized for the market integration study. The β1 and β3 values derived from the regression analysis were utilized to calculate IMC. The regression coefficient for shallot price in the producer market during the prior period was β1. The regression coefficient for shallot price in the consumer market in the previous period was β3. With a β1 value of 0.781 and a β3 value of 0.134, the computation was then performed using the following formula.

$$\begin{aligned} IMC &= \frac{\beta 1}{\beta 3} \\ &= \frac{0.781}{0.134} \\ &= 5.828 \end{aligned} \quad (9)$$

By comparing the regression coefficient of the price of shallots in the producer and consumer markets during the prior period, the IMC of 5.828 was calculated. The IMC value demonstrates IMC > 1, indicating a weak short-term integration between the production and consumer markets. In other words, shallot price changes in the consumer market must be more effectively and promptly transferred to the producer market. The weak short-term market integration between the producer and consumer markets implies that the producer market was characterized by imperfect competition. In addition, the weak short-term market integration in Brebes Regency suggests the lack of an active role for Market Information Service (PIP) officers in disseminating price information to the producer market, hindering the flow of information between producers and consumers in the Brebes Traditional Central Market.

The study's findings differ from those of [2], who discovered that red cayenne pepper prices in West Java Province are not integrated with the Kramat Jati parent market. Other horticultural commodities research by [15] demonstrates the vertical integration of shallot prices at the wholesaler and consumer levels in Tegal, Semarang, and Surakarta. The strong degree of market integration in the short term in Kulonprogo Regency shows that the flow of information between farmers and the PIKJ consumer market is so smooth that the prices among farmers are affected by prices in the PIKJ consumer market. Information flows run smoothly so farmers can find the condition of red cayenne pepper prices in the PIKJ consumer market. It can occur due to the presence of PIP (Market Information Service) officers in the Kulonprogo Regency. Everyday PIP officers record the prices of red cayenne pepper at the farmer and the prices of red cayenne pepper in the PIKJ consumer market so that any changes in red cayenne pepper prices occurring in the PIKJ consumer market can be

immediately shared with the farmers through the PIP officers. Red cayenne pepper farmers in the producer area have been able to utilize the obtained information, either from PIP officers or from Pthe IKJ consumer market optimally.

3.5 Long-Term Vertical Market Integration

Price changes in the consumer market are linked to long-term vertical market integration and may have an effect on long-term producer market prices. It can be observed from the coefficient value of β2. Regression analysis revealed a coefficient β2 of 0.385 (<0.5). In the long term, the price in the integrated producer market in Brebes Regency remained poor. Therefore, a IDR 1,000 rise in the shallot price in the consumer market of the Beringharjo Market resulted in a IDR 385 increase in the producer market of Brebes Regency.

Table 7. Regression Results of Factors Affecting the Shallot Price in the Producer Marketin Brebes Regency

No	Variable	Regression Coefficient	t count	Significance
1.	Shallot price in the producer market in the previous period	0.849	24.907	0.0000**
2.	The difference in shallot price in the current period's consumer market with the previous period	0.455	9.834	0.0000**
3.	Shallot price it the consumer market in the previous period	0.062	2.491	0.0133*
4.	**R^2**	0.896		
5.	**F**	852.354		0.0000**
6.	**D**	1.950		
7.	**N**	300		

Description:
** significant at 1% error rate
* Significant at a 5% error rate

3.5.1 Autocorrelation Test

Table 7 reveals that the *d* value with N=300, K=3, and 5% was 1.950, the dU value was 1.831, and the 4-dU value was 2.169. Consequently, the Durbin-Watson value was between dU and 4-dU ($dU < d <$ 4-dU), 1.831 < 1.950 < 2.169, demonstrating that the model lacked autocorrelation.

3.5.2 Coefficient of Determination Test (R2)

In Table 7, the regression analysis results reveal an R^2 value of 0.895% or 0.896%. It shows that variations in the shallot price in the producer market in the preceding period, the shallot price difference in the consumer market between the current and preceding periods, and the shallot price in the consumer market in the preceding period could account for 89.5% of the variation in the shallot price in the producer market in the current period. At the same time, the remaining 10.5% was accounted for by fluctuations in variables excluded in the regression model.

3.5.3 F-Test

Table 7 illustrates an F value of 852.354, with a significance of 0.0000. The significance value of less than 1% implies that Ho is rejected, and Ha is accepted. It denotes that, with a 99% level of confidence, the independent variable of price in the producer market of the previous period, the price difference in the consumer market between the current and previous periods, and the price in the producer market in the previous period significantly affected the dependent variable of price in the producer market in the current period.

3.5.4 T-Test

Table 7 depicts the analysis results of the independent variable of price in the producer market over the previous period, with a t-count value of 24.907 and a significance level of 0.0000. The significance level was below 1%; thus, Ho is rejected, and Ha is accepted. With a 99% confidence, it suggests that the independent variable of price in the producer market in the previous period substantially impacted the dependent variable of price in the producer market in the current period. The price of shallots in the producer market increased by IDR 849 per kilogram anytime the price of shallots in the market climbed by IDR 1,000 per kilogram in the current period.

The independent variable analysis of the price difference between the current and previous periods in the consumer market yielded a t-count value of 9.834 and a significant level of 0.0000. The significance level is below 1%. Therefore, Ho is rejected, and Ha is accepted. In other words, the independent variable of the price difference between the current period's consumer market and the previous period significantly affected the dependent variable of price in the current period's producer market with a 99% degree of confidence. Suppose the price differential between the consumer market for the current and previous periods increased by IDR 1,000 per kilogram. In that case, the shallot price in the producer market for the current period also increased by IDR 455 per kilogram.

Table 7 exhibits that the independent variable of price in the consumer market in the previous period acquired a t-count value of 2.,491 and a significant level of 0.0133. With a significance level below 5%, Ho is rejected, and Ha is accepted. With 95% confidence, the independent price variable in the consumer market in the previous period substantially impacted the dependent variable of price in the producer market in the current period. Every time the price of shallots in the consumer market increased by IDR 1,000 per kilogram during the preceding period, the price of shallots in the producer market increased by IDR 62 per kilogram.

3.6 Short-Term Vertical Market Integration

The equation derived from Table 7 after the regression is as follows.

$$P_t = 0.849(P_t - 1) + 0.455(R_t - R_t - 1) + 0.062(R_t - 1) \quad (10)$$

Description:

$\beta 1$ = 0.849
$\beta 2$ = 0.455
$\beta 3$ = 0.062

The IMC model was applied to conduct a market integration analysis. The $\beta 1$ and $\beta 3$ values derived from the regression analysis were employed to calculate IMC. The regression coefficient for the shallot price in the producer market over the prior period was $\beta 1$.

Moreover, the regression coefficient for the shallot price in the consumer market in the previous period was β3. β1 had a value of 0.849, and β3 had a value of 0.062. The computation was conducted by entering these values into the following formula.

$$IMC = \frac{\beta 1}{\beta 3} = \frac{0.849}{0.062} = 13.694$$

Comparing the regression coefficient of the price of shallots in the producer market in the previous period to that in the consumer market in the previous period yielded a relatively high IMC value of 13.694. In other words, there was a weak short-term integration between the production and consumer markets. It indicates that price changes in the consumer market for shallots could be more efficiently and swiftly transmitted to the producer market. The weak short-term market integration between the producer and consumer markets implies imperfect competition in the producer market [10].

3.7 Long-Term Vertical Market Integration

Long-term vertical market integration is associated with the relationship between price changes in the consumer market and their potential impact on price in the producer market. It is evident from the coefficient β2 value of 0.455 (0.5), as indicated by the regression equation in Table 7. It depicts that the price in the integrated producer market in Brebes Regency was weak over the long term. To put it briefly, the value of β2 shows that a IDR 1,000 increase in shallot prices in Beringharjo's consumer market led to a IDR 455 increase in Brebes Regency's producer market.

4 Conclusions

The following are the study findings on the integration of the shallot market in Brebes Regency.

1. The price of shallots varied and was inconsistent in all three markets, including the producer market of Brebes Regency, the consumer markets of the Brebes Traditional Central Market, and the Beringharjo Market. The Brebes Regency producer market had a more significant average coefficient of variation over time than the consumer markets of the Brebes Traditional Central Market and the Beringharjo Market. January, February, and December had the largest average coefficient of variation between the three markets. In contrast, May and November possessed the lowest average coefficient of variance.
2. There was a lack of strong integration in the short and long run between Brebes' producer market and Brebes' Traditional Central Market consumer market.
3. The consumer market of the Beringharjo Market and the producer market of the Brebes Regency had no connection in the short term. In the meantime, the consumer market of the Beringharjo Market and the producer market of Brebes Regency had a weak long-term integration.

To ensure the shallot price stability, it is anticipated that the government would issue laws governing the establishment of reference prices for farm purchases and consumer sales. The price is determined by comparing the top and lowest retail prices for the shallot commodity. In a market with poor integration, the Brebes Regency Government must work to strengthen market information systems. Market Information Service (PIP) officers must play an active role in disseminating price information to shallot marketing participants, particularly farmers

as producers. Meanwhile, in unintegrated markets, the Yogyakarta City Government must enhance market information systems and sustainably disseminate shallot price information through print media, television, and other electronic media, allowing farmers and consumers to be aware of shallot price changes rapidly and accurately.

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