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Fluctuation and Price Responses Retail Level of Red Chili, Cayenne Pepper, Shallot in Five Major Cities in Java

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Abstract – Java Island aside from being a center of production is also a center of consumption of commodities such as red chili, cayenne pepper, and shallots. During 2008 – 2018, it was known that the average consumer price of red chili, cayenne pepper and shallots in five major cities in Java fluctuated. The purpose of this study was to determine the price behavior and price response of commodity red chili, cayenne pepper, and shaloots in five big cities in Java. The results showed that the price behavior of red chili, cayenne pepper, and shallot was highly volatile and unstable. This is known from the high average consumer price variations (> 9 persen) in five big cities in java. Meanwhile, based on the IRF value, it is known that the change in the price of red chili is responded positively by the commodity cayenne and shallots. Likewise, changes in the price of shallots responded positively by red chili and cayenne peppers. But for changes in the price of cayenne peppers received a negative response from red chili and shallots in the city of Surabaya. It is suggested that the role of the government in price stabilization is by controlling wholesale and retail prices, improving infrastructure, developing connectivity between regions, by creating a price information system.

Keywords – Cayenne Pepper, Fluctuation, Price Response, Red Chili, Shallot.

I. INTRODUCTION

One of the horticultural products that have good market prospects is in terms of the production, consumption and trade of annual vegetables. In 2018, the commodities of red chili, cayenne pepper and shallots become the main commodity of seasoned vegetables with the largest national production, all sequentially are shallots of 1.50 million tons, cayenne pepper of 1.34 million tons, and red chili of 1, 21 million tons. In Indonesia, more than 45 percent of chili is used for direct household consumption, 50 percent for processed industrial raw materials, 5 percent is scattered and the rest is used for seeds with a very small percentage. Shallots (Alium cape L) are also classified as spices. This is because shallots are included in the group of unsubstituted herbs that function as seasonings for food / cooking. Shallots are also widely used by industry both as raw material and as additional material (BPS 2018).

Production of red chili, cayenne pepper, and shallots is cultivated in almost all provinces in Indonesia, but production centers covering a wide area of plantations, production, and

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high levels of productivity are concentrated on the island of Java which includes West Java, Central Java and East Java (Rachmawati et al. 2019). Based on Direktorat Jenderal Hortikultura data (2018), West Java province is the largest producer of red chili which contributes 22.71 percent of the national stock, then East Java is the largest producer of cayenne pepper by 33.94 percent and Central Java is the largest producer of shallot by 29.64 percent of national stock. The centralization of production areas in Java, resulting in differences in price levels (disparity) between regions in Indonesia. This price difference encourages trade between provinces to meet the needs of the community.

Related to trade between regions (provinces) in Java, the five main cities in Java, namely DKI Jakarta, Bandung, Semarang, Yogyakarta and Surabaya, are big cities as production centers and also as centers for consumption of red chillies, cayenne peppers, and shallots, where the consumer demand for these commodities is high. This shows that Java is the center of production and consumption in Indonesia. This is in line with the opinion of Ridhwan et al. 2012 that Java with a population concentration of around 58 percent of Indonesia's total population became the center of food production and consumption. That causes the Java intra-island trade to show high intensity and the intra-Java commodity trade turn over is also the highest when compared to other regions.

As a strategic food commodity that affects the national economy, red chili, cayenne pepper, and shallot are included in the volatile food group that contributes to inflation (Bank Indonesia 2016). Pressure on price movements in the volatile food group is more triggered by supply shocks while commodity demand tends to be stable because it is a basic need (Prastowo et al. 2008). The volatile food nature of the commodities of red chili, cayenne pepper, and shallot shows that the prices of red chili, cayenne pepper and shallot fluctuate and are unstable. The prices of red chili, cayenne pepper and shallot for the last five years, namely 2014 to 2018, are shown in Table 1.

Table 1. Average National Retail Prices of Red Chili, Cayenne Pepper, Shallot

Commodity	Average National Retail Prices of Red Chilli, Cayenne pepper, shallots (Rp/kg)					Average Growth (%)
	2014	2015	2016	2017	2018	
Red Chili	30.189	29.514	37.333	31.505	37.460	6,90
Cayenne Pepper	41.272	41.090	40.890	57.985	44.411	4,37
Shallots	22.635	25.096	39.274	31.266	28.700	9,69

Source : Pusdatin, 2018.

Table 1 explains the national retail prices of red chili, cayenne pepper, and shallot in the 2014-2018 period using fluctuations. The average growth of shallot by 9.69 percent is the highest compared to red chili (6.90 percent) and cayenne pepper (4.37 percent). Fluctuations in the price of red chili, cayenne pepper, and shallot caused by uncertain conditions that cause production to decline. Red chillies, cayenne peppers, and shallots are paid by household customers in small but large enough quantities needed by the community, so that the compilation of non-availability does not meet the needs of Red chillies, cayenne peppers, and shallots can cause unrest in the community (Sandra 2012).

In addition to climate, fluctuations are also caused by off-farm problems, namely transportation and distribution barriers, for example due to road damage and inter-island crossings. Products in production centers cannot be immediately transported to the marketing area, resulting in a build-up of results which results in lower prices at the producer level and increased losses due to damage to some commodities (Dhanes 2017). In addition, transportation and distribution barriers can also increase marketing margins due to high marketing and transportation costs. According to Asmarantaka 2014, a high marketing margin is due to the added value that occurs after the product from the farmer level as the primary producer until the product produced is received by the final consumer. Differences in marketing margins in each marketing institution can be caused by differences in the treatment of products to create added value that gives rise to final customer satisfaction.

Regarding marketing and transportation margins, based on BPS data (2019), it is known that the trade and transportation margins of red chilli and shallot in five provinces in Java are very high. The highest the trade and transportation margins of red chili is in West Java at 82.31 percent. This indicates that the increase in the price of red chili from producers to final consumers in the province of West Java was 82.31 percent. While shallot, the highest the trade and transportation margins is in Yogyakarta at 60.53

percent. This shows that the increase in the price of shallots from producers to end consumers in Yogyakarta Province was 60.53 percent.

Several studies on price fluctuations both red chili, cayenne pepper and shallot have been conducted by Koster 1989, Irawan 2007, Nuraeni 2015, Ruslan 2016, Elvina 2017, Magfiroh et al. 2017, and Annisa et al 2018. The results of the study concluded that: (a) price fluctuations can result in high marketing margins. The marketing margin with the farmer's share has a negatively related, meaning that a high marketing margin will have an impact on the farmer's share. This indicates that the high marketing margin resulted in farmers obtaining low profits, (b) the price of red chili on the consumer market is thought to be strongly influenced by price formation at the level of large traders. This condition is caused by a network of large traders who have easy access to information regarding the supply and demand situation, (c) the price of shallot producers influences the wholesale price, whereas the wholesale price does not affect the prices of producers. Then the wholesale price affects the price at the retail level while the retail price does not affect the price at the wholesale level. This shows that the price between shallot marketing institutions in Indonesia is more determined from the supply side or is one-way from upstream to downstream. Based on these results it can be stated that high price fluctuations can be losses to producers and consumers. On the other hand there is a high role of marketing institutions (wholesale and retail) in determining consumer prices.

One way to find out price fluctuations is to look at price movements / behavior at the retail level within a certain time period. This price fluctuation can be known from the coefficient value of the price variations that occur in a commodity.

According to Nidausoleha 2007, the coefficient of variation (CV) represents a fluctuation (deviation from the average), where the fluctuation represents a risk. The risk of price fluctuations in consumer markets shows the inability of traders to determine prices, as well as illustrates that prices are not perfectly transmitted and price information between retail markets is not transmittion by each retail market. In addition to the coefficient of variation, price fluctuations can be seen from the existence of price links or price responses between commodities (Arianto et al. 2010). It is well known that the prices of commodities interact with one another due to their complementary or complementary nature. That is, an increase / decrease in the price of one commodity can cause an increase / decrease in the price of other commodities (Griffith et al. 1979). This is also the case with red chillies, cayenne peppers and shallots. Therefore, based on the description, it is important to analyze the fluctuations in the price of red chili, cayenne pepper, and shallot that occur in the retail markets in five major cities in Java based on the value of price variations and price responses / linkages between commodities so that they can be used as material information and price evaluation in investment planning framework and price stability.

II. Research Method

The data used in this study are secondary data with time series data monthly in the period January 2008 to December 2018. Data on the price of three types of annual vegetables at the retail level is the average price in five major cities in Java. Sources of data come from various government agencies / institutions namely the Central Statistics Agency, the Ministry of Agriculture, the Ministry of Trade, as well as various other relevant sources. Data analysis uses qualitative and quantitative methods. Data processing using software of Microsoft Excel 2019 and Eviews 8.0. The results of data processing are presented in tabulation and graphical form. If the coefficient of variation is more than 9 percent, the price indicates high and unstable fluctuations.

1. Fluctuations in the price of red chili, cayenne pepper and shallot are analyzed using the coefficient of variation displayed in tabular form to see the price fluctuations that occur. The smaller the coefficient of variation of a group of data, the data is homogeneous and this means the price is more stable or not fluctuating (Rachman 2005). Prices in a city / province are called stable if the value of the price variation coefficient is in the range of 5-9 percent (Ministry of Trade, 2010). If the coefficient of variation is more than 9 percent, the price indicates high and unstable fluctuations.

Mathematically, the coefficient of variation is formulated as follows:

$$Coefficient\ of\ Variation\ (CV) = \frac{Standard\ Deviation}{Average} x100\% \quad (1)$$

2. The response of retail prices of red chilli, cayenne pepper and shallot to price changes in the period 2008-2018 in five main cities in Java was carried out using the Vector Autoregressive (VAR) / Vector Correction Model (VECM) method.

The VECM model can be written as follows (Maddala 2005):

$$\Delta P_t = \sum_{i=1}^{k-1} \Gamma_i \Delta P_{t-1} + \Pi P_{t-1} + \mu + \varepsilon_t \qquad (t=1,.....T) \quad (2)$$

The stages of formation of VAR / VECM are:

1. *Unit Root Test*

Stationarity test in this study uses the Augmented Dickey Fuller (ADF) test. If the ADF test statistic is actually smaller than the Mac Kinnon critical value test, this means that the data is stationary. The results of the stationarity test data for each region can be seen in the following Table 2:

Table 2. Stationary Test Results

Variable	DKI Jakarta	Bandung	Semarang	Yogyakarta	Surabaya
	Level	*Level*	*Level*	*Level*	*Level*
The Price of Red Chili	**-4.598**	**-3.879**	**-4.229**	**-3.914**	**-4.191**
The Price of Shallot	**-2.610**	**-2.887**	**-3.028**	**-2.861**	**-2.958**
The Price of Cayenne Pepper	**-3.504**	**-3.793**	**-3.549**	**-3.898**	**-7.990**

Note: ADF with intercept. The critical rate of 1%, 5% and 10% t-ADF is -3,500; -2888; -2,578. Bold indicates that the data is stationary at 1%, 5% and 10% level.

2. Determination of Optimal Lag

Testing the optimal lag in this study using the minimum AIC criteria. The optimal lag test results can be seen in the Table 3 below:

Table 3. Optimal lag Test Results

Lag	Akaike Information Criterion (AIC)				
	DKI Jakarta	Bandung	Semarang	Yogyakarta	Surabaya
0	64.791	63.251	62.872	63.609	65.657
1	61.841	60.457	60.090	60.558	63.593
2	61.652	59.973	59.734	60.240	**63.473***
3	**61.567***	**59.858***	**59.733***	**60.151***	63.485
4	61.665	59.901	59.794	60.162	63.567

Note: Stars and bold indicate the smallest AIC value

3. *Impulse Response Function (IRF)*

IRF is a method used to determine the response of an endogenous variable to a particular shock. This is because shock variables, for example the variable to-i, not only affect the variable to-i, but also transmitted to all other endogenous variables through dynamic structures or lag structures in VAR. In other words, IRF measures the effect of a shock at a time on the innovation of endogenous variables at that time and in the future.

III. RESULTSAND DISCUSSION

3.1 Fluctuations in the Price of Red Chillies, Cayenne pepper and Shallot in Five Main Cities in Java

Fluctuations in the price of red chili, cayenne pepper, and shallot on the retail market in five main cities in Java were analyzed using the coefficient of variation analysis with the results that can be seen in Table 4.

Table 4 shows the volatile and high volatile prices of red chilli, cayenne pepper, and shallot in the five main cities in Java. This is based on the Ministry of Trade's recommendation that states the coefficient of variation above

9 percent shows that prices are fluctuating high and unstable. In detail, the price of red chilli commodities in the retail market in DKI Jakarta and in Bandung has fluctuated lower than the prices of chili in the cities of Semarang, Yogyakarta and Surabaya. This can be seen from the average price variations in DKI Jakarta and Bandung, whose value is smaller than the variation in the price of red chili in Semarang, Yogyakarta and Surabaya. For the price of cayenne pepper, higher price fluctuations occurred in Yogyakarta and Surabaya, while in DKI Jakarta, Bandung and Semarang the price of cayenne pepper was relatively fluctuating. For the price of shallot commodities, in DKI Jakarta fluctuated lower than prices in Bandung, Semarang, Yogyakarta and Surabaya.

Table 4. Fluctuations in Prices of Red Chillies, Cayenne pepper and Shallots in 2008-2018 in Retail Markets in Five Major Cities in Java

Description	Coefficient Variation		
	Average (%)	Maximum (%)	Minimum (%)
A. Red chili			
1. DKI Jakarta	29,37	62,43	0,27
2. Bandung	29,39	53,61	14,77
3. Semarang	36,45	77,92	20,43
4. Yogyakarta	36,01	69,02	19,18
5. Surabaya	35,23	67,89	19,96
B. Cayenne pepper			
1.DKI Jakarta	34.93	63,65	15,96
2.Bandung	33,05	58,21	14,38
3.Semarang	38,18	66,93	12,40
4.Yogyakarta	43,40	79,49	23,98
5.Surabaya	51,99	149,29	26,53
C. Shallot			
1.DKI Jakarta	28,57	105,02	12,63
2.Bandung	41,12	105,35	14,49
3.Semarang	44,41	111,19	12,99
4.Yogyakarta	43,72	107,20	12,50
5.Surabaya	43,35	106,65	12,90

3.2 Response of Commodity Prices of Red Chili, Cayenne pepper and Shallot Due to Changes in Prices of One Commodity

The influence of a shock at a time to the innovation of endogenous variables at that time and in the future, in this study using the Impulse Response Function (IRF) method with a projection of eight months of observation. Price responses that occur indicate a link or the price relationship of one commodity with another commodity.

3.3 Response of Price of Cayenne pepper and Shallots Due to Changes in Price of Red Chili

Table 5 shows that the price response of cayenne pepper and shallots due to changes in the price of red chili showed a positive response in each city. The response to the increase in the price of cayenne pepper in DKI Jakarta, Bandung, Semarang and Yogyakarta has been running fast, which has occurred since the first month after the change in the price of red chili, while in Surabaya the response to the increase in the price of cayenne pepper occurred in the second month after the change in the price of red chili. For shallots, the response to price increases has been slow in all cities except in the city of Bandung

.

Table 5. Response of Price of Cayenne Pepper and Shallot Due to Changes in Price of Red Chili

City	Price Response	
	Cayenne Pepper (Rp)	Shallot (Rp)
1. DKI Jakarta	5.762 (1)	1.166 (5)
2. Bandung	4.693 (1)	1.097 (1)
3. Semarang	3.667 (1)	1.228 (5)
4. Yogyakarta	4.203 (1)	1.451 (4)
5. Surabaya	6.948 (2)	1.552 (2)

3.4 Response of Red Chili and Shallot Due to Changes in Price of Cayenne Pepper

Table 6 shows a positive response from the price of red chili due to changes in the price of cayenne pepper in four cities, namely DKI Jakarta, Bandung, Semarang and Yogyakarta, while in Surabaya the response is negative. The same thing happened to the price of shallot.

Tabel 6. Response of Red Chili and Shallot Due to Changes in Price of Cayenne pepper

City	Price Response	
	Red Chili (Rp)	Shallot (Rp)
1. DKI Jakarta	1.023 (1)	490 (1)
2. Bandung	826 (1)	245 (5)
3. Semarang	606 (1)	1.142 (1)
4. Yogyakarta	401 (8)	579 (1)
5. Surabaya	- 1.315 (2)	- 415 (3)

Rapid response to the increase in the price of red chillies occurred in the cities of DKI Jakarta, Bandung and Semarang, while in Yogyakarta the response to the increase in the price of red chili was very slow, which occurred in the eighth month after the change in the price of cayenne pepper. The response to the reduction in the price of red chillies occurred in the city of Surabaya in the second month after the change in the price of cayenne pepper. For Shallots, the response to price increases occurred in four cities with a fast response, namely in the first month after the change in the price of cayenne pepper. While in the city of Bandung the response to an increase in the price of shallot due to changes in the price of cayenne pepper was slow, namely in the fifth month. The decline in the price of shallot occurred in the city of Surabaya, namely in the third month after the change in the price of cayenne pepper.

3.5 Response Price of Red Chili and cayenne pepper Due to Changes in Price of Shallot

Table 7 shows that the price response of red chili and cayenne pepper due to changes in the price of shallots in five main cities in Java showed a positive response. The response to the increase in the price of red chillies and cayenne pepper in each city was slow, which on average occurred in the fourth and fifth months after the change in the price of shallots.

Table 7. Response Price of Red Chili and Cayenne Pepper Due to Changes in Price of Shallot

City	Price Response	
	Red Chili (Rp)	Cayenne pepper (Rp)
1. DKI Jakarta	2.342 (4)	3.136 (5)
2. Bandung	2.186 (4)	1.775 (4)
3. Semarang	2.337 (4)	2.046 (4)
4. Yogyakarta	2.695 (3)	2.371 (4)
5. Surabaya	3.102 (4)	3.774 (6)

IV. Conclusion And Recommendation

4.1 Conclusion

1. Prices for red chilli, cayenne pepper, and shallot in the five main cities in Java in the 2008-2018 period showed that prices were volatile and volatile. The highest average consumer price variation in red chili is in Semarang and the lowest in DKI Jakarta. The highest average consumer price variation for cayenne pepper is in Surabaya and lowest in Bandung. The highest average consumer price variation for shallot is in Semarang and the lowest in DKI Jakarta.

2. The overall price response of red chilies, cayenne peppers and shallots showed a positive response to changes in the prices of one commodity. Specifically, a positive response was indicated by the prices of cayenne pepper and shallot in all five main cities in Java due to changes in the price of red chili. Meanwhile, a change in the price of cayenne pepper, the prices of red chili and shallot showed a positive response in four cities, namely DKI Jakarta, Bandung, Semarang and Yogyakarta while in Surabaya the response to the price of red chili and shallot was negative. Furthermore, changes in the price of shallot, the prices of red chili and cayenne pepper showed positive responses in all five main cities in Java.

4.2 Recommendation

To maintain the stability of the price of red chili, cayenne pepper, and shallot, the government should (1) optimize pricing policies by controlling prices in the wholesale market and retail market. When prices decline significantly the government can implement export policies so that abundant production in the country does not make the price of red chili, cayenne pepper, and shallot low, (2) improve connectivity between regions by building price information at every level of the market to avoid asymmetric information, (3) improve infrastructure so that transportation and distribution run smoothly.

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