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## The Pricing System of Shallot at Producer and Consumer Levels

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### Abstract

The price of shallot tends to fluctuate every day. The aims of this research are: (1) to analyze factors that affect the price of shallot at producer and consumer level in Indonesia and (2) to analyze trader's behavior on pricing systems of shallot. Vector Error Correction Model (VECM) and Game Theory method are used in this study. The results showed that there was no variable that has significant influence on the price of shallot at consumer level in the short term. The variables that significantly influence shallot price in the long-term were wholesale prices, supply, fuel prices, and wholesale price variables had positive significant effects on price formation at the consumer level. The prices of shallot at retailer was more responsive to the price changes than the price on merchant and wholesaler level. Each economic actor has their own strategies to respond to other economic actors strategies. Based on the results of Game Theory analysis, the pricing strategy by traders showed that every trader in the market applied a collusion strategy by offering the same selling price even though there was no intense communication among traders. The strength of market prices could be reflected in the purchasing power of consumers.

*Keywords: game theory, market conduct, price, shallot, Vector Error Correction Model*

### Introduction

Indonesia is one of the largest countries that produces horticulture products in the world.

Among horticulture products, Shallot is one of the biggest commodities produced in Indonesia.

For the people of Indonesia, shallot is one of the most important vegetable used in various food.

In 2016, Indonesia's total shallot production reached 1.45 million tons. Almost all Indonesians consume vegetables, or around 97.29 percent [1]. The majority of vegetables consumed come from purchases. Only about 27 percent of the rural population consumes vegetables from their own production and only 6.4 percent in urban areas. Considering that the majority of horticultural product consumption comes from purchases, affordability and price stability need to be achieved.

According to National Socio-Economic Survey in [12], household consumption of shallot tend to rise every year.

Price is one indicator to determine the efficiency level of the supply chain for a commodity.

The price of shallot tend to fluctuate overtime. Shallot are one of the commodities contributing to the inflation rate. Prices of shallot in Indonesia experienced relatively high price fluctuations at the consumer level and at the producer level during the period 2011-2017. In that period, prices at the consumer level tended to be more volatile than the producer level. The lowest price of shallot at the farmer level occurred in December 2011 with a value of Rp 12,244.39. While at the consumer level the lowest price occurred in January 2011 with a value of Rp. 14,226.00. The highest price of shallot at the farmer level occurred in January 2017 with a value of Rp. 28,511.44.

While the highest price of shallot at the consumer level occurred in August 2013 with a value of Rp. 36,582.00. Improvement of market information systems and provision of storage facilities are needed to prevent inequality in price formation between producer and retailer in the short term [10].

Demand for shallot will continue to rise along with the increasing number of populations. In 2016, shallot production experienced an increase of 3.93 percent per year, supported by an increase in harvest area of 7.16 percent per year so that productivity rose 1.05 percent per year and experienced a surplus of 997 thousand tons (BPS 2016). [11] and [7] proposed that the formulation and implementation of price stabilization policy require information on price fluctuations and disparities caused by price changes in a market which are transmitted partially to the prices determined by other markets. The aims of this study are: (1) To analyze the factors that influence the price of shallot at the producer and consumer levels in Indonesia; and (2) to analyze the behavior of traders in determining the price of shallot.

## **Methodology**

This study was based on primary and secondary data. Primary data was in the form of traders' behavior in pricing, selling price determination strategies, and marketing agency strategies. The data was obtained by interview using a questionnaire list to the shallot wholesalers and retailers who made purchases at the wholesaler and were considered to represent the study population. The shallot collector trader survey conducted in Brebes Regency and surveys to wholesalers and retailers were conducted at Kramat Jati Central Market in East Jakarta and Caringin Market in Bandung City by the purposive sampling technique.

This study used secondary data in the form of monthly time series data from 2011 to 2017.

Secondary data was obtained from relevant sources such as the Central Statistics Agency (BPS), the Industry and Trade Office (Disperindag) of DKI Jakarta, Agriculture Service for Food Security and Horticulture Office of Brebes Regency, Department of Agriculture and Food Crops of West Java Province, Ministry of Agriculture of the Republic of Indonesia, Kramat Jati Central Market (PIKJ), and other literature relevant to the research. The price of East Jakarta consumers uses an approach with the price of DKI Jakarta. These data was analyzed using E-Views 8 software.

## **Results**

### ***Vector Error Correction Model (VECM) Analysis***

To analyze the factors that influence the price of shallots at the producers and consumers level in Indonesia, an econometric model was estimated using the Vector Error Correction Model (VECM) estimation technique. Consumer prices of shallots per kilogram period  $t$  ( $\text{LnCP}$ ) in DKI Jakarta are allegedly affected by producer price of shallot per kilogram of  $t$  period ( $\text{LnPP}$ ), wholesale prices at Kramat Jati Central Market per kilogram of the  $t$ -period ( $\text{LnWP}$ ), Supply of shallot to wholesalers per ton of  $t$ -period ( $\text{LnS}$ ), and The Price of Gasoline per liter of the  $t$ -period ( $\text{LnPGS}$ ), and also  $a_{ij}$  is regression coefficient of the VECM model,  $\varepsilon_t$  is the error term in the  $t$ -period, and  $t$  is the monthly period from January 2011 to December 2016. The model used in this study was adopted from the Sahara and Wicaksana models in [13]. The VECM restriction model used in analyzing consumer price formation is as follows:

$$\Delta \ln CP_t = \alpha_0 + \sum_{i=1}^1 \alpha_1 \ln WP_{t-1} + \sum_{i=1}^1 \alpha_2 \ln PP_{t-1} + \sum_{i=1}^1 \alpha_3 \ln S_{t-1} + \sum_{i=1}^1 \alpha_4 \ln PGS_{t-1} + \gamma ECT_{t-1} + \varepsilon_t$$

**Game Theory Analysis**

Game theory analysis is used to analyze the behavior of traders in determining the price of shallot. The assumption in this game is common knowledge [13]. Through this approach, the pricing strategy that is carried out at the level of wholesalers and retailers can be seen. The Pareto Optimum is used as an indicator, if there is a change, there will be a loss for all actors.

The first step in the analysis of the game theory in this study is to determine the elements in the game theory used in this study. [5] explains that game theory has 4 elements, including players who have rational choices, decision strategies, payoffs received by each player in every decision they receive, and information to achieve Nash equilibrium conditions. The analysis can be explained in the payoff matrix listed in Table 1.

**Table 1.** Matrix of pricing strategies by retailers in one market

Economic Actors <sub>2</sub>	Economic Actors <sub>1</sub>	
	Competitive Price	Market Price
Market Price	$\alpha_1, \alpha_2$	$\alpha_2, \alpha_2$
Competitive Price	$\alpha_1, \alpha_1$	$\alpha_2, \alpha_1$

Note:  $\alpha_i$  = payoff strategy

The games carried out by wholesalers with retailers in this study were applied through the Nash procedure. [8] explains that the approach most often used to explain balance in games is Nash equilibrium. In the process of bargaining with consumers, retailers have a strategy to maximize Minimax (highest profit).

**Results and Discussion**

**Factors Affecting Shallot Prices at Producer and Consumer Levels in Indonesia**

The VECM test was used to see the effect of producer prices (PP), wholesale prices (WP), supply (S), and the price of gasoline (PGS) on consumer prices (CP) of shallot. Prior to VECM estimation, several tests were carried out on these variables: stationary test, optimum lag test, VAR stability test, and cointegration test.

Stationary test results showed that these variables are stationary in the first difference at a significance level of 5 percent. This indicates the absence of unit roots in each variable used in analyzing the influence of producer prices (PP), wholesale prices (WP), supply (S), and the price of gasoline (PGS) on consumer prices (CP) of shallot.

The minimum Schwarz Criterion (SC) information showed that the optimum lag of these variables is in lag 1. This test showed the reaction time of a variable against other variables and can also eliminate autocorrelation problems in the VAR model [4]. While the Vector Autoregressive (VAR) stability test results showed that the VAR system was stable because the modulus value is <1 and located in its unit circle. The results of the cointegration test at 5 percent significance level using the Johansen cointegration test showed that all variables in this study were integrated in first degree (1). This can be interpreted as a long-run balance between variables.

After being tested that there is cointegration on the model, the next step was the estimation using VECM. The VECM estimation results at the significant level of 5 percent showed the relationships between variables in the short and long term. Based on the results of the analysis, in



the short term there are no variables that have a significant effect on the prices shallots at consumer level.

Variables that have a significant effect on long-term estimation were **wholesale prices, supply, and gasoline price**. Among these three variables, the wholesale price variable has a significant positive effect on price formation at the consumer level. This is in line with the theory which states that the amount of shallot that will be purchased by traders has an impact on the increase in their business budget (capital) and the trader will increase the selling price to consumers.

Shallot are horticultural crops that have a high economic value, so their role is important in contributing to the economic condition of the country. The price of shallot tends to fluctuate every month; hence the high price of shallots contributes to the inflation rate in Indonesia. Shallot can be sensitive to the expenditure of household needs because it is a daily necessity.

The VECM analysis phase was carried out after unit root testing, VAR stability, optimum lag, and cointegration which showed that there was a long-term relationship between consumer prices, wholesale prices, producer prices, supply and gasoline prices in the model. The significance of each variables is seen through the absolute value of t-statistic which is greater than the value of t-ADF at the real level of five percent which is the same as 1.965, then it can be concluded that the variable has a significant influence. Table 2 shows the results of the VECM estimation on the shallot price model.

**Table 2.** Results of VECM Estimation on the Shallot Commodity Model

ù	Variable	Coefficient	t-statistik
<b>Short Run</b>			
	CointEq1	-0.258799	-1.05725
	D (LNCP (-1))	-0.222144	-0.89680
	D (LNWP (-1))	0.367291	1.14825
	D (LNPP (-1))	-0.264258	-1.21173
	D (LNS (-1))	-0.228469	-1.87656
	D (LNPGS (-1))	-0.265390	-0.52851
<b>Long Run</b>			
	LNCP (-1)	<b>-0.948868</b>	<b>-6.31031</b>
	LNPP (-1)	-0.076574	-0.58654
	LNS (-1)	<b>-0.279094</b>	<b>-3.78637</b>
	LNPGS (-1)	<b>0.225827</b>	<b>2.15132</b>

*Note: \* Significant at five percent real level*

The VECM estimation results in Table 2 proves that there are no variables with significant influence on the consumer prices of shallot in the short term. Variables that have a significant effect on long-term estimates are wholesale prices, supply, and gasoline prices. Among these three variables, the wholesale price variable has a significant positive effect on shallot price at the consumer level. This is consistent with the results of the research by [6] which states that the first information obtained by retailers in offering selling prices to consumers comes from wholesalers so that the response in price is faster compared to other factors.

Shallot supply variable also has a positive influence to shallot price at consumer level and the gasoline price variable negatively affects the retail price of shallot. The influence of shallot supply result is different from the theory, but through the results of interviews with traders, shallot is a very responsive commodity, in contrast to garlic which can last for a long time.

The gasoline price variable used is the price of “Premium” type by Pertamina and not all traders use “Premium” type as a proxy for transportation costs from the wholesale market to the retail market. So, the increase in premium gasoline prices does not directly affect the retail price of



shallot. [2] support that disruption or natural disaster during the distribution period in this case is more influential than changes in gasoline costs and supply does not have a significant influence on price formation at the consumer level. [3]

Also explained that there is no long-term relationship between the West Java producer area and Kramat Jati Central Market wholesaler, so that market efficiency has not been achieved.

Therefore, a significant variable in the formation of the price of shallot are the wholesale price, supply and price of gasoline in the long run.

Based on the results of The Impulse Response Function (IRF) analysis with the identification based on the Generalized Decomposition, it can be concluded that the price of shallot at the consumer level responds positively but in-significant impulses from producer prices from the beginning to the end of the period. The response of the consumer price of shallot to producer price shocks was 0.178468 in the second period. Each increase in the price of shallot producers by one standard deviation will increase the level of consumer price of shallots by no significant amount of 0.178468 percent. Long run balance occurs in the 23rd period of 0.163877 percent. This result is supported by previous studies conducted by [9] and [15] which found that price information also determines price integration and transmission that occurs.

Beside that, synergy between short-term policies in the form of tax and customs incentives, medium-term policies in the form of increasing agricultural productivity and long-term policies in the form of adaptation and mitigation to climate change can create price stability and adequate supply of agricultural products to ensure people’s welfare [14].

***The Game Theory of Shallot Pricing***

Market prices are prices that generally apply to a market, and competitive prices are prices lower than market prices in response to the current market prices. The application of competitive prices aims to attract consumers. Every economic actor has each strategy to respond to the strategies of other economic actors. Market prices apply when prices are generally increasing so that prices are generally applied evenly with the margins received from previous economic actors.

Table 3 describes the pricing strategies carried out by wholesalers for shallot. Nominal Rp.12,000 per kg is a competitive pricing strategy for shallot collector trader in response to a higher market price of Rp. 17,500 per kg in 2017.

**Table 3.** The game theory matrix between collect trader in Kramat Jati Central Market, 2017

Collector Trader 2	Collector Trader 1	
	Competitive price	Market price
Market price	12 000, 17 500	<b>17 500, 17 500*</b>
Competitive price	12 000, 12 000	17 500, 12 000

*Description: \* Nash equilibrium*

The choice of wholesaler strategies also consists of competitive pricing strategies and market price strategies which can be seen in Table 4. The price of Rp 16,000 per kg for shallot in 2017 becomes a competitive pricing strategy applied by wholesaler to attract retailer to buy shallot from them. The market price of shallot at wholesaler level was IDR 45,000 per kg. The high market prices were responded by collectors with lower competitive prices so that prices did not continue to increase.

**Table 4.** The game theory matrix between wholesalers in Kramat Jati Central Market, 2017

Wholesaler 2	Wholesaler 1	
	Competitive price	Market price
Market price	16 000, 45 000	<b>45 000, 45 000*</b>
Competitive price	16 000, 16 000	45 000, 16 000

*Description: \* Nash equilibrium*

Retail traders are more responsive to price changes, especially for shallot because the price is always fluctuating every month. At the level of retail traders, the prices applied are higher than the prices of collector traders and wholesalers. Competitive prices as a response to the implementation of higher market prices for shallots ranged from Rp. 22,000 per kg for the lowest selling price. In general, the market price in 2017 for shallots is around Rp. 50,000 per kg. Shallot are perishable, so the selling price is unstable.

**Table 5.** The game theory matrix between retail in Kramat Jati Central Market, 2017

Retailers 2	Retailers 1	
	Competitive price	Market price
Market price	22 000, 50 000	<b>50 000, 50 000*</b>
Competitive price	22 000, 22 000	50 000, 22 000

*Description: \* Nash equilibrium*

## Conclusion and Recommendation

Based on the research results, the conclusions derived were as follows: The wholesale prices are the variables that most influence consumer prices of shallot, so various efforts must be made to protect consumers. Market price (collusion) becomes the preferred strategy adopted by retail to maintain profits. So in the retail market, consumers paying a higher prices.

The government can implement the ceiling price policy. Ceiling price policy at the consumer level expected to avoid exploitation behavior by trader's intermediary, in the form of determining the price of shallot that are too high at consumer level.

Another policy is that the government needs to determine the reasonable price range, which is a price level that is not exploitative for consumers but still provides the ideal margin for the traders.

Optimization of the supervision function through the Business Competition Supervisory Commission (KPPU).

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