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Factors Affecting the Volatility of Maize Consumer Price in Indonesia

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Abstract: The reduction of price volatility of maize is important for the economic stabilization in Indonesia, as maize serves not only as food for humans but also feed for animals. The volatility of maize price imposes risk and uncertainty on the price of chicken meat and other meats in Indonesia, affecting consequently all the economic sectors of Indonesia. Thus, this study aims to measure annual price volatility of the consumer price of maize and the factors affecting the price changes in Indonesia. Historical price volatility is measured by standard deviation in this study, and Vector Error Correction Model (VECM) is used to examine the factors affecting maize consumer price. Result shows that despite of the highest price volatility occurring in 2007, the price stabilization and self-sufficiency policy implemented in Indonesia is able to reduce price volatility of maize at consumer level in Indonesia. The main factor affecting maize consumer price is the previous maize consumer price in the short-run, while demand of maize is the main factor affecting the maize consumer price in the long-run. The implication of this study is to intensify the role of BULOG as a buffer to maize price, and aid the price stabilization policy in enhancing self-sufficiency by stablizing the consumer price of maize in Indonesia.
Keywords: Historical Price Volatility, Vector Error Correction Model, Maize

INTRODUCTION:

Food being a strategic commodity cannot be denied. The scarcity of food can result in a country's economic crisis [1]. This makes the fulfillment of food demand become the main target of food policies for the government. Maize is one of staple foods necessary in the development of Indonesia's agriculture and economy. As it is a multifunction agri-commodity, both for human food and animal feeds, maize has the second largest contribution to Indonesia's economy after rice. The contribution of maize always increases Indonesia's GDP [2].

Currently, Indonesia's maize market faces risk and uncertainty because its price is inclined to increase and be unstable [3]. Moreover, Indonesia attempts to connect with international market through maize trade, so its maize price change is not only caused by domestic factors but also international ones. The maize consumer price continuously increases from 2000 to 2015 in Indonesia with an average of 10.57% [3]. The fluctuation of maize price gives siginificant impact on producers, consumers and the whole economy of Indonesia due to its unpredictability. In consequence, the economic growth is disturbed. The high and unpredictable change in price is caused by imbalance in supply and demand of maize. Gilbert and Morgan [4] said that the lower supply and higher demand cause increase in price and vice versa. Such a condition leads to a variable maize price.

Price volatility of staple foods is a complex issue in developing countries, as it has a ripple effect on food security, financial market, and trade flow [5]. Indonesia as a developing country is susceptible to volatility of food price. This is because some of its foods rely on import; change in world food price affects domestic price in Indonesia. This is evidenced by Bourdon [6] who points out unstable food price is a risk for developing countries. An increase in food price leads to inflation and consequently decreases economic growths of developing countries. This is more severe in the poverty class of those countries. Thus, the price volatility of food affects not only a nation's macroeconomy but also microeconomy. In the micro level, the higher price gives negative impact to households in terms of food consumption. In the macro level, the fluctuation of food price affects other commodities and GDP [7].

The important role of food especially maize in Indonesian economy leads the government to carry out food policies against price volatility. There are some instruments of volatility reduction, one of them is the price stabilization policy. Three political instruments are often used to stabilize food price. These are the food stock, trade control, and financial regulation. Controlling trade is believed to be the most effective

means for price stabilization [5]. The stabilization policy of maize in Indonesia is listed in the regulation of Ministry Agriculture number 14, year 2010. The policy is included to increase the role of BULOG (Indonesia Bureau of Logistics) as a buffer to maize price [8].

Aformentioned reasons make maize important in Indonesia, the price change of which affects the Indonesian economy as a whole. While the issue is important, little study attempts to examine the price volatility of maize and the factors affecting it at the consumer level. The price volatility in agri-commodity has been conducted by several researchers. Sukati [9] measures the price volatility of maize in Swaziland by using ARCH/GARCH modeling. Swaziland failed to stabilize maize price, as it relies heavily on imports. Therefore, a sudden exogenous shock in international maize price sharply affect Swaziland's maize domestic price. Jordaan *et al*. [10] measure the price volatility by using ARCH/GARCH approach. Their result show that the price of white maize is the most volatile, followed by yellow maize, sunflower seeds, soybeans, and wheat. The research suggests that maize producer in South Africa use price risk management tools such as putting the ceiling price of maize in the highest level.

The novelty of this study is that we measure historical price volatility by using standard deviation. This method is traditionally adopted to measure volatility of stock return. We apply the approach to measure price volatility in agricultural commodity, given the premise that farming is also an investment. Farmers input capital investment for production with the expectation to get returns in the future. Vector Error Correction Model (VECM) is used to estimate factors affecting price. This study contributes to making available additional information about price volatility and factors affecting maize consumer price, which can be very siginificant in the establishment of an early warning system for authorities.

DATA AND METHODOLOGY:

Monthly data of maize consumer price form January 2004 to December 2015 are used to measure price volatility in Indonesia. The annual data from 1990 to 2016 are used to measure factors affecting maize consumer price. The data include maize producer and consumer price, maize world price, production, demand, and total import of maize. Those data are secondary data obtained from the Ministry of Agriculture and Index Mundi. Consumer Price Index (CPI) is used as a price deflator to get real price in consideration of our time span which covers longer than ten years. STATA 14 is used to analyze factors affecting maize consumer price in Indonesia.

1. **Standard Deviation:** Maize consumer price is statistically measured for fluctuation by standard deviation [11]. A higher standard deviation indicates a higher volatility in consumer price. Therefore, this study uses standard deviation approach.

a. Calculation of Return on Investment;

Return is referred to as the profit or loss in investment during a certain period. Retun on investment can be calculated by arithmetic, logarithmic and geometric forms. This study uses logarithmic scale.

$$R_t = \log\left(\frac{P_t}{P_{t-1}}\right)$$

Where:

R_t = log of price change
P_t = maize price in t period
P_{t-1} = maize price in t-1 period

b. Volatility ;

Among the methods of measuring price volatility, the historical volatility approach is used to measure the relative volatility based on the movement of price in the last year of the observation period. Because the historical volatility assumes that the movement of price in last year can represent the movement of price in the future. So, return on investement is used in this study. The measurement of historical volatility can be expressed as follows.

$$\sigma = \sqrt{k\frac{\sum_{t=1}^{n}\left(R_t - \bar{R}_t\right)^2}{n-1}}$$

Where:

σ = Annually volatility
k = Number of observation in one year

c. Vector error correction model (vecm):

The second purpose of this study is to examine factors affecting maize consumer price. The potential factors are as follows:

1. Maize World Price: According to Widodo [12], world price has a significant effect in the country's domestic price. Indonesia is an importer of maize, so Indonesia's maize consumer price changes with maize world price.

2. Maize Producer Price: According to Widodo [12], producer price has a significant effect on consumer price. Producers determine price based on cost and profit. Producers set the price based on the production cost. Increase in production cost leads to the increase in maize producer price, resulting to the increase in maize consumer price [13].

1. Production of Maize: The higher amount of products in the market decreases the price of that product, according to the law of supply [13]. Thus, a higher total production of maize decreases maize consumer price.

2. Demand for Maize: A lower price increases product demand. The high demand of product increases price of that product, according to the law of demand [13]. If demand for maize in Indonesia is high, domestic maize stock decreases. In turn, this increases maize consumer price.

3. Total Import of Maize: The amount of imported maize increases Indonesian domestic maize stock, so the higher supply amount decreases consumer price of Maize [13].

This study uses VECM to verify the theory of maize consumer price to be predicted by the aforementioned variables. The equation can be expressed as follows:

$Pc_t = \beta_0 + \beta_1 Pw + \beta_2 Pp + \beta_3 Prod + \beta_4 Dm + \beta_5 Mm + e_t$

Where:

Pc_t = Mmaize consumer price (Rp/kg)
Pw = Maize world price (Rp/kg)
Pp = Maize producer price (Rp/kg)
Prod = Production of maize (Tons)
Dm = Demand of maize (tons)
Mm = Import of maize (Tons)

The VECM model can estimate short and long term effects. The post estimations that are used in this study are Impulse Respond Function (IRF) to measure the response of maize consumer price to shock from Exogen variable, and Forecast Error Variance Decomposition (FEVD) to measure the strength of each variable to influence each other.

RESULTS AND DISCUSSION:

1. Empirical Data:

Table 1 shows the statistical summary of data used in the analyses. Time span covers 27 years from 1960 to 2016. The average price of world maize is lower than Indonesia's maize domestic price either at consumer level or producer level. The average price of maize at producer level is Rp 1,705.86/kg, while the average maize consumer price is Rp. 2,533.71/kg. On the other hand, the average international price is Rp. 1,292.97/kg. This indicates that Indonesia's maize is less competitive than maize from other countries in terms of price.

Table-1, Descriptive Statistics of Data

Variables	Obs	Mean	Std. Dev.	Min	Max
Pc (Rp/kg)	27	2,533.71	2,169.08	289.8	7,134.04
Pw (Rp/kg)	27	1,202.97	850.81	207.743	2,804.29
Pp (Rp/kg)	27	1,705.86	1,320.55	233.17	4,093.42
Prod (Tons)	27	12,491,061.37	4,992,790	6,256,000.00	23,188,000.00
Dm (Tons)	27	8,228,222	2,042,749	5,182,000	12,200,000.00
Mm (Tons)	27	1,246,124	1,039,619	515	3,500,104

Source-Analysis Result, 2017

The average annual production of maize in Indonesia is 12.5 million tons and the average demand of maize is 8.22 million tons. Though the production of maize in Indonesia is able to meet its domestic demand, the country still continuously imports maize from other countries. The annual average amount of imported maize is 1.25 million tons. As Indonesia is also a maize exporter, its maize production is used to meet the demand from both domestic and international markets. In addition to supply-demand adjustment purpose, Indonesia establishes relationships with international markets through trade in maize. Imported maizes are stocked in BULOG, and released to the domestic market while the price soars.

Standard deviation shows the fluctuation of maize consumer, producer, and international price. The fluctuation of maize consumer price is higher than that of producer price and the world price. There are some factors affecting the fluctuation of maize consumer price. The factors affecting price include demand and supply of maize, cost, and government intervention [13]. In addition to these are the transportation cost incurred while distributing goods from producers to consumers, and tariffs incurred while exporting goods overseas. Any change in transportation cost, maize world price, and producer price have a significant effects on consumer price [14], therefore making it volatile.

2. Volatility of Maize Consumer Price in Indonesia:

Table- 2 shows the annual price volatility of maize at consumer level in Indonesia. The logarithm of return is used to measure historical price volatility, so the value ranges from zero to infinity ($0 \leq \sigma \leq \infty$). The result shows that the average value of maize consumer price volatility during the observed period is 0.233.

Table-2, Price Volatility of Maize at Consumer Level in Indonesia

Year	Standard Deviation	Annual Volatility
2004	0.051	0.177
2005	0.059	0.204
2006	0.077	0.268
2007	0.243	0.843
2008	0.190	0.658
2009	0.012	0.043
2010	0.030	0.105
2011	0.015	0.052
2012	0.012	0.040
2013	0.006	0.020
2014	0.100	0.348
2015	0.011	0.038
Average	0.067	0.233

Source- Analysis Result, 2017

The price volatility of maize is lower than one throughout the observed period, while the highest number is 0.843 of 2007. The sharp changes in maize price in 2007 is caused by maladjustment of demand and supply of maize. The reason behind it lies on the fact that the market share of Indonesian maize increased in the Malaysian market in 2007. Indonesian maize is competitive in the Malaysian market by 13.352 per value of Revealed Comparative Advantage (RCA) [15]. This results to the increasing export of Indonesian maize in Malaysia. The export of maize from Indonesia is 101,459 tons in 2007. That amount is higher than the export in 2006. Surprisingly, the imported maize of Indonesia is also high [3]. Indonesia tends to export maize during the harvest months for demand and supply adjustment purpose. Exportation of maize leads to the lower level of stocks in the succeeding month, so Indonesia tends to import maize from other countries. In this period, the role of BULOG becomes nil as a buffer to the stabilization price, so the maize price becomes high.

The lowest price volatility of 0.020 is in 2013, which indicates a stable maize consumer price in Indonesia during the year. The stabilization of maize price policy has been effectively implemented by the Indonesian government since 2012. The policy is able to stabilize maize price [16]. That evidence, as shown in Table 2, indicates a lower price volatility of maize. The other policy implemented by Indonesian government is self-sufficiency policy in 2015. Since the implementation of the two policies, the price volatility of maize exhibits a lower number in 2015. The self-sufficiency policy is able to increase maize production in Indonesia. The price stabilization policy requires BULOG to procure maize from farmers in harvest seasons, and release it in famine seasons, so the stock of maize is stable every month. The stability of maize stock leads to the stability of maize price in 2015.

1. Factors Affecting Maize Consumer Price in Indonesia:

This section discusses factors affecting maize consumer price in Indonesia. These factors include maize world price, Indonesian maize producer price, production of maize in Indonesia, demand of maize in Indonesia, and import of maize by Indonesia. The steps of analyzing the effect of these factors to the maize consumer price in Indonesia are as follows.

a. Stationary Test:

First, the Augmented Dickey-Fuller test is used to examine if our data is stationary. As shown in the results, the consumer price, world price, producer price, maize production, demand of maize, and import of maize are not stationary on actual and logarithmic scale, with the data transformed to the first difference. Table 3 shows the result of the first difference estimators.

Table-3, Augmented Dickey-Fuller Test of Factors Affecting

	First Difference (Logarithic scale)

	dLPc	dLPp	dLPw	dLProd	dLDm	dLMm
Test Statistic	-4.090	-4.543	-6.565	-7.366	-4.747	-11.561
5% Critical Value	-3.000	-3.000	-3.000	-3.000	-3.000	-3.000
MacKinnon	0.0010	0.0002	0.000	0.000	0.0001	0.0000

Source-Analysis Result, 2017

The MacKinnom value in Table 3 indicates that all of the variables are stationary at the first difference. The value of MacKinnom in all variables are less than 0.05. In addition, the value of test statistics of all variables are less than the critical value of 5%. It suggests the the data with the first difference is used in our analyses.

b. Co-Integration Test:

Johansen test for cointegration is used to determine if VAR model or VECM model should be used to analyze the determinants of the price changes in Indonesia. In addition, this test indicates the long-run relationship between dependent and independent variables.

Table-4, Cointegration Test for Affecting Factors

Maximum Rank	Trace Statistic	5% Critical Value
0	200.42	94.15
1	136.061	68.52
2	74.943	47.21

Source- Analysis Result, 2017

Table 4 indicates that the trace statistic suggests the presence of cointegration equation among the six variables at 5% level. That evidence as shown with the value of trace statistic is higher than the critical value of 5% level. As a result, VECM is selected in this study to analyze the effect of volatility factors in the maize consumer price. In addition, it can categorize the effect into a short-run and long-run effects.

c. Causality Test:

The Granger causality Wald test is used to analyze causality relationships between variables. The null hypothesis, two variables are independent i.e., no causality relationship, and the alternative hypothesis, there is causality between variables. If the value of Prob > chi2 is less than 0.1, the null hypothesis is rejected.

Table-5, Granger Causality Test for Affecting Factors

Equation	Excluded	Chi2	Prob > chi2
dLPc	dLPp	15.355	0.000*
	dLPw	5.456	0.065*
	dLProd	0.195	0.907
	dLDm	30.717	0.000*
	dLMm	12.753	0.002*
	ALL	58.066	0.000*
dLPp	dLPc	2.771	0.250
	dLPw	2.103	0.349
	dLProd	2.278	0.320
	dLDm	3.034	0.219
	dLMm	1.854	0.396
	ALL	46.272	0.000*
dLPw	dLPc	4.474	0.107
	dLPp	6.306	0.043*
	dLProd	2.429	0.297
	dLDm	12.706	0.002*
	dLMm	10.836	0.004*
	ALL	32.734	0.000*
dLProd	dLPc	3.753	0.153
	dLPp	0.608	0.738
	dLPw	4.897	0.086*
	dLDm	9.020	0.011*

	dLMm	11.017	0.004*
	ALL	20.763	0.023*
dLDm	dLPc	3.613	0.164
	dLPp	3.643	0.162
	dLPw	6.141	0.046*
	dLProd	0.159	0.924
	dLMm	8.018	0.018*
	ALL	22.312	0.014*
dLMm	dLPc	3.659	0.160
	dLPp	1.018	0.601
	dLPw	3.659	0.161
	dLProd	5.650	0.059*
	dLDm	6.149	0.046*
	ALL	22.669	0.012*

Source-Analysis Result, 2017

The result of Granger causality test can be seen in Table 5. It is simplified in figure 1. Figure 1 shows a one-way relationship between maize consumer price and maize producer price, which indicates that maize consumer price Granger caused maize producer price. We infer that is because Indonesian farmers are price takers in the maize trade. It means that farmers do not have the power to set the price of their produce. The price change in the farm level is an impact of price change in the market.

Consumer price Granger causes world price. Meanwhile, world maize price Granger causes importation of maize. We infer that an increase in maize world price decreases the amount of imported maize. Thus, maize world price and Indonesia's demand of maize have a feedback causality relationship.

Indonesian domestic maize production Granger causes world maize price, which means Indonesian maize domestic production can be a predictor of world maize price. Increase in maize production in Indonesia causes lower maize world price. Maize production in Indonesia Granger causes demand of maize. Maize production Granger causes maize imported by Indonesia, because an increase in maize production tends to decrease the amount of imported maize.

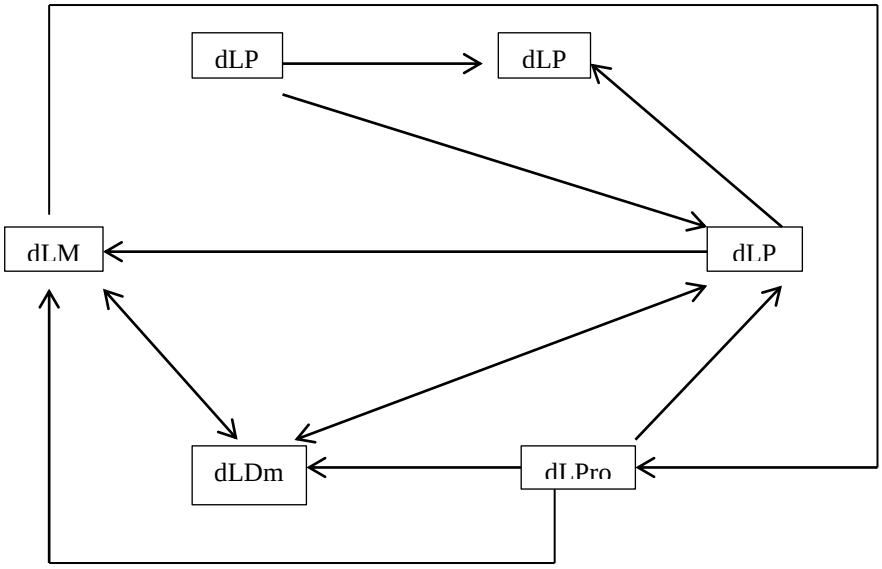

Fig-1, Causality between Variables
Source: Analysis Result, 2017

The feedback causality occurs between demand of maize and import of maize in Indonesia. This could be explained by the fact that an increase in domestic demand of maize urges the government to import more maize. Moreover, imported maize Granger causes domestic maize production. This is possibly because the government leads in increasing domestic maize production.

d. Vector Error Correction Model (VECM)

The VECM gives both short run and long run effects on explanatory variables of maize consumer price. The short run effect is shown in Table 6.

Table-6, the Short Run Effect to Maize Consumer Price

Variable	Coefficient	P>z
dLPc (t-1)	0.818*	0.002
dLPp (t-1)	-0.727*	0.000
dLPw (t-1)	-0.195*	0.050
dLProd (t-1)	0.008	0.975
dLDm (t-1)	0.590	0.138
dLMm (t-1)	-0.069*	0.000
Ce1	-1.051*	0.000

Source- Analysis Result, 2017

Table 6 indicates that maize consumer price is affected by four variables including its last price, the last price of producer price and world price as well as the last imported amount of maize. Consumer price lag 1 significantly affect maize consumer price with 0.818 coefficient value (with a p-value of 0,002). It means that, one percent increase in maize consumer price in the previous year increased the current value of maize consumer price by 81.8%. This finding is in accordance with Widadie and Susanto [17] that price in the previous year affects the current price.

The previous maize producer price significantly affects maize consumer price with 0.727 coefficient value. It means that one percent increase in maize price significantly decrease maize consumer price by 72.7% (with a p-value of 0.000). This is because a higher maize producer price in the previous year encourage farmers to produce more. As a result, a higher stock of maize in the market decreased the maize consumer price.

Maize world price significantly affects maize consumer price in Indonesia with a coefficient of -0.195. The number indicates that one percent increase in the maize world price of the year before significalntly increases by 19.5% the current value of maize consumer price (with a p-value of 0.050). Because Indonesia is also a maize importer, its maize domestic price is affected by maize world price. Decreasing maize world price indicates overstock of maize in the world. When Indonesia imports because it has deficit of maize, it will lead to an increased maize price in Indonesia.

Importing maize significantly affects maize consumer price in Indonesia with the coefficient of -0.069. This means that one percent increase in imported maize decrease by 6.9 % the current maize consumer price (with a p-value of 0.000). This is in accordance with the international trade law. The imbalance of stocks in importing (deficit product) and exporting (surplus product) countries lead to international trade. The price of product in exporting countries are lower than in importing countries. So imported products of importing countries will add stocks of products in those countries. As a result, the price of that product will decrease in the importing countries.

Ce1 shows significant value with -1.051 coefficient value (with a p-value of 0.000). Ce1 shows the adjustment rate at the long run equilibrium. It means that there is an adjustment to the long run equilibrium of maize consumer price. The negative value of coefficient shows that increase in maize consumer price will keep away maize consumer price from equilibrium in the long run.

Table-7, the Long Run Effect to Maize Consumer Price

Variable	Coefficient	P>z
dLPc		
dLPp	-1.026*	0.000
dLPw	0.009	0.945
dLProd	-0.151	0.598
dLDm	2.084*	0.000
dLMm	-0.181*	0.000
Cons	-0.052	

Source-Analysis Result, 2017

Table 7 shows that the maize consumer price in the long-run is significantly affected by three factors

including producer price, demand of maize, and import of maize. The long-run relationship between dependent and independent variables are expressed as follows.

dLPc = -0.052 – 1.026 dLPp + 2.084 dLDm – 0.181 dLMm

Maize producer price in Indonesia significantly affects maize consumer price with -1.026 coefficient value. This number indicates that one percent increase in maize producer price significantly decreases by 102.6% the maize consumer price in the long run (with a p-value 0.000). Increasing maize producer price indicates low stock of maize. That condition leads farmers to produce more maize. If farmers expand their production in the long term, the stock of maize will be abundant in the market. As a result, maize consumer price will decrease. According to Haryati [18], the law of supply said that increase in the supply of a product decreases the price of that product.

Maize demand significantly affected maize consumer price with a coefficient of 2.084. It means that one percent increase in demand of maize significantly increases by 208.4% the maize consumer price in the long run (with a p-value 0.000). Based on the cobweb curve, increasing demand causes low stock of maize in market. Low stock of maize in the market leads to the increase of maize consumer price. This is in accordance with Swastha and Irawan [13] stating that generally, lower price leads to higher demand of a product, and higher demand causes low stock in market. In the long run, a higher demand is likely to increase the consumer price.

Imported maize significantly affects maize consumer price with -0.181 coefficient value. It means that one percent increase in the import of maize significantly decreases by 18.1% the maize consumer price in the long run (with a p-value 0.000). This is because the increase in the amount of imported maize causes abundant stock of maize in Indonesia. If Indonesia imports maize, in the long run it will lead to the decrease in maize price.

e. Impulse Response and Function (IRFs):

Fig-2 shows the IRFs of maize consumer price in Indonesia from independent variables. The response of maize consumer price in Indonesia is a standard deviation of 0.092 to shock from (maize consumer price) itself in the first period. The response fluctuated from the first period to the 18th period. Starting from the 19th period, response of maize consumer price to shock from itself is stable at a standard deviation of 0.069. The response of maize consumer price is low to itself. As can be seen from figure 2, its graph is flat. It means that the fluctuation of shock from itself is low.

The response of maize consumer price in Indonesia is a standard deviation of 0.078 to shock of maize producer price in Indonesia in the first period. That response fluctuated from the first period to the 16th period. Starting from the 17th, the response is stable until the end of the period. The response of maize consumer price to maize producer price in Indonesia is low. Because the graph shows a flat line, the stable response starts from the 17th period until the last period.

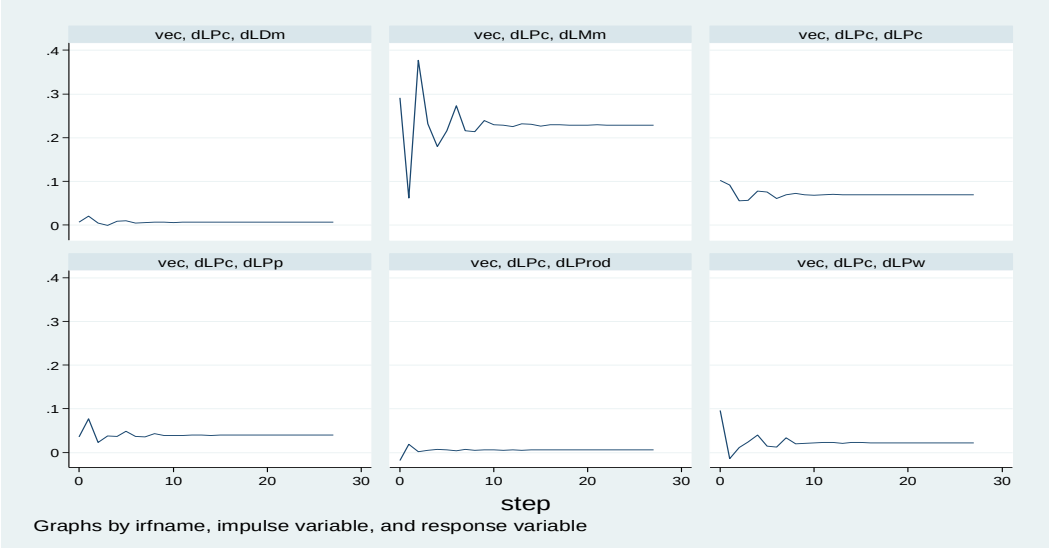

Fig-2, Response Consumer Maize Price to Independent Variables
Source-Analysis Result, 2017

The response of maize consumer price in the Indonesian market is a standard deviation of -0.014 to shock of maize world price in the first period. The response became positive from the second period until

the last period. The response of maize consumer price in Indonesia is slow to shock of maize world price as shown in figure 2, which is a flat line. The response of maize consumer price fluctuated and became stable from the14th period to the last period.

The response of maize consumer price in Indonesia is a standard deviation of 0.018 to shock of production in the first period. The response of Indonesian maize consumer price fluctuated from the first period until the 13th period. Starting from the 14th, the response of maize consumer price in Indonesia is stable to the shock of production until the last period. Figure 2 shows a flat line, which means that the response of maize consumer price is slow to the maize production in Indonesia.

The response of maize consumer price in Indonesia is a standard deviation of 0.020 in the first period to shock of demand of maize in Indonesia. There is only one negative response. It is a standard deviation of -0.000614 in the third period. Such response fluctuated from the first period until the 16th period. Starting from the 17th period, the response became stable. The graph shows a flat line. It means that response of Indonesia maize price to demand of maize in Indonesia is slow.

The response of maize consumer price in Indonesia is a standard deviation of 0.061 in the first period to shock from import of maize by Indonesia. The rate increases to a standard deviation of 0.377 in the second period which is the highest response of maize consumer price to the import of maize. The response of maize consumer price to the import of maize is the fastest response of maize consumer price. This is indicated in the sharp fluctuation of the line. The response is stable starting from 22nd period until the end of the period.

f. Forecast Error Variance Decomposition (FEDVs):

Fig-3 shows Variance Decomposition at fluctuation of maize consumer price. The figure explains the contribution of maize producer price, maize world price, production of maize, demand of maize, and import of maize in changes of consumer maize price.

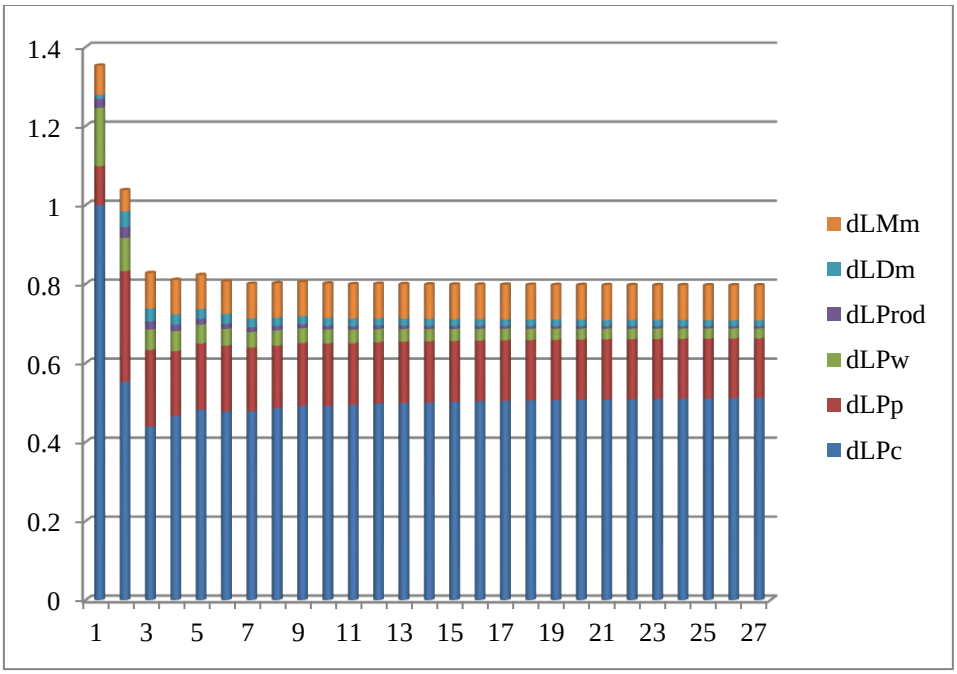

Fig-3, FEVD of Consumer Maize Price in Indonesia
Source-Analysis Result, 2017

Fig-3, shows that in the first period, the fluctuation of maize consumer price in Indonesia is caused 100% by maize consumer price itself. In the second period, the maize consumer price is 55.22% explained by maize consumer price itself, 28.07% is explained by maize producer price, 8.37% is explained by maize world price, 2.8 percent is explained by production of maize, 3.93 percent is explained by demand of maize in Indonesia, and 5.37 percent by import of maize.

In the 13rd period, maize consumer price is 49.9% explained by maize consumer price itself, 15.54% is explained by maize producer price, 3.19 percent is explained by maize world price, 0.83 percent is explained by production of maize in Indonesia, 1.81 percent is explained by demand of maize in Indonesia,

and 8.73 percent is explained by import of maize by Indonesia. Compared to the first period, the effect of maize consumer price to itself is lower in the middle part of the observation period.

In the last period, which is the 27th period, maize consumer price in Indonesia is 51.15% explained by maize consumer price itself, 15.1% is explained by producer maize in Indonesia, 2.5 percent is explained by maize world price, 0.6 percent is explained by production of maize, 1.5 percent is explained by demand of maize, and 8.83 percent is explained by import of maize by Indonesia.

CONCLUSION:

The logarithm return of stock market can be adopted to measure price volatility of maize at the consumer level in Indonesia. Results show that historical price, and the stabilization price policy of the Indonesian Government are able to reduce price volatility at the consumer level in Indonesia. The Indonesian government has applied price stability starting 2012. As a result, the price volatility of maize at consumer level in Indonesia is low in 2012-2013. The self-sufficiency of maize policy in Indonesia also successfully reduced price volatility of maize at the consumer level. The policy is able to increase maize production in Indonesia. The Indonesian government reactivated the role of BULOG as a buffer to maize price. So, BULOG stocks maize during the harvest seasons and releases it to the market when the domestic market faces maize deficit.

In the short run, the previous price is the main factor affecting the current price of maize consumer price, while the demand amount of maize is the main factor in the long run. Thus, this study suggests authories to enhance the role of BULOG and price stabilization policy as demand of maize has the highest effect on volatility of maize price. If BULOG can meet people's demand for maize during the famine season by releasing maize obtained during the harvest season, then the price volatility of maize will become low at the consumer level in Indonesia.

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