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The Effect of Price Policy on Price Dynamics: Empirical Evidence in Indonesian Rice Market at Wholesale Level

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ABSTRACT

As a major share expenditure for the poor, rice is attributed as a strategic food commodity in the Indonesian economy. For many decades, the Indonesian rice market has been intervened by the price regulation. The Indonesian government had set two types of rice price policies of 2016 and 2017 with the argument of price stabilization during the last five years. This study aimed to investigate the effect of price policies of 2016 and 2017 on the domestic price dynamics in the Indonesian rice market. This study used daily price series taken from the Cipinang Wholesale Rice Market in Jakarta within the period of October 1st, 2014, until February 12th, 2018 covering 10 rice varieties. The role of price policy on the price dynamics was evaluated by using a multivariate error correction model (MVECM). The empirical findings confirmed that generally, these price policies had different effects on the price dynamics which proposed different reactions from the different rice varieties both in magnitude and signs. The variations were also found regarding the short-run and long-run behavior. Generally, the findings suggested a relatively small elasticity of the policy on the prices.

Keywords: Indonesia; price dynamics; price policy; rice; VECM

INTRODUCTION

Market, politics, and price dynamics have been interesting subjects of discussions in the existing economic literature (Anderson, 2012; Gilbert, 2012; Pieters & Swinnen, 2016; Timmer, 2017). The debates simultaneously arrive at questions related to the effectiveness and efficiency of the government interventions in regulating the domestic markets. In economic development and poverty reduction strategies, particularly for developing countries, market interventions are generally implemented for pursuing stability of prices and managing the allocation of resources within the economy (Barrett, 2013; Naylor, 2014; Pinstrup-Andersen, 2014). In the food sector, price instability has been attracting a lot of attention since it indicates what is happening in food security (Berger, Dalheimer, & Brümmer, 2021; Dalheimer, Herwartz, & Lange, 2021; Gardebroek, Hernandez, & Robles, 2016; Herwartz & Saucedo, 2020; Honfoga, N'tandou-Bonzitou, Vodouhè, Bellon, & Hounhouigan, 2018; Timmer, 2017).

The price dynamics reflect a commodity availability in a competitive market which matched by the consumers' willingness to substitute the commodity for another in their expenditure bundle. In this setting, high prices imply scarcity which will drive the producer to expand the production, while the consumers are likely to expand their consumption. Along with the debates in the existing literature, intervention in the price, such as setting the price reference, may lead to market destruction where the role of the market as price discovery would be dampened. Moreover, as markets have the economic function of guiding the cost of transportation, storage, and processing of food products which reflect the willingness of sellers to transfer to the consumers, this price policy will also influence the behavior of actors along the supply chain in the food industry. Consequently, the competitiveness of the industry would also be affected.

Rice is attributed as a strategic commodity in most Asian economies and the main staple food of nearly half of the world population (Maclean, Dawe, Hardy, & Hettel, 2013). Being the fourth world's most populous country, Indonesia plays an important role in the world's rice economy, particularly in food security and development. The rice industry plays a critical role in affecting people's welfare and the national economic growth of the Indonesian economy. In several rice-producing countries, rice generally accounts for half of the farmers' income, although with declining trends of its share due to its changing nonfarm rural economies. Meanwhile, on the consumer side, rice accounts for 25-40% of households' expenditures. Thus, changes in rice prices will likely lead to large changes in purchasing power and nutrition of the poor (Dawe & Timmer, 2012). In addition, Grabowski & Self (2016) found that rice price stability was one of the main drivers of structural change in Indonesia. The shifting of labor from agricultural to manufacturing is critically dependent on the existence of food price stability. Meanwhile, Warr and Yusuf (2013) found that during the world food price spikes in 2007-2008, poverty in Indonesia had increased, particularly among the rural people. The higher agricultural prices can also result in higher income for the rural people since poor farmers in rural areas are the net food buyers.

Besides discussions on the role of the rice industry in the Indonesian economy, some studies have emphasized the relation of the Indonesian rice industry with the world market. In response to the increasing population, the current situation has shown that import has also played a role in fulfilling the domestic rice consumption. By assuming slow yield growth, steady consumption, and contracting cultivated area in the Indonesian rice industry, Bourgeois and Kusumaningrum (2008) have predicted that Indonesia will likely become a net importer for several food products including rice in 2020. Dawe (2008) in his paper critically asks whether Indonesia can trust the world market. His question is then related to whether the world market prices truly reflect the opportunity cost of producing rice given the trade-distorting subsidies and import restrictions in other countries. As the existing literature shows, the world rice market is characterized by an unstable and unreliable supply. Ceballos, Hernandez, Minot, and Robles (2017) emphasized this finding that the world rice prices are quite volatile in many developing countries so that the rice market appears to be more sensitive to volatility in the international markets. Meanwhile, Hoang and Meyers (2015), using a

partial equilibrium framework, predicted that the realization of free trade liberalization in 2020 would likely induce declining domestic prices in the Indonesian rice market.

Indonesian rice market has been politically intervened for decades mainly by the price regulation on the domestic markets besides intervention on the domestic supply related to import and export regulations. Therefore, rice price stabilization is one of the most popular issues in every political agenda in Indonesia. Along with the importance of policy discussions in the literature, some studies have emphasized the role of Indonesian government's interventions in the rice industry (Simatupang & Timmer, 2008). There are at least two points arising in the policy debates in Indonesian rice economic literature which focus on the goal of self-sufficiency and price stabilization. First, the self-sufficiency policy seems to be high cost in terms of government budget and thus could lead to inefficiency, and second, the policies are likely to result in market distortion (Timmer, 2017). In addition, Nuryanti, Hakim, Siregar, and Sawit (2017) argued that rice policies in Indonesia are biased to the government where the highest political preference of the government is received by the government itself. Meanwhile, Dorosh (2008), based on his studies on the food price stabilization policies in some developing countries, proposed the importance of more relying on market mechanisms to trigger the efficiency of the policy implementation.

The Indonesian government set two types of rice price policy in 2016 with the argument for maintaining price stabilization during the last five years and revised it in 2017. This study aimed to investigate the effect of price policies in 2016 and 2017 on the domestic price dynamic in the Indonesian rice market. Specifically, this study attempts to analyze the effect of the price policy through a detailed investigation on different rice varieties which can represent quality differences and find out the existence of different reactions from the different rice varieties. An understanding of the impact of price dynamics for different groups of consumers and producers can help to identify the unanticipated consequences of the policy.

RESEARCH METHOD

This study employed the time series econometric model, namely the multivariate error correction model (VECM). This study used daily price series taken from the Cipinang Wholesale Rice Market in Jakarta within the period of October 1st, 2014, until February 12th, 2018 (n = 1225 observations). The Cipinang Wholesale Market (PIC) is the main wholesale rice market in Jakarta which transfers most of the rice from several producing areas in Java as well as supplies rice to several regions outside Java Island. This study covered 10 rice varieties based on the type and quality presented in Table 1. All price series were transformed into logarithmic form. Figure 1 presents the dynamics of rice prices being investigated.

The multivariate vector error correction model (VECM) was employed to investigate the dynamics of rice prices. A VECM can give information about the reactions among investigated prices both in the long run and short-run periods. First, it was presumably asked whether the investigated rice prices in PIC share the same long-run information. According to this assumption, a test for the existence of one common cointegrating factor was conducted.

Suppose n x 1 vector of nonstationary price series i.e. I(1) $P_t = P_1, P_2,..., P_{nt}$ at time *t* for the *i* rice variety. This P_t can be written as:

$$P_t = A_{nxs}ft + \sim P_t \quad (1)$$

TABLE 1. DESCRIPTION OF INVESTIGATED RICE PRICES IN IDR

Rice Varieties	Quality	Mean	Minimum	Maximum
Cianjur Kepala (CK)	Premium	13,366	12,000	15,600
Cisadane (CS)	Premium	12,171	11,000	14,925
Setra (SE)	Premium	12,219	10,900	13,825
Saigon (SA)	Premium	11,117	9,900	13,200
Murni 1 (M1)	Medium	10,465	9,000	13,675
Murni 2 (M2)	Medium	9,656.8	8,200	12,400
Murni 3 (M3)	Medium	8,938.3	7,500	11,825
IR 641	Low	9,990.3	8,800	12,650
IR 642	Low	9,091.8	8,100	12,075
IR 42	Medium	10,486	9,000	12,600

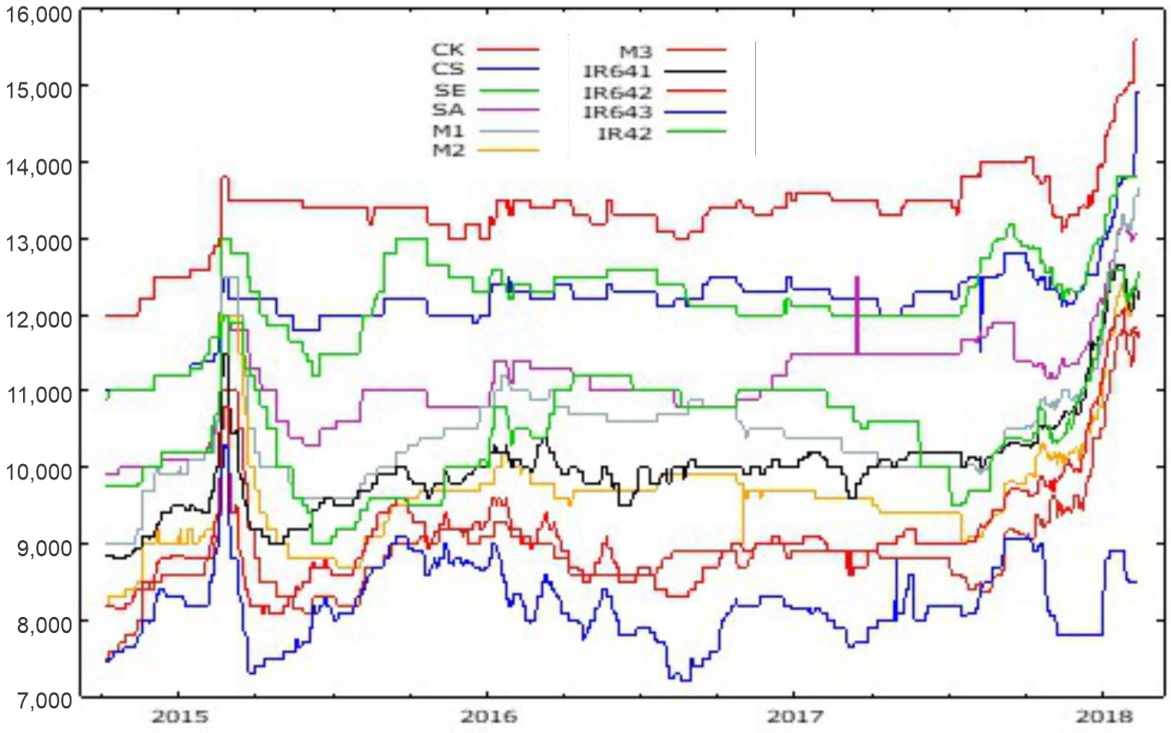

FIGURE 1. DAILY RICE PRICES IN PASAR INDUK CIPINANG FROM OCTOBER 2014-FEBRUARY 2018 (IDR/KILOGRAM)

Where P_t was an s x 1 vector of s (s<n) common unit root vectors and ~Pt was a 1 x n nonstationary component. This equation implies the common factor representation if and only if there were n-s cointegrating vectors among the elements of the vector of Pt as depicted in the Engel-Granger representation theorem. Based on this theorem, a cointegrated system can be explained by a vector of error correction model as follows:

$$\Delta Pt = \mu + \pi Pt\text{-}1 + \Gamma 1 \Delta Pt\text{-}1 + \Gamma 2 \Delta Pt\text{-}2 + ... + \Gamma p\text{-}12 \Delta Pt\text{-}p+1 + \varepsilon t \quad (2)$$

Where π and Γ were the coefficient of matrices of n x n and π had reduced ranks of n-s. The matrix of π can also be written as $\pi = \alpha\beta'$ where α was a nxn (n<s) cointegrated vector.

Accordingly, it is Π Pt-1 = αβ' Pt-1 = α Zt-1. The interesting point ~~here~~ was the error correction term as Zt-1 = β' Pt-1 with α called as adjustment coefficient from the long run disequilibrium. With this framework, the market integration was holding when s = 1 for markets that share the same long-run information. Therefore, searching the common factor representation as in Equation 1 was equivalent for n-1 cointegrating vectors. The search for n-1 cointegrating vectors was conducted in a multivariate framework proposed by Johansen i.e. the reduced rank of VAR cointegration testing. Subsequently, the investigation on interdependency among the rice prices was conducted by referring to the magnitude of error correction coefficients i.e. αresulted from the MVECM. The VEC in Equation 2 contains the short-run dynamics of the vector Pt as a function of α past disequilibrium and the lags of P_{t-1} for every Δ*Pt*. The matrix of the speed of adjustments provides information about the structure of the market which can be observed by referring to which coefficient was statistically significant. For example, if all α was found to be statistically significant, it implies the reactions of one rice variety to every disequilibrium of any other rice varieties.

The long-run and the short-run equation were augmented with the dummy variables representing the implementation of rice policy was used to capture the effect of the policy during the periods of investigation between 2014-2017. Therefore, for this purpose the normalized cointegrating vector for each pair was defined as follows:

$$P_{1t} = \beta_0 + \beta_1 P_{2t} + \beta_3 \text{POLICY 2016} + \beta_4 \text{POLICY 2017} + u_t \quad (3)$$

$$\Delta Pt = \mu + \pi Pt\text{-}1 + \Gamma 1 \Delta Pt\text{-}1 + \Gamma 2 \Delta\, Pt\text{-}2 + \ldots + \Gamma p\text{-}12 \Delta Pt\text{-}p + \beta_5\, \text{POLICY 2016} + \beta_6\, \text{POLICY 2017} + \varepsilon t \quad (4)$$

Where P_{1t} and P_{2t} were the price pairs of the respective rice varieties, while POLICY 2016 was the dummy variable in which value 1 represents the implementation of the price reference policy of 2016 and POLICY 2017 for the implementation of the ceiling price policy of 2017 respectively. According to these results, the estimation of cross-product price elasticities was calculated, which refers to the magnitude of β1 for each pair of rice variety prices.

The empirical technique was briefly summarized as follows: 1) checking the time series properties by testing the stationary of the price variables using the Augmented Dickey-Fuller unit root test; 2) for the price variables which had the same order of integration at the first difference i.e. I(1), testing the existence of cointegration relationships by employing the Johansen multivariate cointegration test; then, 3) after finding the number of cointegration ranks, the estimation with multivariate error correction model (MVECM) with several modifications in normalizing the cointegrating vector for each rice variety.

RESULT AND DISCUSSIONS

Price Policy in Indonesian Rice Industry in 2016 and 2017

The Indonesian government had set up some food price policies for some primary food commodities including rice to maintaining food price stabilization. These price policies were mainly coordinated by the Ministry of Trade (MoT) by issuing Minister's regulations. During the last five years, in the rice industry, the MoT had issued two regulations in 2016 and 2017 as a revision from the previous regulation. In 2016, through the Minister regulation number

63/M-DAG/PER/9/2016, the government published the application of purchasing price reference policy and the price reference policy for the sale. According to this regulation, the purchasing price reference was applied at the farmer level while the price reference was determined by considering the reasonable cost structure including production costs, distribution costs, as well as profits, and other possible costs. Furthermore, the purchasing price preference at the farmer level for rice was set at IDR 7,500, while the price reference for the sale at the consumer level was set at IDR 9,500. These reference prices were mainly applied by National Logistics (BULOG) and other state-owned companies. National logistics (BULOG) is a state-owned company that is responsible for coordinating the supply of some food commodities. To this responsibility, BULOG had to purchase food commodities from the farmers and distribute them to the public through market operation, for instance.

The government had revised the previous price reference policy in 2017 by issuing the Minister of Trade's Regulation, Number 57/M-DAG/PER/8/2017. According to this regulation, a ceiling price policy at the retail level for rice has been applied, which was called *Harga Eceran Tertinggi (HET*). Different from the regulation of 2016, the rice price was set up at the retail level and applied to the medium and premium rice varieties. The regulation of 2016 did not consider the differences in the rice product's quality. In addition, the *HET* was also set differently for a particular area in Indonesia. The details were presented in the Table 2.

TABLE 2. THE CEILING RICE PRICE IN 2017 (HET 2017)

Areas	HET for medium rice (IDR/kg)	HET for premium rice (IDR/kg)
Java, Lampung, and South Sumatera	9,450	12,800
Sumatera (excluding Lampung and South Sumatera)	9,950	13,300
Bali and West Nusa Tenggara (NTB)	9,450	12,800
East Nusa Tenggara (NTT)	9,950	13,300
Sulawesi	9.450	12,800
Kalimantan	9,950	13,300
Maluku	10,250	13,600
Papua	10,250	13,600

Notes: as mentioned in the Minister of Trade Regulation Number 57/M-DAG/PER/8/2017

Empirical Findings

A common procedure in the time series analysis, first, was checking the time series properties to investigate whether the investigated variables were stationary. ~~To do this~~ An Augmented Dickey-Fuller (ADF) unit root test including both constant and trend was employed to complete this step. According to the results of ADF test as summarized in Table 3, all price variables were stationary at the first difference i.e. I (1).

Furthermore, after finding that all price variables had a same order of integration at the first difference, then cointegration tests were conducted by employing the Johansen cointegration test. The results suggested the existence of nine cointegration ranks for the ten price variables being investigated, as shown in Table 4. The presence of cointegration among variables suggest that these rice varieties have long-run relationships with each other.

TABLE 3. CORRESPONDING P-VALUE OF ADF UNIT ROOT TEST

Variable of rice Varieties Price	Level		First Difference	
	Constant	Constant and Trend	Constant	Constant and Trend
1_Cianjur Kepala (CK)	0.9066	0.9254	0.0000	0.0000
1_Cisadane (CS)CS	0.9660	0.9668	0.0000	0.0000
1_SE	0.2139	0.2489	0.0000	0.0000
1_SA	0.7147	0.4243	0.0000	0.0000
1_Murni 1 (M1)	0.5061	0.6154	0.0000	0.0000
l_Murni 2 (M2)	0.2484	0.2964	0.0000	0.0000
l_Murni 3 (M3)	0.3257	0.4363	0.0000	0.0000
1_IR 641	0.4352	0.1142	0.0000	0.0000
1_IR 642	0.6897	0.6641	0.0000	0.0000
1_IR 42	0.6144	0.7241	0.0000	0.0000

Notes: The lag selection in the unit root test was based on the AIC/ Nul hypothesis was the existence of unit root.

TABLE 4. RESULTS OF JOHANSEN COINTEGRATION TEST

Rank of Cointegration	Constant		Constant and Trend	
	Trace-Test	P-value	Trace-Test	P-value
0	314.11	0.0000	382.70	0.0000
1	235.57	0.0001	268.53	0.0001
2	165.92	0.0218	192.40	0.0282
3	111.98	0.2588	137.10	0.2315
4	78.770	0.4156	103.03	0.2988
5	48.965	0.6870	72.907	0.4047
6	29.367	0.7563	43.131	0.7334
7	13.154	0.8815	23.712	0.8478
8	4.6736	0.8394	8.2297	0.9724
9	0.14233	0.7067	2.1733	0.9430

Notes: Number of lags was selected by AIC.

The effect of rice price policy on the price dynamics was investigated by referring to the estimated coefficient of policy variables (POLICY 2016 and POLICY 2017) which were augmented both in the cointegrated relations among the price variables (long-run relationships) and in the error correction models (short-run relationships). The first one was called the restricted VECM and the second one is the unrestricted VECM. By following the Johansen cointegration in a multivariate framework, several modifications were conducted in the normalization process by determining which price variable based on Table 5 and Table 6.

The effect of the implementation of price policy on the rice price dynamics generally showed variations in the long-run both in the magnitudes and signs of the estimated policy variable i.e. POLICY 2016 and POLICY 2017 as presented in Table 5 and Table 6 respectively. This implied that each price variable had a different reaction to the implementation of price policy. Regarding the significance of policy variables, the findings showed that price policy in 2016 did not have a significant effect on the price dynamics in most cases. The significant effect of POLICY 2016 was found in some rice varieties which were commonly characterized as medium and low rice variety i.e. SA, Murni 1, Murni 2, IR 641, and IR 642. Meanwhile, different findings were found in the significant effect of price policy in 2017. For instance, in the case of Cianjur Kepala (CK), this variable did not react to the implementation of POLICY

2016 in most cases, but contrary with respect to POLICY 2017. As shown in Table 6, the effect of POLICY 2017 on the price dynamics was generally negative. However, an exception was found when normalizing the cointegrating vectors by using the CK price variable. According to this model, it was suggested that the effect of POLICY 2017 was positive for most variables, but with an exception for the response of IR 64 which was negative. Regarding the sign of the estimated coefficient, an exception was also found in the case of IR 42. It was suggested that the effect of POLICY 2017 was positive.

TABLE 5. ESTIMATED COEFFICIENT OF PRICE POLICY IN 2016 FROM LONG-RUN EQUATION

Variable of rice Varieties Price	Dependent Variables									
	CK	CS	SE	SA	M1	M2	M3	IR 641	IR 642	IR 42
Cianjur Kepala (CK)		0.05	0.02	0.01	0.18	0.13	0.02	0.06	-0.10	0.29
Cisadane (CS)	-0.01		-0.00	-0.04	0.07	0.03	0.00	-0.01	-0.05	0.07
Setra (SE)	-0.01	0.01		-0.03	0.09	0.05	0.00	0.00	-0.06	0.11
Saigon (SA)	-0.00	0.04	0.02		0.16**	0.11**	0.014	0.04**	-0.09	0.24**
Murni 1 (M1)	-0.02	-0.02	-0.02	-0.06**		-0.02	-0.00	-0.04**	-0.02**	-0.05
Murni 2 (M2)	-0.02	-0.02	-0.02	-0.06**	0.02**		-0.00	-0.03**	-0.03	-0.01
Murni 3 (M3)	-0.02	-0.00	-0.00	-0.04	0.05	0.02		-0.01	-0.05	0.05
IR 641	-0.01	0.00	-0.00	-0.03**	0.08**	0.04**	0.00		-0.05	0.09
IR 642	0.78**	-0.05	-0.03	-0.08**	-0.04	-0.05	0.01	-0.07**		-0.14
IR 42	-0.02	-0.01	-0.01	-0.05**	0.03	0.00	-0.00	-0.03	-0.03	

Notes: *significant at 10 % level, ** significant at 5 % level, *** significant at 1 % level

TABLE 6. ESTIMATED COEFFICIENT OF PRICE POLICY IN 2017 FROM LONG-RUN EQUATION

Variable of rice Varieties Price	Dependent Variables									
	CK	CS	SE	SA	M1	M2	M3	IR 641	IR 642	IR 42
Cianjur Kepala (CK)		0.38**	0.20**	0.37**	1.08**	0.83**	0.02	0.52**	-0.75**	2.23**
Cisadane (CS)	-0.11**		-0.03	0.00	0.21**	0.14**	-0.10**	0.04	-0.36**	0.61**
Setra (SE)	-0.09**	0.04		0.05	0.32**	0.23**	-0.09**	0.09	-0.41**	0.81**
Saigon (SA)	-0.11**	-0.00	-0.03		0.19**	0.13**	-0.11**	0.03	-0.35**	0.58**
Murni 1 (M1)	-0.13**	-0.09**	-0.08**	-0.08**		-0.02	-0.13**	-0.07**	-0.26**	0.22**
Murni 2 (M2)	-0.13**	-0.08**	-0.07**	-0.07**	0.03		-0.13**	-0.06**	-0.28**	0.28**
Murni 3 (M3)	-0.01	0.32**	0.17**	0.31**	0.95**	0.73**		0.45**	-0.69**	1.99**
IR 641	-0.11**	-0.03	-0.05	-0.02	0.14**	0.08**	-0.11**		-0.33**	0.48**
IR 642	-0.21**	-0.35**	-0.24**	-0.32**	0.32**	-0.49**	-0.21**	-0.04**		0.09**
IR 42	-0.15**	-0.14**	-0.11**	-0.13**	-0.12**	-0.12**	-0.15**	-0.14**	-0.21**	

Notes: *significant at 10 % level, ** significant at 5 % level, *** significant at 1 % level

The effect of policy variables on the price dynamics in the short run can be seen in Table 7, as estimated by the unrestricted VECM. Table 7 showed, not all price variables react to the implementation of rice policy both in 2016 and 2017. Referring to the significance of the respected price variables, the rice prices reacting to the implementation of policy in 2016 were Cisadane (CS), Murni 1 (M1), IR 642, and IR 42. Meanwhile, with respect to the policy in 2017, the reacting rice prices were CS (Cisadane), Murni 1 (M1), IR 641, and IR 642. Furthermore, regarding the magnitude of the estimated coefficient, the findings generally suggested relatively small elasticity. In addition, regarding the signs of the effect of the policy variables, both positive and negative effects were found in the empirical results. The positive signs of this policy were found in the coefficients of CS and IR 642, while the negative

relations were found in Murni 1 (M1). These findings were quite interesting as the objective of the price policy was to maintain rice price stabilization. This means that the effect of price policy was expected to be negative which implies that either price reference or ceiling price policy should be able to lower the rice prices.

TABLE 7. ESTIMATED COEFFICIENT OF POLICY VARIABLES FROM THE UNRESTRICTED VECM (SHORT-RUN EQUATION)

Dependent Variable of rice Varieties Price	POLICY 2016	POLICY 2017
d_1_Cianjur Kepala (CK)	-0.00017	-0.00049
d_1_Cisadane (SC)	0.00117**	0.00082**
d_1_Setra (SE)	-0.00059	-0.00148
d_1_Saigon (SA)	0.00038*	-0.00151
d_1_Murni 1 (M1)	-0.00123**	-0.00183**
d_1_Murni 2 (M2)	0.00056	-0.00088
d_1_Murni 3 (M3)	0.00077	-0.00103
d_1_IR 641	0.00088*	-0.00197***
d_1_IR 642	0.00134**	0.00323***
d_1_IR 42	0.00123**	0.00113

Notes: *significant at 10 % level, ** significant at 5 % level, *** significant at 1 % level

Summarizing the empirical findings both in the short-run and long-run behavior, this study suggested that the Indonesian rice market seems to become more heterogeneous. This was implied in the response of rice prices to the implementation of the price policy which each rice variety has a different reaction compared to each other's. In 2016, where the government set up only one price reference without considering the product differentiation, the policy effect was found to be insignificant in most cases especially in the long run. Meanwhile, when the government imposes the price reference for the premium and medium rice varieties and regional differentiation in 2017, the effect of the policy was found to be significant, though with relatively small elasticity. In the previous studies, rice as the main staple food in Indonesia was usually treated as a single commodity which was commonly viewed as a homogenous product in the market. However, along with the changing consumers' socio-economic condition, this assumption needs to be reconsidered by looking more detail into the behavior of each rice variety. Even though rice is still positioned as the main staple food which has the highest share in the food intake, as people are more aware of the rice products quality (Rachmat, Thahir, & Gummert, 2006), this can consequently lead to the different market behavior among rice products.

Concerning the question of the effectiveness of setting price reference policy, the government should be able to understand the market behavior in the industry. As heavily discussed in the literature, controlling prices into some administrative zone could likely result in market distortion which will also affect the competitiveness of the industry in the long run. When the market becomes more heterogeneous with different consumer behavior, the implementation of the policy should consider the targeted market behavior focusing on the goal of the policy. Managing the price in the food system requires an understanding of the behavior of the actors along the value chain. Even though rice is still considered as the main

staple food of the people, each rice variety seems to have different behavior which may be affected by changes in the socioeconomic situation.

Furthermore, regarding the price stabilization purpose, the empirical findings suggested that maintaining price stabilization could not be achieved by only implementing the official price intervention in the market. As previously mentioned, in the short run, not all rice variety prices were reacting to the implemented price policy both in 2016 and 2017. Moreover, the elasticities were also found to be small in the significant price variables. Following the conceptual framework by Pieters & Swinnen (2016) which emphasizes the existence of a trade-off between price distortions and reduced-price volatility in the presence of government intervention in the food market during the food price spikes, the empirical finding supports the importance of policy improvement in the context of food price stabilization policy in general. The main task is to set up the intervention price at an appropriate level which requires a lot of understandings of the market dynamics (Galtier, 2013). Despite maintaining price stabilization, setting the price intervention in the domestic market could likely induce price instability because too high floor prices or too low ceiling prices notwithstanding unpredictable intervention will likely lead to crowd out private storage and trade (Tschirley & Jayne, 2010). In addition, for a more macro perspective, the price stabilization policy should be updated following the country's progression along its development stage as stated by (Timmer, 2002).

CONCLUSION

The application of price policy in the Indonesian rice industry had resulted in various effects on the price dynamics. Confirming this situation, this study found that the price policy which was implemented in the Indonesian rice market in 2016 and 2017, had different effect for each rice variety both in magnitude and sign. The effects were also found to be different regarding short-run and long-run behavior. In the short run, the effects of the price policy in 2016 and 2017 were slightly different in terms of which rice varieties were reacting to the implementation of the policy. However, regarding the magnitude of the effects of both price policies, the effects of price policy in 2016 and in 2017 were quite similar, which propose relatively small elasticity. Therefore, according to these findings, it can be concluded that the short-run effect of the price policy both in 2016 and 2017 was relatively small. Combining the empirical findings both in the short-run and long-run periods of the effect of price policy, this study suggested that the Indonesian rice market seems to become more heterogeneous. Each rice variety had been found to have a different reaction to the implementation of price policy. These findings confirmed the assumption that rice consumers have been differentiated according to the type and quality of rice varieties.

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REFERENCE

Anderson, K. (2012). Government Trade Restrictions and International Price Volatility. *Global Food Security*, *1*(2), 157–166. https://doi.org/10.1016/j.gfs.2012.11.005

Barrett, C. B. (Ed.). (2013). *Food Security and Sociopolitical Stability*. Oxford: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199679362.001.0001

Berger, J., Dalheimer, B., & Brümmer, B. (2021). Effects of Variable EU Import Levies on Corn Price Volatility. *Food Policy*, *102*. https://doi.org/10.1016/j.foodpol.2021.102063

Bourgeois, R., & Kusumaningrum, D. (2008). What Cereals Will Indonesia Still Import In 2020? *Bulletin of Indonesian Economic Studies*, *44*(2), 289–312. https://doi.org/10.1080/00074910802169038

Ceballos, F., Hernandez, M. A., Minot, N., & Robles, M. (2017). Grain Price and Volatility Transmission from International to Domestic Markets in Developing Countries. *World Development*, *94*, 305–320. https://doi.org/10.1016/j.worlddev.2017.01.015

Dalheimer, B., Herwartz, H., & Lange, A. (2021). The Threat of Oil Market Turmoils to Food Price Stability in Sub-Saharan Africa. *Energy Economics*, *93*. https://doi.org/10.1016/j.eneco.2020.105029

Dawe, D. (2008). Can Indonesia Trust The World Rice Market? *Bulletin of Indonesian Economic Studies*, *44*(1), 115–132. https://doi.org/10.1080/00074910802008053

Dawe, D., & Timmer, C. P. (2012). Why Stable Food Prices are A Good Thing: Lessons from Stabilizing Rice Prices in Asia. *Global Food Security*, *1*(2), 127–133. https://doi.org/10.1016/j.gfs.2012.09.001

Dorosh, P. A. (2008). Food Price Stabilisation and Food Security: International Experience. *Bulletin of Indonesian Economic Studies*, *44*(1), 93–114. https://doi.org/10.1080/00074910802001603

Galtier, F. (2013). Managing Food Price Instability: Critical Assessment of The Dominant Doctrine. *Global Food Security*, *2*(2), 72–81. https://doi.org/10.1016/j.gfs.2013.02.001

Gardebroek, C., Hernandez, M. A., & Robles, M. (2016). Market Interdependence and Volatility Transmission among Major Crops. *Agricultural Economics*, *47*(2), 141–155. https://doi.org/10.1111/agec.12184

Gilbert, C. L. (2012). International Agreements to Manage Food Price Volatility. *Global Food Security*, *1*(2), 134–142. https://doi.org/10.1016/j.gfs.2012.10.001

Grabowski, R., & Self, S. (2016). Staple Food Price Instability and Structural Change: Indonesian Experience. *Journal of Asian Economics*, *47*, 35–44. https://doi.org/10.1016/j.asieco.2016.10.001

Herwartz, H., & Saucedo, A. (2020). Food–oil Volatility Spillovers and The Impact of Distinct Biofuel Policies on Price Uncertainties on Feedstock Markets. *Agricultural Economics*, *51*(3), 387–402. https://doi.org/10.1111/agec.12561

Hoang, H. K., & Meyers, W. H. (2015). Price Stabilization and Impacts of Trade Liberalization in the Southeast Asian Rice Market. *Food Policy*, *57*, 26–39. https://doi.org/10.1016/j.foodpol.2015.07.009

Honfoga, B. G., N'tandou-Bonzitou, G., Vodouhè, R. S., Bellon, M. R., & Hounhouigan, J. D. (2018). Assessing the Role of Market Integration in The Consumption of Traditional Foods in Benin: A Joint Price Instability Coefficient and Diet Composition Approach. *Agricultural and Food Economics*, *6*, 2. https://doi.org/10.1186/s40100-018-0097-1

Maclean, J. L., Dawe, D. C., Hardy, B., & Hettel, G. P. (Eds.). (2013). *Rice Almanac: Source Book for The Most Important Economic Activities on Earth* (Fourth Ed.). Wallingford: CABI Publishing.

Naylor, R. L. (Ed.). (2014). *The Evolving Sphere of Food Security*. Oxford: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199354054.001.0001

Nuryanti, S., Hakim, D. B., Siregar, H., & Sawit, M. H. (2017). Political Economic Analysis of Indonesian Rice Market. *J. ISSAAS (Internasional Society for Southeast Asian Agricultural Sciences)*, *23*(2), 158–168.

Pieters, H., & Swinnen, J. (2016). Trading-off Volatility and Distortions? Food Policy During Price Spikes. *Food Policy*, *61*, 27–39. https://doi.org/10.1016/j.foodpol.2016.01.004

Pinstrup-Andersen, P. (Ed.). (2014). *Food Price Policy in an Era of Market Instability: A Political Economy Analysis*. Oxford: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198718574.001.0001

Rachmat, R., Thahir, R., & Gummert, M. (2006). The Empirical Relationship Between Price and Quality of Rice at Market Level in West Java. *Indonesian Journal of Agricultural Science*, *7*(1), 27–33. https://doi.org/10.21082/ijas.v7n1.2006.p27-33

Simatupang, P., & Timmer, C. P. (2008). Indonesian Rice Production: Policies and Realities. *Bulletin of Indonesian Economic Studies*, *44*(1), 65–80. https://doi.org/10.1080/00074910802001587

Timmer, C. P. (2002). Agriculture and economic development. In *Handbook of Agricultural Economics* (Vol. 2A, pp. 1487–1546). Amsterdam. https://doi.org/10.1016/S1574-0072(02)10011-9

Timmer, C. P. (2017). Food Security, Structural Transformation, Markets and Government Policy. *Asia & the Pacific Policy Studies*, *4*(1), 4–19. https://doi.org/10.1002/app5.161

Tschirley, D. L., & Jayne, T. S. (2010). Exploring the Logic Behind Southern Africa's Food Crises. *World Development*, *38*(1), 76–87. https://doi.org/10.1016/j.worlddev.2009.09.008

Warr, P., & Yusuf, A. A. (2013). World Food Prices and Poverty in Indonesia. *Australian Journal of Agricultural and Resource Economics*, *58*(1), 1–21. https://doi.org/10.1111/1467-8489.12015