THE ROLE OF MASS COMMUNICATIONS TO THE MARKET INTERVENTIONS OF RICE COMMODITY IN INDONESIA

(Peran Komunikasi Massa terhadap Intervensi Pasar Komoditas Beras di Indonesia)

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Abstrak

Beras merupakan makanan pokok bagi masyarakat dan secara signifikan berkontribusi terhadap pembangunan ekonomi di Indonesia. Terkadang intervensi pasar harus dilaksanakan oleh pemerintah di luar musim panen untuk mengendalikan dan mengelola harga beras dan inflasi, sehingga masyarakat berpenghasilan rendah dapat memenuhi kebutuhan mereka. Penelitian ini mengkaji bagaimana aspek komunikasi sangat penting sebagai mekanisme intervensi pasar untuk mengendalikan harga dan stok beras di Indonesia. Autoregressive and Moving Average and Autoregressive Conditional Heteroskedasticity/Generalized Autoregressive Conditional Heteroskedasticity serta the Structural Time-Series Model digunakan dengan variabel dummy pada data stok dan harga beras, baik harian maupun bulanan, antara 1 Januari 2015 hingga 27 Juni 2016. Hasil analisis menyimpulkan bahwa komunikasi massa oleh pemerintah kepada pihak-pihak yang berkepentingan (pelaku usaha dan konsumen) dapat berjalan dengan baik terutama untuk menjaga pasokan dan stabilitas harga beras. Namun demikian, model ARMA(1,1)-GARCH(1,1) dengan variabel dummy yaitu komunikasi massa, serta jumlah operasi pasar dan kebijakan beras kurang berpengaruh terhadap harga beras namun lebih berpengaruh terhadap stok beras. Kemudian, the Structural Time-Series Model menunjukkan bahwa naik turunnya harga dan stok beras berasal dari komponen musiman dan siklus terutama lebih berfluktuasi pada bulan Januari-Maret. Oleh karena itu, otoritas terkait diharapkan dapat memaksimalkan kebijakan beras untuk menjaga stabilitas harga dan stok beras dalam jangka pendek, menengah, dan panjang.

***Kata kunci**: intervensi pasar, ARMA, ARCH/GARCH, structural time-series model.*

Abstract

The rice is a staple food for the people and significantly contributes to economic development in Indonesia. Occasionally a market intervention should be implemented by the Government of Indonesia during the low harvest season to control and to manage the price of rice and the inflation, so low-income society could meet their basic needs. This study examines how communication aspect is really important as a part of market intervention mechanism to control the price and the stock of rice in Indonesia. Autoregressive and Moving Average, Autoregressive Conditional Heteroskedasticity/Generalized Autoregressive Conditional Heteroskedasticity, and the Structural Time-Series Model are applied with a dummy variable on daily and monthly data of the stock and the price of rice from January 1, 2015 until June 27, 2016. It can be inferred from the data that the form of mass communication by the government to relevant stakeholders (channel distribution and consumers) can run well, especially in order to maintain the supply and the price stabilization of rice. Nevertheless, the ARMA(1,1)-GARCH(1,1) model with dummy variables, inter alia mass communication, and also the number of market operations and rice policy, are not so influential on the price of rice, but more influence on the stock of rice. Then, the Structural Time-Series Model shows that the fluctuation of price and stock is affected by seasonal and cycle components especially more fluctuated in the month of January-March. Therefore, the relevant authorities are expected to maximize the rice policy in order to maintain the price stability in the short term, medium term, and long term.

Keywords: market intervensions, ARMA, ARCH/GARCH, structural time-series model.

INTRODUCTION

The rice is a staple food for the people of Indonesia and significantly contributes to its economic development. Based on FAO (2011), a basic foodstuff including rice should be able to meet the needs of human energy to maintain a good health condition. The human body is recommended to acquire calories as much as 1,800 kilo calories a day, in which can be obtained by consuming rice. Therefore, the lower the consumption of rice can cause malnutrition, which is affected to the welfare of society.

In Indonesia, the price of rice is strongly influenced by the supply of rice. The price of rice tends to be stable at the time of normal supply condition, declining at a time when the supply is abundant at high harvest periods, and increasing at the time when supply is limited during low harvest periods. The high harvest seasons in Indonesia are around March-May, while the low harvest seasons are around January-February. Occasionally a market intervention should be taken into an action by the Government of Indonesia during the low harvest season to control and to manage the price of rice and the inflation, so low-income society could meet their basic needs. Wood et al. (2012), one of the reasons for the rising number of poor families in developing countries due to rising food prices (including rice). The increase in food prices most affects the lives of the poor people because the proportion of spending on food consumption in this group is the biggest (Naranpanawa and Bandara, 2012; Monteiro et al., 2012). Therefore, the government's role is obviously vital in order to manage the supply and the price stability and keep it affordable for the poor people.

On the supply side, the form of price control can be applied by increasing the supply of rice to the market and also giving free direct assistance by providing "rastra/raskin" to the poor people. According to Indonesia Act Number 18 Year 2012 on Food, the definition of food security is a condition while the fulfillment of food for the country up to individuals, that reflected in the availability of adequate food, both quantity and quality, safe, diverse, nutritious, evenly distributed and affordable and not contradictory with religion, belief, and culture society, to be able to live healthy, active, and productive in a sustainable way. Based on the definition it can be inferred that the issue is not just food availability, but the affordability of food especially rice is very important. The relevant authorities have to conduct market interventions if the food is not affordable and available for the society especially the poor people. This study pursues to define how communication aspect is really important as a part of market intervention mechanism to control the price and the stock of rice in Indonesia.

Related to the Regulation of the Ministry of Trade No.46/M-DAG/PER/7/2017 on the Implementation of Communication and Information Technology in the Ministry of Trade, the role of information and communication technology is increasingly supportive of activities and achievement of the Ministry of Trade's performance needs to be supported by technology governance information and communication more effectively and efficiently. Article 1, Paragraph 3 states that Communication and Information Technology is a technique for collecting, preparing, storing, processing, announcing, analyzing, and/or disseminating information (Kementerian Perdagangan, 2017).

According to Berger (1995), mass communication involves the use of print or electronic media, such as newspapers, magazines, film, radio, or television, to communicate to large numbers of people who are located in various places -- often scattered all over the country or world. The people reached may be in groups of varying sizes or may be lone individuals. A number of different elements make up mass communication media; images, spoken language, printed language, sound effect, music, color, lighting, and a variety of other techniques are used to communicate messages and obtain particular effects.

Based on Law of Republic of Indonesia Number 7 Year 2014 on Trade, Ministry of Trade has an obligation to ensure the smooth distribution and availability of staple and essentials goods (Barang Kebutuhan Pokok dan Barang Penting) including rice. Therefore, Ministry of Trade using the concept of Mass Communication to announce and disseminate information in print or electronic media so that rice commodity can be intervened to become affordable and available.

Few researchers look at the role of mass communications to the market interventions of staple and essentials goods especially rice commodity in Indonesia using ARCH/GARCH and Structural Time-Series Model. There is an opportunity to fill the gap. Thus, this paper aims to give a contribution for further study by analyzing the role of mass communications to the market interventions of rice commodity in Indonesia.

METHODS

This is a quantitative analysis using Autoregressive and Moving Average (ARMA), Autoregressive Conditional Heteroskedasticity/Generalized Autoregressive Conditional Heteroskedasticity (ARCH/GARCH), and Structural Time-Series Model (STSM). ARMA model is a combination of AR(p) and MA(q) models and is suitable to analyze for univariate time series modeling (Adhikari and Agrawal, 2013). Meanwhile, ARCH/GARCH is applied in this study to analyze return series that have the property of changing the variance level (Chand et al., 2012). Then, STSM is applied in this paper to provide the possibility to expand the information to explain the observed data by structural decomposition that consists of 3 components (Trend, Seasonal and Cycle) and 1 irregularity (Sen and Chaudhuri, 2016; Rahman, 2012).

Autoregressive Moving Average (ARMA)

ARMA univariate modeling is conducted by Box-Jenkins procedure with stages: (1) identification by looking and comparing correlogram from some combination of existing model, (2) estimation by Ordinary Least Square (OLS) or Maximum Likelihood, (3) evaluation with check the estimated model if it is sufficient. A simple ARMA model is ARMA(1,1) which can be presented as follows:

$$Y_t - \omega = \beta_1 (Y_{t-1} - \omega) + e_t + \delta_1 e_{t-1}$$
$$d_t = \beta_1 d_{t-1} + e_t + \delta_1 e_{t-1}$$

$E(d_t) = E(Y_t - \omega) = 0$

$Var(d_t) = E(d_t^2)$ .... (1)

Where: β_0, β_1, δ_1 are parameters, e_t is *residual random*.

Autoregressive Conditional Heteroskedasticity/ Generalized Autoregressive Conditional Heteroskedasticity (ARCH/GARCH)

There are several studies attempting to analyze food prices by using several econometric approaches. Shiferaw (2012) examined the fluctuations in agricultural commodity prices in Ethiopia using ARCH/GARCH to capture the benefits of commodity price changes. In addition, Ederington and Guan (2013) used the GARCH model to estimate food prices that found large conditional variance changes led to increased risk of variance. Then Jati (2014) analyzed the volatility of sugar price by using ARCH/ GARCH which found that sugar price in Indonesia has higher potential risk compared to sugar price in India.

ARCH models estimate a conditional variance. The OLS assumption uses Best Linear Unbiased Estimator (BLUE) assumptions, whereas ARCH sees that residual variance at a point of time (t) is a function of residual variance at other time points. The ARCH model was introduced by Engle (1987) and the model was generalized to GARCH by Taylor (1986) and Bollerslev (1986). Here is a simple model from GARCH(1,1):

$Y_t = X_t\theta + e_1$ .... (2)

$\sigma_t^2 = c + \alpha e^2_{t-1} + \beta\sigma^2_{t-1}$ .... (3)

Where: c = constants; e^2_{t-1} = ARCH parameter; σ^2_{t-1} = GARCH parameter

Equation (2) is a function of an exogenous variable with an *error term (e)*. Equation (3) is a conditional variance by predicting a future period of variance based on information in the past.

Research Model ARCH/GARCH with Dummy Variable

The form of mass communication by the government towards business actors and consumers is relatively effective in maintaining supply and stabilizing rice prices. However, a strong scientific evidence is needed to prove it. Therefore, in this study, we propose a modification to the equation of GARCH model by entering dummy variable "the mass communication and the number of market operations". The function of this dummy variables are to analyze the behavior of the conditional variance at the time of the rice market operation to the price and the stock of rice. The model analyzing the effects of the rice market operation and the number of market operations to the price and the stock of rice is below:

$y_t = c_1 + \beta_1 y_{t-1} + e_t + \delta_1 e_{t-1}$.................................. (4)

$\sigma_t^2 = c_2 + \alpha_1 e^2_{t-1} + \beta_3\sigma^2_{t-1} + \beta_4(D_1 e^2_{t-1}) + \beta_5(D_2 e^2_{t-1})$..(5)

D_1 = the mass communication and the number of rice market operations is relatively has happened a few, D_2 = the mass communication and the number of rice market operations is relatively has happened a lot. Where β_5 is the effect of the mass communication and the amount of operation of the rice market is relatively has happened a lot. The effect of the mass communication and the number of market operations is incorporated in the model using dummy variable D_2 which assumes that the value becomes 1 if the mass communication and the number of market operations is relatively has happened a lot. This model has been used and evaluated in Mensah (2011) and Miniaoui et al. (2014) on the effects of structural changes from the global financial crisis.

One of the important functions of the media is to respond and act on a particular event. If an estimated change in the stock or price of rice occurs at certain times such as religious holidays or school holidays, it is necessary to have mass communication from the government to calm and stabilize it. Based on Bulog's managerial report (Bulog, 2016) and market operations reporting in the mass media (Tempo, 2016 and Detik, 2016) it can be expected that the mass communication and the number of rice market operations are most prevalent happened a lot in January, May, June, July, and December. This rice market operation is not only happening in the field of technical , but also communicated by the central government, local government, SOEs such as Bulog, and BUMD such as Cipinang Rice Market through the process in the digital economy so that business and consumers have clear and complete information. So, in the month of January, May, June, July, and December, the dummy variable D_2 value becomes *1* because the mass communication and the number of market operations is relatively has happened a lot. Then the dummy variable D_1 value becomes *0* in the month of February, March, April, August, September, October, and November.

Related to the mass communication and the amount of market operations, the government had made regulations in order to stabilize prices and maintain rice stock. One of the latest regulations on rice was the regulation of the President of the Republic of Indonesia Number 71 Year 2015 on the Establishment and Storage of Essentials and Basic Staple Food (PP No. 71 Year 2015) which was very important for the livelihood of many people as a factor supporting the welfare of the community and a determination the smoothness of national development. In order to implement the regulation effectively, the Government and the Indonesia Logistics Agency (Bulog) has been attempting to communicate with business actors and the public through advanced digital technology since July 2015 in order to monitor the implementation of the regulation. The technology was expected to help the price stability of rice and to ensure the stock of rice in the market.

According to Wijayanti, Candra, and Sarjono (2011) the government of Indonesia (Bulog) determines the stock of reserves which is a means of price stabilization in order to foster greater stock as the population growth. The relevant authorities should know how to use stock of rice (release the stock during high price/paceklik season, and collect the stock during low price/harvest season). In this paper, due to the limitations of existing data associated with time series data rice stock in Indonesia, the available time series data is from private sector / Regional-Owned Enterprises (BUMD / Cipinang Rice Market / Pasar Induk Beras Cipinang).

The authors make a modification to the equation of GARCH model by entering a dummy variable to analyze the behavior of the conditional variance before and after the regulation applied as below:

$$y_t = c_3 + \beta_6 y_{t-1} + e_t + \delta_2 e_{t-1} \quad (6)$$

$$\sigma_t^2 = c_4 + \alpha_2 e^2_{t-1} + \beta_7 \sigma^2_{t-1} + \beta_8 (D_3 e^2_{t-1}) + \beta_9 (D_4 e^2_{t-1}) \quad (7)$$

D_3 = before the enactment of policy applied, D_4 = after the enactment of policy applied. Where β_9 is the effect of the rice policy enactment. The effect of this rice policy is incorporated in the model using the D_4 dummy variable which assumes that the value becomes 1 if the regulation of PP No. 71 Year 2015 is already valid. This model has been used and evaluated in the study of Mesah (2011) regarding the effects of structural changes from the global financial crisis.

STSM Decomposition

The rice price of Cianjur SLYP, IR-64 I, IR-64 II and rice stock from Cipinang Rice Market are food commodity variables that are difficult to put them into a model. Therefore, a simple model is needed that can explain the dynamics of the changes in those variables. An alternative possible solution to make more direct short-term assessments and forecasts is to decompose and project in a comprehensive model of the STSM Decomposition (Harvey & Peters, 1990).

The advantages of this STSM approach compared to historical averages are more structured, can model seasonal patterns and irregularity of commodity prices and make their models more robust. STSM decomposition (Harvey & Peters, 1990) and (Durbin & Koopman, 2001) consists of 3 components:

(1) Trend components that follow the random walk process.

$$\tau_t = \mu_t + \tau_{t-1} + n_t, n_t \sim N(0, \sigma_n^2) \quad (8)$$

$$\mu_t = \mu_{t-1} + U_t \sim N(0, \sigma_U^2) \quad (9)$$

Where ʊ$_t$ is the trend component, μ_t is the slope that can be stochastic, and n_t is the error of ʊ$_t$, and U_t is the error of μ_t.

(2) The seasonal component of the specification (γ_t) follows the trigonometric model

$$\begin{bmatrix} \gamma_{j,t} \\ \gamma^*_{j,t} \end{bmatrix} = \begin{bmatrix} \cos\lambda_j & \sin\lambda_j \\ -\sin\lambda_j & \cos\lambda_j \end{bmatrix} \begin{bmatrix} \gamma_{j,t-1} \\ \gamma^*_{j,t-1} \end{bmatrix} + \begin{bmatrix} \omega_t \\ \omega^*_t \end{bmatrix} \quad (10)$$

for $j = 1,...,[s/2]$; $t = 1,...,T$. Where γ_t is a seasonal component, ω_t is an error of γ_t.

(3) Cycle component whose models resembles seasonal components

$$\begin{bmatrix} \psi_{j,t} \\ \psi^*_{j,t} \end{bmatrix} = \rho\psi \begin{bmatrix} \cos\lambda_c & \sin\lambda_c \\ -\sin\lambda_c & \cos\lambda_c \end{bmatrix} \begin{bmatrix} \psi_{j,t-1} \\ \psi^*_{j,t-1} \end{bmatrix} + \begin{bmatrix} K_t \\ K^*_t \end{bmatrix} \quad (11)$$

for $t = 1,...,T$. Where ψ_t is the cycle component, ρ_ψ and λ_c are damping and frequency factors with values $0 < \rho_\psi \leq 1$ and $0 \leq \lambda_c \leq \pi$ while K_t and K_t^* are not mutually correlated $N(0,\sigma_k^2)$. If all three components are summed then it becomes:

$$y_t = \tau_t + \Upsilon_t + \psi_t + \varepsilon_t \quad (12)$$

So, y_t is the price of the commodity predicted by the trend component (ʊ$_t$), seasonal (γ_t) and cycle (ψ_t). This model is estimated using the MLE (*Maximum Likelihood Estimation*) method and difficult to estimate components generated from Kalman filter (Harvey & Peters, 1993). The software used in this model uses OxMetrics Stamp 7.

Research Data

The ARMA and ARCH/GARCH models are estimated based on 543 daily time series from January 1, 2015 to June 27, 2016 for the price of Cianjur SLYP, IR-64 I, IR-64 II (sentra ramos) rice and rice stock from Cipinang Rice Market in Jakarta (Foodstationjayakarta, 2016a; and Foodstationjayakarta, 2016b). Especially for STSM, the data modified to 78 weekly data from January 1, 2015 to June 2016 (week 26th). Rice price data in units of Rp/kg while the rice stock data in tons. The price of Cianjur SLYP rice is taken because it represents the rice consumed by the middle / upper class with a relatively high price, IR-64I and IR-64II rice prices are taken because it represents the rice consumed by the middle/lower class with a relatively cheap price, while the stock rice is taken because it is a variable between government policies in the form of market operations by increasing rice supply/stock in the market in order to stabilize rice prices. This data can be used by anyone because it is open to the public as a means of socialization of the central government, Bulog and Regional-Owned Enterprises (BUMD) Cipinang Rice Market to business and consumer in the digital economy. Cipinang rice market is actually is traditional market, but this market represent the majority of people that buying rice is mostly goes to traditional market. According to Indrasari et al. (2016), from 100 respondents in Jakarta, Bandung and Yogyakarta, people bought their rice: 40% from traditional market; 22% from modern market; 13% from mini market; 18% from farmers, mills, rice shops, cooperatives; and 7% from the their own harvest.

Results and Discussion

The form of communication is one of the instruments in the framework of public transparency so that people can obtain correct information and know how much the price and stock of rice on the market. In Indonesia, mass communication is often known as socialization in Indonesia. To be more effective, the government can also utilize information technology such as internet in order to help business actors and consumers access data about stock and price of rice. There are six key advantages of internet in terms of communication (socialization) that can be implemented in rice policy: (1) provide ease of sending and receiving messages quickly and cheap, (2) marketing and business research, (3) easiness to obtain data and information, (4) the cooperation of new product and services development, (5) information exchange by means of communication and socialization between business actors, (6) producers who pay attention to consumer satisfaction can offer product consultation, consumer satisfaction survey, new information exchange (Turban et al., 2005; Samovar and Porter, 1985). If these six keys can be implemented optimally then it is expected to make people live better.

Government communication / socialization to market operations and rice policy is very important. Therefore, the government commissioned Bulog to procure rice from farmers or imports to ensure the supply and rice price can be affordable by the whole community (Zulham and Ferizal, 2006). In addition, according to Wijayanti et al. (2011), the management of rice stocks in Bulog should be watched carefully, especially for the procurement of rice because the supply of rice (stock) negatively effects the price of the producer level. In predicting the price and stock of rice, there is a need for an econometric methodology so that the results obtained have strong statistical evidence and can be justified scientifically.

Table 1 shows that the average price of SLYP cianjur rice is more expensive than other rice. The skewness value greater than zero (0) for IR 64I and IR 64II (Sentra Ramos) rice prices indicates that the data distribution is more to the right. The value of kurtosis is greater than three (3) for all rice prices because the quadratic distribution of the price of rice has a fat tail compared to the normal distribution. More than three (3) kurtosis values also indicate heteroscedasticity.

Data Stationarity Test Results

The data were analyzed using Eviews version 7 and version 8 econometric, OxMetrics software. The stationary data test should be performed before estimating ARMA and ARCH / GARCH models. Time coherent data can be said to be stationary if the value of the mean, variance and autocovariance for each lag is constant over time (Gujarati, 2003). The way to detect the stationarity of an existing variable is by using Augmented Dicky-Fuller (ADF) test. This ADF test is done at a level level. The result is all stationary variables at the level level (Table 2).

Table 1. Descriptive Quantitative Data Analysis

Description	Cianjur SLYP (Rp/Kg)	IR 64 I (Rp/Kg)	IR 64 II (Rp/Kg)	Stock (Ton)
Mean	12.068	9.768	8.952	40.900
Median	12.200	9.800	8.950	41.100
Maximum	12.500	11.500	10.800	55.778
Minimum	11.200	9.000	8.100	22.077
Std. Dev.	276,27	403,88	468,60	7791
Skewness	-1,432271	0,790589	0,563757	-0,044614
Kurtosis	5,011187	5,945589	4,571181	2,401947
Jarque-Bera	277,1670	252,8710	84,61517	8,272348
Probability	0,000000	0,000000	0,000000	0,015984
Sum	6553450.	5304350.	4861400.	22209226
Sum Sq. Dev.	41369622	88412136	1,19E+08	3,29E+10
Observations	543	543	543	543

Source: authors' calculation, 2018.

Table 2. Stationerity Test Results Using Augmented Dicky-Fuller (ADF)

No.	Variable	Test ADF	MacKinnon Critical Value	Orde Integration
1.	Cianjur SLYP Price	-3,286527	-2,866673**	Level
2.	IR 64 I Price	-2,724129	-2,569564*	Level
3.	IR 64 II Price	-2,611188	-2,569564*	Level
4.	Rice Stock	-3,275260	-2,866795**	Level

information significance * = 10%, ** = 5%.
Source: authorized person, 2018.

Results of ARMA Analysis

Table 3 shows that the best ARMA model for all four variables is ARMA (1,1). One stock variable and three rice price variables are known to have first-order Autoregressive and first-order moving average. The election of the first order is common in the ARMA model because if the order is taken higher (e.g. second or third order) then the effect will be smaller in ARMA model.

Table 3. ARMA Model for Price and Rice Stock

No.	Variable	The Best Model for ARMA
1.	Cianjur SLYP Price	ARMA (1,1)
2.	IR 64I Price	ARMA (1,1)
3.	IR 64II Price	ARMA (1,1)
4.	Rice Stock	ARMA (1,1)

Source: authorized results of the authors, 2018.

ARCH / GARCH Test Results

This research uses ARCH / GARCH model based on ARMA model. The ARMA result shows that clustering volatility indicates an ARCH effect. Furthermore, to test there ARCH effect or not on model then used ARCH-LM test.

Table 4. ARCH-LM Test

No.	Variable	Obs*R-squared (LM statistic)	F-statistics (Probability)
1.	Cianjur SLYP Price	22,47	11,61 (0.000)***
2.	IR 64 I Price	37,59	20,01 (0.000)***
3.	IR 64 II Price	44,50	24,02 (0.000)***
4.	Rice Stock	8,51	4,2 (0.0142)**

information significance * = 10%, ** = 5%, *** = 1%
Source: authorized results of the authors, 2018.

Table 4 shows that the price variables of Cianjur SLYP rice, IR 64I rice prices and IR 64II rice prices have a probability below 1%, while rice stock variables have a probability below 5%. This indicates an indication that ARMA analysis (1,1) -ARCH / GARCH will be more effective than using only the ARMA test. The next step is to simulate the ARCH / GARCH test by estimating the parameters using Quasi Maximum Likelihood (QML). This test looks at the ARCH-GARCH model of the lowest value presented in Akaike Info Criterion (AIC) and Schwarz Criterion (SC).

Table 5. Test ARMA (1,1) -ARCH / GARCH for Rice Price Cianjur SLYP

Coefficient	ARCH (1)	ARCH (2)	GARCH (1,1)
Constant (C)	49025***	52354***	48672***
ARCH *(α_1)*	-0,248	-0,255	-0,1096***
ARCH *(α_2)*	-	-0.167	-
GARCH *(β)*	-	-	-0,9917***
AIC	12,672	12,792	11,7325
SC	12,712	12,763	11,7801

information significance * = 10%, ** = 5%, *** = 1%
Source: authorized results of the authors, 2018.

Table 6. Test ARMA (1,1) -ARCH / GARCH for IR64I Rice Price

Coefficient	ARCH (1)	ARCH (2)	GARCH (1,1)
Constant (C)	107064***	114043***	105939***
ARCH *(α_1)*	-0,176	-0,226	-0,0816**
ARCH *(α_2)*	-	-0.138	-
GARCH *(β)*	-	-	-0,8722***
AIC	13,472	13,523	12,850
SC	13,488	13,541	12,869

information significance * = 10%, ** = 5%, *** = 1%
Source: authorized results of the authors, 2018.

Table 7. Test ARMA (1,1) -ARCH / GARCH for IR64II Rice Price

Coefficient	ARCH (1)	ARCH (2)	GARCH (1,1)
Constant (C)	143885***	153648***	8888***
ARCH *(α_1)*	-0,2264	-0,3174**	-0,004***
ARCH *(α_2)*	-	-0.1357	-
GARCH *(β)*	-	-	-0,9076***
AIC	13,755	13,825	11,344
SC	13,771	13,872	11,391

information significance * = 10%, ** = 5%, *** = 1%
Source: authorized results of the authors, 2016.

Table 8. Test ARMA (1,1) -ARCH / GARCH for Rice Stock

Coefficient	ARCH (1)	ARCH (2)	GARCH (1,1)
Constant (C)	39826084***	42423438***	39393193***
ARCH *(α_1)*	0,0806*	-2,367**	-1,769***
ARCH *(α_2)*	-	-2,703***	-
GARCH *(β)*	-	-	-0,934***
AIC	19,273	19,291	18,651
SC	19,312	19,309	18,669

information significance * = 10%, ** = 5%, *** = 1%
Source: authorized results of the authors, 2018.

Tables 5, 6, 7, and 8 show that α_1 and α_2 are the coefficients of ARCH and β is the GARCH coefficient. This calculation takes the lowest values of AIC and SC. In addition, there are also significant values of constants, α and β. So, based on the simulation comparison of some models above shows that the best model chosen is ARMA (1,1) -GARCH (1,1).

Table 9. Test ARMA (1,1) -GARCH (1,1) With Dummy Variable Socialization and Number of Market Operations Rice Against Stock and Price of Rice

Coefficient	Cianjur SLYP Rice Price	IR-64I Rice Price	IR-64II Rice Price	Rice Stock
Mean Equation				
Constant (c_1)	12026***	9783,6***	8946,9	40930***
AR (1) (β_1)	0,957***	0,691***	0,9892***	0,627
MA (1) (δ_1)	0.05	0,469	0,014	0,79*
Variance Equation				
Constant (c_2)	73571	163152,5	219926***	60609268
ARCH (α_1)	0,2402	0,075	0,2009	-0,104
GARCH (β_3)	-0,005	0,423	-0,235	0,423
Dummy 1 (β_4)	-0.602	-0,61*	-0,467	-11,85***
Dummy 2 (β_5)	-1,082	-3,233	-4,671	-10,273***
AIC	13,056	14,432	13,905	20,216
SC	13,119	14,495	13,969	20,279
HQ	13,081	14,457	13,93	20,241
Log Likelihood	-3523,7	-3895,9	-3753,4	-5460,5

information significance * = 10%, ** = 5%, *** = 1%
Source: authorized results of the authors, 2018.

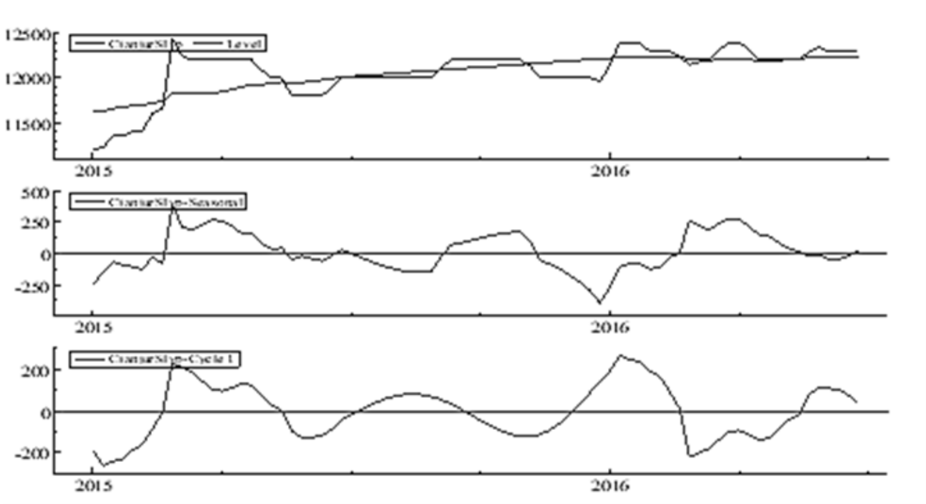
Table 9 shows an estimate of conditional variance to see the effects of "mass communication and the number of market operations" to rice stocks and prices in Indonesia. The estimation results show that the effect of socialization and the number of market operations is negative against the price and stock of rice. Socialization and relatively large number of market operations on rice prices and stocks. This indicates that socialization and relatively large number of market operations are more effective in controlling rice prices and stocks. However, the significance of the dummy variable coefficient only occurs in IR-64 I rice price at D_1 and rice stock on D_1 and D_2. This indicates that the socialization and the number of rice market operations more affect the stock than the price of rice. The stock of rice as a variable between government policies can be directly affected by market operations by increasing the supply of rice, while rice price variables tend to be more difficult to influence, due to other factors such as consumer tastes and distribution.

Table 10. Test ARMA (1,1) -GARCH (1,1) With Dummy Variable Rice Policy on Rice Stock and Prices

Coefficient	Cianjur SLYP Rice Price	IR-64 I Rice Price	IR-64 II Rice Price	Rice Stock
Mean Equation				
Constant (c_3)	12088***	9773,2***	8960,8	40890***
AR (1) (β_6)	0,892**	0,475***	1,021***	0,973***
MA (1) (δ_2)	0.202	0,45*	0,096	0,741***
Variance Equation				
Constant (c_4)	73662	163154*	219953,1**	60609268***
ARCH (α_2)	0,064	0,065	-0,017	-1,34***
GARCH (β_7)	0,438	0,485	0,361	-0,991***
Dummy 3 (β_8)	-0.543	-0,43	-0,546	-0,112**
Dummy 4 (β_9)	-1,514	-3,718**	-7,758***	0,287***
AIC	13,637	14,527	14,508	18,907
SC	13,7	14,591	14,572	18,971
HQ	13,662	14,552	14,533	18,932
Log Likelihood	-3680,9	-3921,7	-3916,6	-5106,4

information significance * = 10%, ** = 5%, *** = 1%
Source: authorized results of the authors, 2018.

Table 10 shows an estimate of conditional variance to see the effect of rice policy on rice stock and price. The estimation result shows that the effect of rice policy is negative to rice price and stock. Dummy variables after the enactment of rice policy have a greater coefficient in absolute than before the enactment of rice policy on rice price and stock. This indicates that rice policy, especially PP No.71 Year 2015, is relatively effective controlling rice prices and stocks. However, the significance of dummy variable coefficient does not occur at Cianjur SLYP rice price, this situation possible because the price of Cianjur SLYP rice is relatively more expensive compared to IR64 rice price. Apparently for premium quality rice is not required special rice policy to regulate because its market segment is already special with middle / upper level consumers. PP No.71 Year 2015 is more regulated to rice for middle-class consumers who



Source: Oxmetrices software calculation results, 2018.

Figure 1. Development of Rice Price of Cianjur SLYP and the Influence of Trend, Cycle, and Seasonal Components

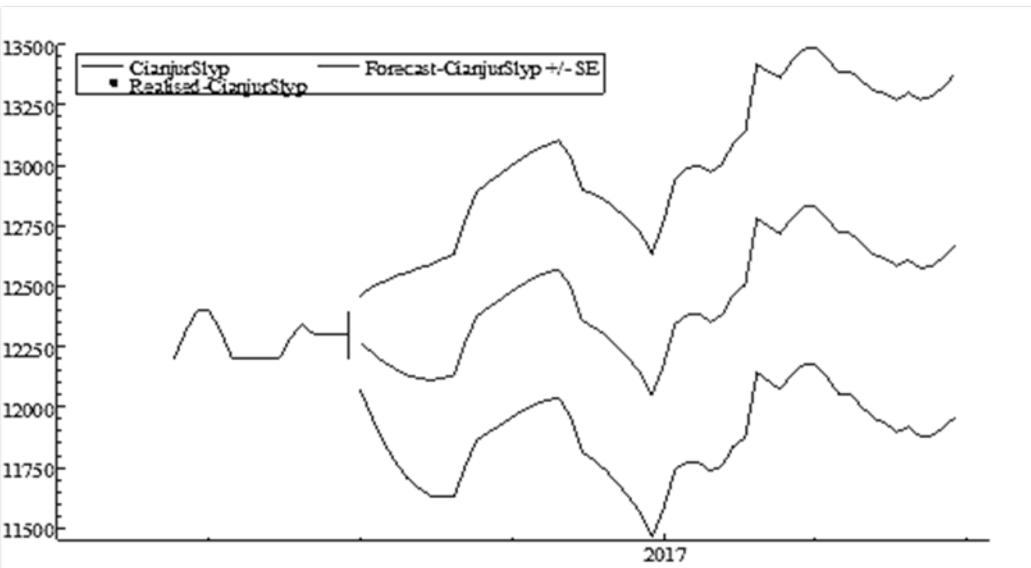
are relatively more than middle / upper consumers so that the affordability of prices and availability of goods needs to be regulated by the government.

Analysis Result from Estimation of *Structural Time-Series Model (STSM) Decomposition*

Rice Price of Cianjur SLYP Analysis with *STSM Decomposition*

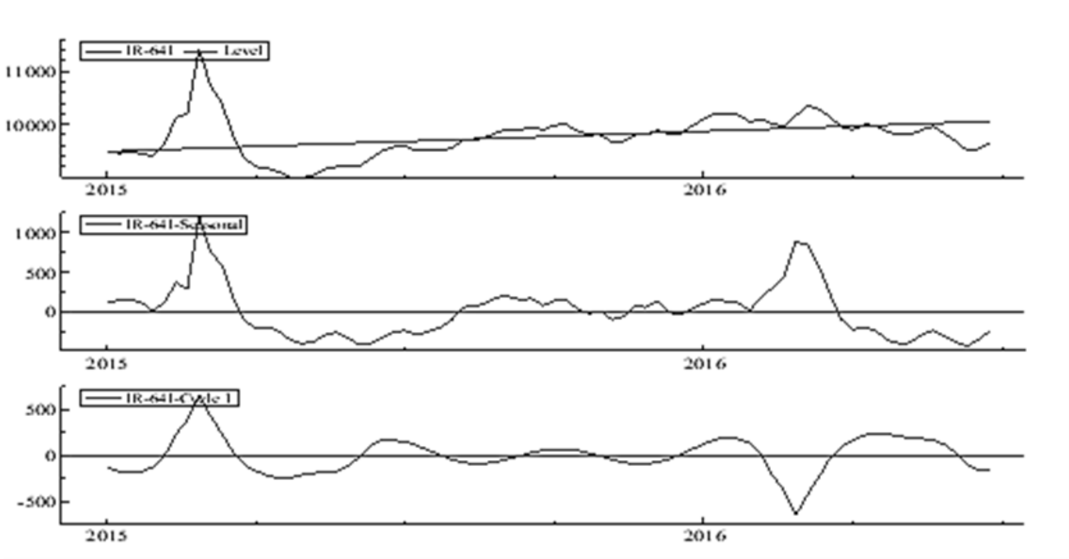
STSM Decomposition approach to price of Cianjur SLYP rice shows (see Figure 1): (1) Dynamics of Cianjur SLYP is derived from seasonal and cycle components associated with production, distribution and consumption of rice from West Java especially Cianjur, (2) Seasonal of Cianjur SLYP rice price in the early 2015 decreased, arose in month of April-May 2015 and then decreased from middle 2015 to August 2015, arose in month of September-October 2015, decreased in November 2015-February 2016, arose in March-May 2016. The arose of Cianjur SLYP rice price in the middle of 2015 and 2016 is in line with research from Hadikusumah (2013), where Cianjur rice, especially "Pandan Wangi" rice has the highest price in month of May-June and will be decreased in month of November-December, (3) The existence of cycle component in 2015 follow the seasonal pattern, but in 2016 the pattern is relatively different.

Forecast of rice price of Cianjur SLYP with STSM Decomposition approach can be seen in Figure 2. The rise of Cianjur SLYP rice price is predicted in 2018. This is an indication that the consumer preferences in the future tend to choose better quality of rice. Cianjur SLYP rice is represents the rice consumed by the middle / upper class society. This means that the increasing of purchasing power of the people in Indonesia can increase the consumption of better quality of rice including Cianjur SLYP rice. This is



Source: Oxmetrices software calculation results, 2018.

Figure 2. Forecast of Rice Price of Cianjur SLYP



Source: Oxmetrices software calculation results, 2018.

Figure 3. Development of Rice Price of IR 64 I and Influence of Trend, Cycle, and Seasonal Components

inline with research from (Indrasari et al., 2016), that 78% of rice consumen bought labeled rice in plastic packaging weight between 5-25 kg, the remaining 22 % bought rice in bulk form.

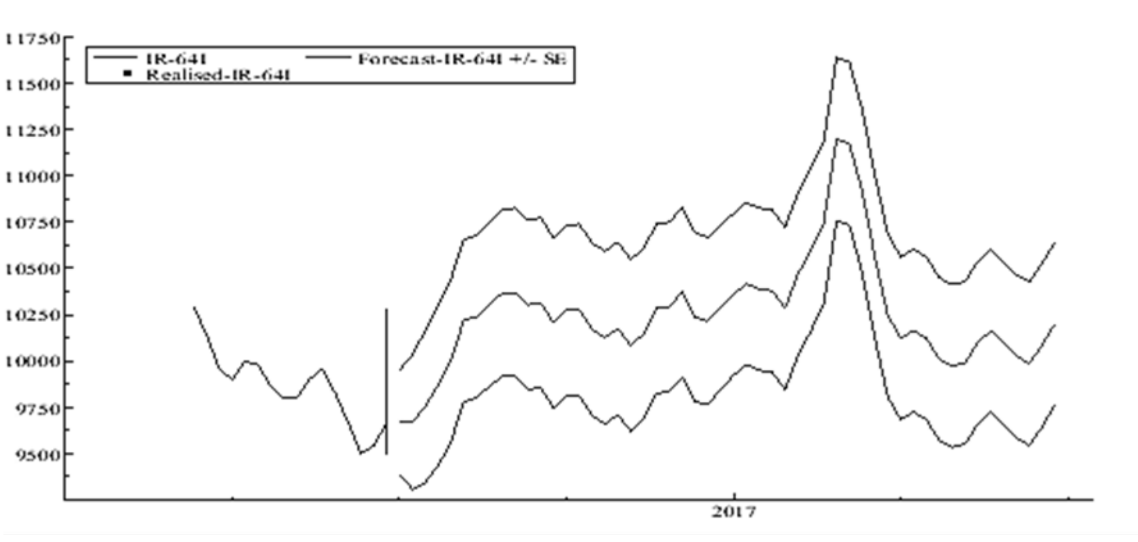
Rice Price of IR 64 I Analysis with STSM Decomposition

STSM Decomposition approach to price of IR 64 rice shows (see Figure 3): (1) Dynamics of IR 64 rice price from seasonal and cycle components (same with Cianjur SLYP rice), (2) Seasonal of IR 64 rice price in month of March-April 2015 and 2016 increased, (3) The existence of cycle component in 2015 follows the seasonal pattern but in 2016 the pattern is relatively opposite the seasonal.

Forecast of rice price of IR 64 I with STSM Decomposition approach can be seen in Figure 4. The IR 64 I rice price is predicted relatively stable in 2018. Although there is an indication of small pattern that in the month of April/May, the IR 64 I rice can be predicted to be rise. Usually, the increase of the IR 64 I only happened in two or three months, after that the price will be stable again. Relevant authorities should consider to take action more during this period of time.

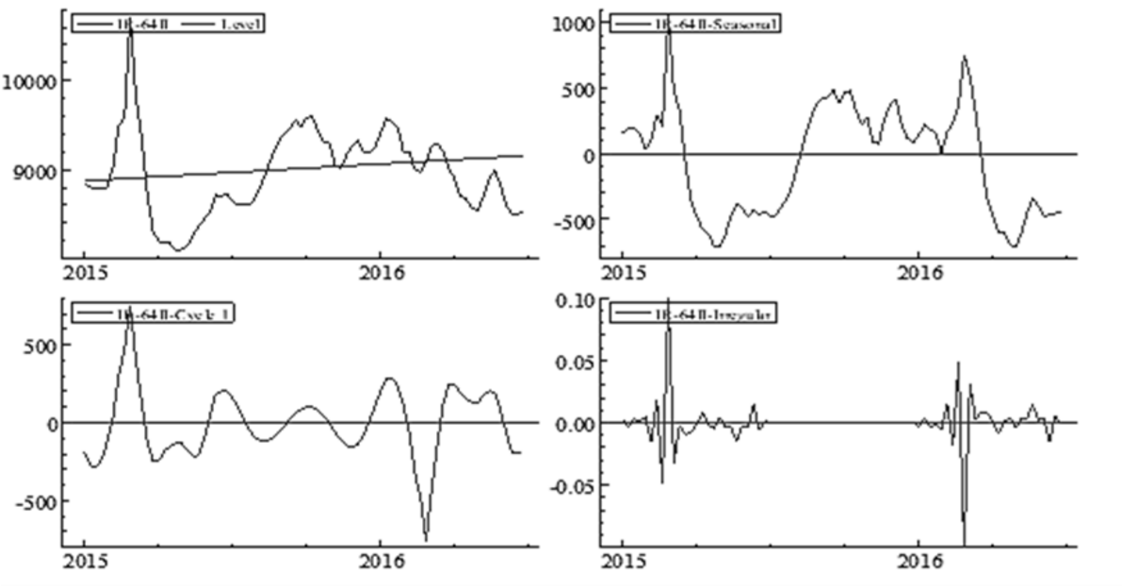
Rice Price of IR 64 II Analysis with STSM Decomposition

STSM Decomposition approach to IR 64 II rice price shows (see Figure 5): (1) Dynamics of IR 64 II rice price derived from seasonal, cycle and irregularity components associated with production, distribution and consumption of rice from West Java, Central Java and East Java, (2) Seasonal of IR 64 II rice price reach its peak in the beginning of 2015 and 2016, (3) Cycle



Source: Oxmetrices software calculation results, 2018.

Figure 4. Forecast of Rice Price of IR 64 I



Source: Oxmetrices software calculation results, 2018.

Figure 5. Development of Rice Price of IR 64 II and Influence of Trend, Cycle, Seasonal and Irregularities Components

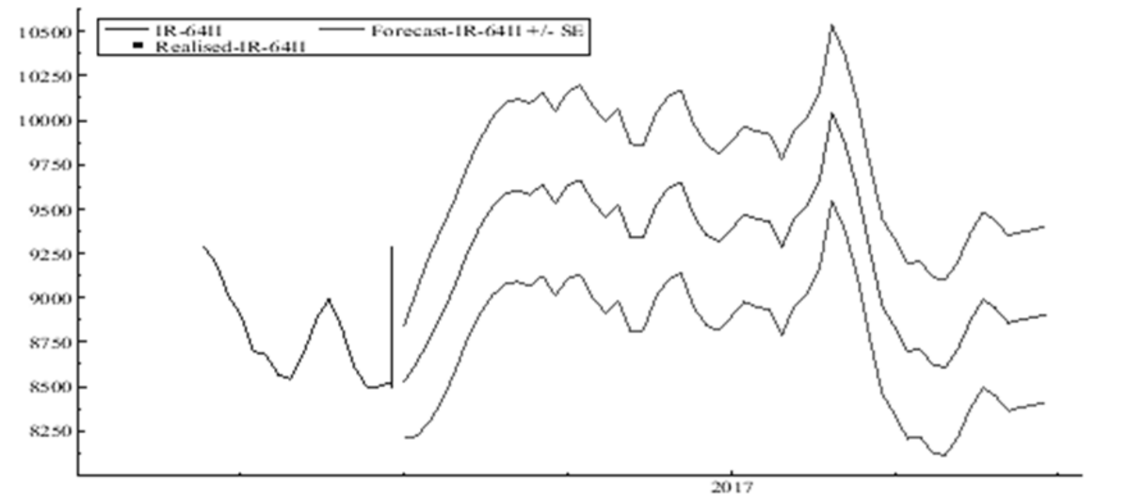
of IR 64 II rice price reach its peak in the beginning of 2015 and reach its bottom in the early of 2016, (4) Different with Cianjur SLYP and IR 64 I, the IR 64 II rice price has irregularity component.

Forecast of rice price of IR 64 II rice price with STSM Decomposition approach can be seen in Figure 6. There is indication that IR 64 II rice price is predicted decline in 2018. There is an indication the the production of IR 64 II price increased because if the rice supply incresed then the price tend to decline. The relevant authorities should consider to maintain the productivity of IR 64 II rice because majority of the Indonesian people prefer to choose cheaper rice. According to (Sutrisno, 2007), the consumer segment of rice differs between consumers with upper, middle, and lower income, but in general people's preferences (about 60%) still choose cheap price with low to medium quality, while the rest (about 40%) choose rice with good quality.

Stock of Rice with STSM Decomposition

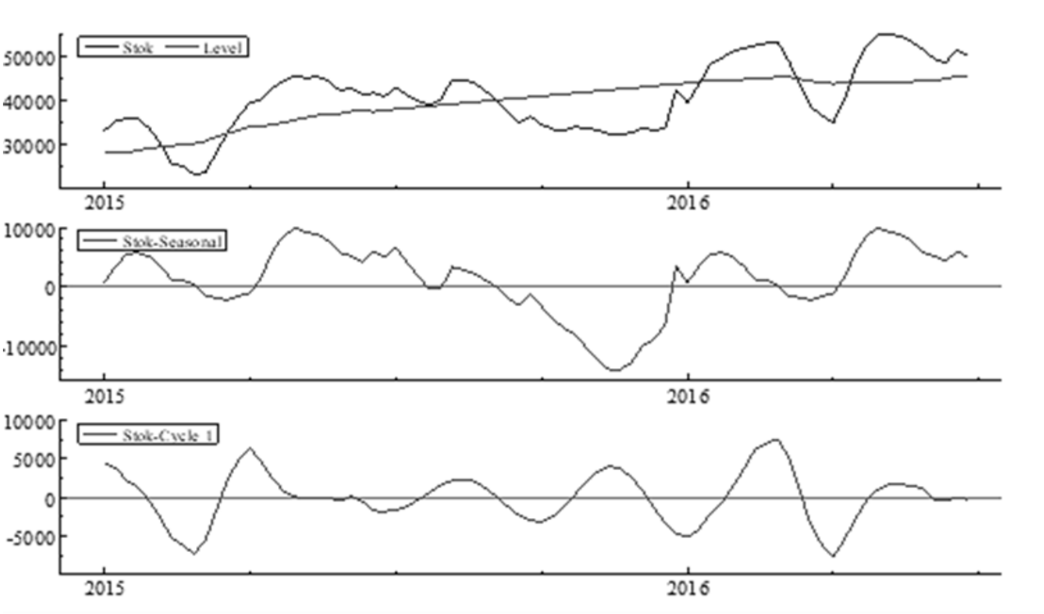
STSM Decomposition approach to Rice Stock shows (see Figure 7): (1) Dynamics of Rice Stock is derived from seasonal and cycle components associated with production, distribution and consumption of rice mostly from West Java, Central Java, and East Java, (2) Seasonal of Rice Stock reach its lowest point in month of November 2016, (3) The Existence of cycle component reaches the highest in the middle of 2015 and in the early of 2016.

Forecast of stock price with STSM Decomposition can be seen in Figure 8. The rise of stock price is



Source: Oxmetrices software calculation results, 2018.

Figure 6. Forecast of Rice Price of IR 64 II



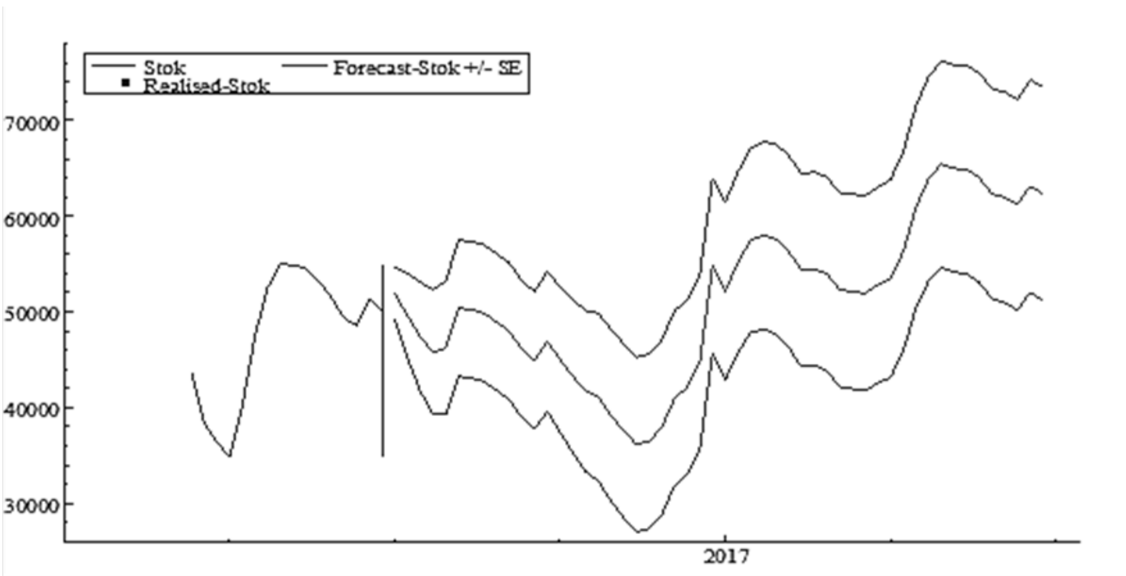
Source: Oxmetrices software calculation results, 2018.

Figure 7. Development of Rice Stock and Influence of Trend, Cycle, and Seasonal Components

predicted in 2018. The supply of rice to Cipinang Rice Market began to flow in line with the entry of the harvest season. The harvest in West Java, Central Java and East Java, can make the Cipinang Rice stock rise again (Republika, 2018).

CONCLUSION

Based on the calculation, as it turns out that the best model for the four variables with the number of significant variables or more is ARMA(1,1)-GARCH(1,1). It is because the AIC and SC values are the lowest. The estimation result of dummy variables with ARMA(1,1)-GARCH(1,1) indicates that socialization and relatively large number of market operations have a greater impact in controlling rice prices and stocks in the market. However, socialization and number of market operations significantly affected the stock compared to the rice prices. The result of ARMA(1,1)-GARCH(1,1) estimations with dummy variable of rice policy indicates that PP No.71 Year 2015 is relatively effective in controlling rice and stock price. Nevertheless, the significance of the dummy variable coefficient does not occur in the price of Cianjur SLYP rice because the price is more expensive compared to the price of IR64 rice. This indicates that for the type of premium rice is not required special rice policy to regulate it PP No.71 Year 2015 is more effective in regulating rice for middle and lower consumers in terms of maintaining the affordability of rice prices and availability by the government and Bulog.



Source: Oxmetrices software calculation results, 2018.

Figure 8. Forecast of Stock Price

The STSM shows the rice price of Cianjur SLYP, IR 64 I, and stock price are derived from trend, seasonal, and cycle, but rice price of IR 64 II derived from trend, seasonal, cycle and irregularity. In general, the price and stock of rice more fluctuated in the early of the year, especially in the month of January-March. Therefore, the relevant government is expected to maximize rice policy in order to maintain rice price stability in short term, medium term, and long term.

Stakeholders and policy makers related to the price and stock of rice need to see the movement of Cianjur SLYP, IR 64 I, IR 64 II rice price and stock price in Cipinang Rice Market because there are indications that these four variables follows different type of movements. In practices, the policy makers should increased the stock of rice in Cipinang Rice Market at the beginning of harvest season and keep maintaining the stock until paceklik season ends. Moreover, the relevant authorities for rice commodity should consider new regulation that support PP No.71 Year 2015 that might reduce the negative excess of rice price fluctuations especially for IR 64 rice because it is mostly consumed by middle and lower income.

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