Retno Lantarsih, Dwidjono Hadi Darwanto, Jangkung Handoyo Mulyo
Faculty of Agriculture, Gadjah Mada University,Yogyakarta
E-mail: retnolantarsih@yahoo.co.id

Decreasing Rice Supply as the Impact Of The Government's Policy on Rice Grain Purchasing Price

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ABSTRACT

This research aimed at examining: (1) rice supply adjustment for the long-term equilibrium (2) the impact of the government's policies on rice grain purchasing price to the rice supply, (3) and factors influencing the long-term and short-term rice supply in the rice-producing regions in Indonesia. This research used the panel data regression with the error correction model approach. The data were the yearly time series data of 1987 through 2008. The results showed that (1) the rice supply adjustment for the long-term equilibrium was at 68%, (2) in the long term, the government's policies on rice grain purchasing price reduced the rice supply, (3) in the long term, the rice retail price, the rain fall, and the technology had a positive influence on the rice supply, while the cassava and soybean prices had a negative influence. In the short term, the rice retail price and technology had a positive influence, while the cassava and soybean prices and the monetary crisis dummy had a negative influence to the rice supply in the rice-producing regions in Indonesia.

KEY WORDS: rice supply, error correction model, panel data, Indonesia

INTRODUCTION

Rice plays a strategic role in achieving the food resilience, absorbing the human labor, and achieving the national stability. To achieve the national food resilience, it is necessary to have an adequate rice supply in order to meet the domestic rice need. The effort for meeting the rice supply is prioritized with domestically produced rice. Such is very important because at present rice is the stapple food for the majority of the Indonesian society, and the majority also wish to have a stable rice supply at an affordable price. Therefore, the government's role in the economy of rice in Indonesia is highly needed. Availability of food stuffs in Indonesia, including rice, is determined by the domestic production capacity as well as the domestic and global trade policies. According to Rusastra, Saliem, and Ashari (2010), the policies consist of the policies in food stuff production, supply, exports and imports, and some others. The rice sector is also the largest labor-absorbing sector because it includes the processes of production, processing, and trading as well as the supporting sectors, such as transportation (Saifullah, 2009). Rice policies have been adopted to reach the national stability, so rice policies need to be formulated prudently.

The increase of rice domestic production has been a priority in the national development. This is shown in the agricultural revitalization which was launched in June 2005 and aimed at returning to the once-sustainable rice-self-sufficiency. Efforts for increasing rice production have been made by increasing productivity and expanding rice-farming. The increase of rice production is inseparable from the availability of irrigation water, fertilizer, qualified seeds, and rice-farming technology, but unfortunately it has been relied only on the island of Java as as the main rice-producer in Indonesia. Meanwhile, Java has faced major obstacles in rice production, such as the diminishing farming lands due to the population increase and the decreasing quality of the irrigation infrastructures.

Potential-wise, Indonesia still has very good land-availability for rice growing expansion. The rice-producing lands in 2009 were mostly in Java, which were 5,909,468 hectares in area or 46.65% of the national figure. They were distributed almost evenly in West Java, Central Java and East Java provinces, which were respectively 14.79%, 14.50% and 13.29 %. The island of Sumatra had 26.07% of the national rice-producing lands. Three provinces in Sumatra with the largest rice farming areas were North Sumatra (6.10%), South Sumatra (5.86%), and Lampung (4.32%). The island of Celebes had 11.06%, with South Sulawesi Province as the largest (6.64%). The rice-producing areas for the period of 2005 to 2009 throughout the country continuously increased.

In addition to the rice-supply stability policy through the production increase program, the government has also enforeced the rice-price stabilization policy. This later policy was an important one during the New Order era. Then, the government determined the rice and rice-grain prices with the market price instrument. Via *Bulog* (National Logistic Bureuau), the government also set up the rice and rice grain supply. The floor-price policy was compensated with input subsidy, rice-farming research, irrigation building, and farmng information dissemination so that finally it led Indonesia to reach rice self-sufficiency in1984 (Sawit, 2010). However, from the 1980s to the mids of the 1990s there was a slow decrease of rice production. According to (Darwanto, 2001), the rice self-sufficiency failed to be maintained because of disincentive factors such as (1) no more finding of new high-yield varieties of rice, (2) the shift of the government's economic policy to the industrial sector, which has left behind the agricultural development, and (3) the changes of the economic and physical environments. These all led to the decrease of the rice production growth so that in order to meet the domestic rice demand Indonesia had to import rice.

In the period of 1997 to 2000, the government had to adopt rice price liberalization (Bulog's import monopoly was abolished and private companies were allowed to import rice) due to the pressure of the economic donor agencies. During the period there was a steep increase of food and non-food prices. The rice price increased 16 folds in comparison to the price before the economic crisis. This condition led to the increasing number of the poor population (Ariani, 2004). In the end of 2001, the government rearranged the national rice policies. The floor price policy was replaced with the government basic purchasing price as regulated in Presidential Instruction No. 9 of 2001, which was enforced on 1 January 2002. Through Presidential Instruction No.2 of 2005, the determination of the government purchasing price could no more refer to the international rice price but had to be fully determined by the production costs (Sawit, 2010). The cost of implementing the government purchasing price policy is lower that the rice-grain floor price policy. In the former, the government only needed to buy rice or rice grain in the amount required by the distribution demand.

Theoretically, the supply concept represents the producers' general behavior. If the price of an item increases, the producers' supply for the item will

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increase too, and vice versa. The supply shows the amount of the item offered by the producers at various levels in certain periods while other factors remain constant (*ceteris paribus*). Mathematically, the supply function can be formulated as follows,

$$Y_t^s = f(X_{1t}, X_{2t}, X_{3t}, ..., X_{nt}, U_t) \qquad (1)$$

where Y_t^s is the amount of the item supply, X_{1t} is the price of the item, X_{2t} is the prices of the inputs needed for the production process, $X_{3t}, ..., X_{nt}$ represent non-economic determinants such as technology and institutional factors, while U_t is the stochastic disturbance.

In the study of economics, the dependence of variable Y (dependent variabel) on other variable X (independent variable) is seldom instantly observed and often creates a lag effect, which is observed after some time. According to Irawan (2005) and Suryadi, Ananda, and Kiptiyah (2008), there are at least three main reasons which are responsible for the lag, namely the psychological, institutional, and technological factors. A main characteristic of an agricultural product is the time interval between the planting and harvesting. For the majority of agricultural products, the output price cannot be determined when the commodities were planted. Based on their price estimation and experience, farmers make a production decision. The responses of an agricultural commodity towards the (input and output) price change and other determinant factors (such as the government's policies) require a time lag. Thus, the dynamic supply function also involves a lagged variable as an independent variable (Adnyana, 2000; Suryadi, Ananda, dan Kiptiyah, 2008). During the production process, if farmers experience a rice(-grain) price increase, they cannot readily respond to it. This is because the decision for resource allocation has been applied in the earlier period (the planting period). According to Tomek and Robinson (1990), the above condition is called asset fixity. If this price increase is predicted to remain constant in the next period, only then do farmers change the resource compositions for the next planting season. Therefore, the influence of the price increase can be seen only in the next planting period. If the prediction for the expectation is acceptable, the specific relationship between the expected price and the past price can be made, so that a model can be developed into a dynamic one, such as Nerlove's partial adjustment model.

According to the assumption developed in Nerlove's partial adjustment model, at any period farmers adjust future price estimates in the form of the proportion of the difference between prediction and reality. Farmers cannot immediately adjust their production activities as a response of a previous market stimulus. According to Saksono (1998) and Rahayu (2008), Nerlove's adjustment model describes the agricultural dynamic supply which relates it to the expected price. The general suppy function is as follows:

$$Q_t^{s*} = a_0 + a_1 P_{x,t}^* + a_2 Z_t \qquad (3)$$

Q^{s*}_t is the expected output or the equilibrium output at time t. $P^*_{x,t}$ is the expected price of P_x at a determined t at t-1. In this model, it assumed that $P_{x,t}^* = P_{x,t-1}$, which means that farmers assume and expect the prices in the previous planting seasons will remain constant during the following harvesting season. Z_t reflects the ecology, the technology, and the economic influence.The

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change of the actual supply at time t is a ä of the change of the planned/expected supply equilibrium.

$$Q_t^s - Q_{t-1}^s = \delta(Q_{t-1}^{s*} - Q_{t-1}^s)$$

$$Q_t^s = Q_{t-1}^s + \delta(Q_{t-1}^{s*} - Q_{t-1}^s)$$

$$Q_t^s = \delta Q_{t-1}^{s*} + (1-\delta)Q_{t-1}^s \quad (4)$$

If equation (3) is substituted to equation (4), the following equation (5) is obtained:

$$Q_t^s = \delta(a_0 + a_1 P_{x,t}^* + a_2 Z_t) + (1-\delta)Q_{t-1}^s \quad (5)$$

$$Q_t^s = \delta a_0 + \delta a_1 P_{x,t}^* + \delta a_2 Z_t + (1-\delta)Q_{t-1}^s$$

Assuming that the product price estimate is the same as the current price or, the supply equation can be stated as follows:

$$Q_t^s = \delta a_0 + \delta a_1 P_{x,t-1} + \delta a_2 Z_t + (1-\delta)Q_{t-1}^s \quad (6)$$

According to McKay, Morrisey, and Vaillant (1998), the adoption of traditional approach for estimating aggregate supply responses has received criticisms for its empirical and theoretical background. Nerlove's technique fails to show quite obvious and concise distinction between long-term elasticity and short-term elasticity. The OLS adoption can possibly result in spurious regression. Assumption of specific behavior of Nerlove's approach is not satisfactory while the modern time-series technique offers a new hope. The cointegration analysis can be applied on unstationary data and it can also get rid of spurious regression. The cointegration analysis which is combined with the error correction model (ECM) can provide the significance of the estimation of short-term elasticity and long-term elasticity.

The Error Correction Model (ECM) is a model which includes adjustment to correct imbalances (Widarjono, 2007; Winarno, 2007). According to Insukindro (1999), the ECM sincde the early has been used in econometric analyses for time series data introduced by Sargan. This model was then developed by Hendry, who introduced the concept of The General to Specific Approach and finally was popularized by Engle-Granger (Insukindro, 1991; Widarjono, 2007). The *ECM* assumes the long-term permanent equilibrium among economic variables. This model corrects the short-term imbalance in the next period (Engle and Granger, 1987). The error correction mechanism can be interpreted as a balancer for the short-term and long-term behavior (Engle and Yoo, 1987). This is taken as an effort to solve the problem of the utilization of unstationary time-series data. The utilization of unstationary data might produce spurious regression. Therefore, economic analyses require a sound empirical model which can account for the occurring economic phenomena.

The Error Correction Model which is consistent with the cointegration concept is known as Granger Representation Theorem (Engle and Granger, 1987). This model emphasizes that if observed variables form a cointegrated set the valid dynamic model is the ECM. This means that if there are two unstationary economic variables at one level but the variables become stationary at the differency level and there is a co-integration relation between the two, it can stated that there has been a long-term equilibrium relation between the two variables. The possibility of a short-term equilibrium requires adjustment (Widarjono, 2007; Winarno, 2007). Engle and Granger's ECM model provides long-term equilibrium information by keeping on providing short-term information. This model is known as Engle and Granger's two-step model.

The ECM approach has the capability to utilize more variables in analyzing short-term and long-term economic phenomena. It can also be used to check the consistency of empirical models with economic theories and seek for solution for unstationary time-series variable problems and spurious regression (Insukindro 1999). Previous researches with the ECM model include those conducted by Pasaribu and Saleh (2001), Alemu, Oosthuizen and Van Schalkwyk (2003), Malian, Mardianto, and Ariani (2004), and Irawan (2006). Pasaribu and Saleh (2001) applied the ECM in simultaneous equations for case studies on money earning and money supply. Their research results show that using the the first lag of integration equation residuals and the Two Two Stage Least Square (TSLS) or the error correction term (ECT), an ECM empirical result which is more valid than the ECT estimated with the Ordinary Least Square (OLS) is obtained. Alemu, Oosthuizen and Van Schalkwyk (2003) analyzed the response of the supply of grains (teff, wheat, corn, and sorghum). The research concluded that the planned supply of a crop is positively influenced by the real price of a commodity in the producers' level, and is negatively influenced by the real price of the substitution items at the producers' level. This was observed in both the short term and the long term. The short-term price elasticity was not significant except for corn. Long-term prices were not elastic. Malian, Mardianto and Ariani (2004) used the ECM to analyze factors influencing rice production, rice consumption, and rice prices and also food stuff price inflation. The factors influencing rice production (represented by the harvest area) are the previous harvest area, the urea fertilizer price, the domestic rice price, and the rice import volume. The factors influencing rice consumtion consist of the population size, the previous year's rice import, the domestic price of corn kernels, the domestic rice price, and the rice grain floor price. Irawan (2006) conducted a research on rice market integration. The result showed the integration of the province rice market, the national (Jakarta) rice market, and the international (Bangkok) rice market. This means that every change in the international rice market will have an impact on the domestic rice price. Nkang et. all. (2006) conducted a survey on the chocolate export trade in Nigeria. The research showed that the short-term chocolate export supply was negatively influenced by the producer-level real price. This shows the possibility of the long-term prospect for chocolate export increase, but productivity increase, replacement of old-trees and research to eliminate plant diseases are needed.Yusuf and Yusuf (2007) conducted a research to determine the export commodities. Their research indicated that the previous year's production and the world-trade net value had a negative influence on the chocolate export, meanwhile the previous year's real Gross Domestic Product contributed positively the chocolate export. The rubber price lag ratio decreased the rubber export, but the conversion rate had positive influence to the rubber export. The previous year's palm seed export and the real GDP contributed positively to the palm seed export, while the previous year's production negatively influenced the palm seed export. The implication is that promotion of agricultural crop export to reduce the dependence on the oil export is needed.

http://dx.doi.org/10.18196/jgp.2015.0006

The above discussion shows that previous researches on the supply of agricultural crop commodities, including rice, generally used the concept that supply is the total of the domestic rice production, the import volume, and the change of rice stocks. The domestic production is elaborated in the functions of the harvest area and the productivity. However, most researchers used the price response in the productivity function, which views the productivity of a commodity is a response to price change. Viewed from the production theory, production is a function of the amount of utilized inputs so that productivity, which is no other than the amount of production per area unit, should also be a function of the total of the inputs and not of the price of the inputs. In addition, the studies on supply using Nerlove's adjustment model still produce good short-term and long-term elasticity values. When examined further, the influence of the independent variable to the harvest area and producitivity is not always significant. So far, the ECM approach has been more often applied to analyze the market integration, and it has been used for analzing the supply of commodity exports. The ECM approach can also provide distinction between short-term and long-term elasticity, and can provide information on the rate of adjustment of imbalance to long-term balance through the ECT. The ECM approach can also be applied to the OLS and TSLS estimation. The ECM has provided empirical results which are in line with the theories. However, the ECM application in the analysis of rice supply, in the present writers' observation, has been rarely done.

The study on rice supply in this present research uses the direct supply model. The rice supply is function of the price of rice itself, the price of substitution/complementary food stuffs (corn, cassava, sweet potato, and peanuts), the price of the inputs (urea fertilizer), the climate (precipitation), the technology (used in the rice productivity proxy) and other external variables (the monetary crisis dummy and the crop price policy dummy) using the the panel data regression with the ECM approach. The application of this method is expected to produce higher consistence in the supply elasticity estimation result. In this relation, this research is aimed at examining: (1) the adjustment of rice supply in order to have a long-term equilibrium, (2) the impacts of the government policy in grain/rice purchasing prices to rice supply, and (3) the factors influencing rice supplies in the rice-producing regions in Indonesia both in the short term and in the long term.

RESEARCH METHODS

This study of the rice supplies in Indonesian rice-producing regions used the yearly time-series data from the period of 1987 to 2008. The data consisted of rice production, rice-harvesting areas, rice productivity, and the prices of several commodities (rice grain, rice, corn, cassava, soybean, peanut, and sweet potato), the price of urea fertilizer, the precipitation, and the government's policy in rice/rice grain. The data were obtained from the Ministry of Agriculture, the Central Bureau of Statistics, *Bulog* Public Company, Bank of Indonesia, IRRI, FAO, and other related institutions..

What is the different between election monitoring and election observation? Bjorlund (2004, pp. 40-41) explains that "monitoring" and "observation" signifying two different positions in a range along with two different aspects. First, the "degree of involvementin the process" and second, the

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period of time over which the activity occurs. First, concerning the involvement, "observation" connotes to something relatively passive, while "monitoring" refers to something more engaged. Bjorlund (2004, p. 41) also notes that in theory level, "observation" is limited to reporting and recording, whereas "monitoring" enables some possibilities of modest interventions to correct the deficiencies or to offer recommendation for action. However, in practice, observers at the polling stations often deliver some advice or highlight some problems that can be fixed. This research covered 8 rice-producing provinces in Indonesia, which were West Java, Central and Eas Java provinces to represent rice-producing regions in Java; North and South Sumatra provinces and Lampung Province to represent the rice-producing regions in the island of Sumatra, South Sulawesi and North Sulawesi to represent rice-producing regions in the island of Sulawesi.

Rice supplies in the rice-producing regions in Indnesia were analyzed using the panel data regression with the Error Correction Model (ECM). In the panel data regression analysis, cross-sectionally each province had a number of time-series data. Before the data were analyzed further, all the variables used in the regression analysis were transformed into natural logarithm forms. The applied ECM in this research was Engle Granger's ECM. Several requirements have to be satisfied in using the Engle Granger's ECM, namely: (1) the integration degree of the used data data should be identified and (2) the applied regression equations must pass the cointegration test.

The ECM estimation procedure started with testing unit roots and the used cointegration variables. This test was conducted to check whether the analyzed data were stationary (non-stochastic) or not (which means that they had a stochastic trend (Pasaribu and Saleh, 2001). The stationarity test was conducted to all time-series data used in the supply analysis. This was done to prevent spurious regression. The method used to detect the problem of data sationarity was the unit root test using the Dickey-Fuller (DF) formula. The unit root test was as follows:

$$\Delta LQSb_{it} = a_{i0} + \gamma_i LQSb_{it-1} + \sum_{m=2}^{p} \beta_{i1} \Delta LQSb_{it-(1+1)} + e_{it}$$

(constant) (7)

$$\Delta LQSb_{it} = a_{i0} + a_{i1}T + \gamma_i LQSb_{it-1} + \sum_{m=2}^{p} \beta_{i1} \Delta LSDb_{it-(1+1)} + e_{it}$$

(trended constant) (8)

$$\Delta LQSb_{it} = LQSb_{it} - LQSb_{it-1} \qquad (9)$$

$$\Delta LQSb_{it-1} = LQSb_{it-1} - LQSb_{it-2} \qquad (10)$$

where is rice supply, i is a rice producing region in Indonesia (1 for West Java, 2 for Central Java, 3 for East Java, 4 for North Sumatra, 5 for South Sumatra, 6 for Lampung, 7 for South Sulawesi, and 8 for North Sulawesi), L is the natural logarythm, while t is time. The proposed hypothesis, Ho: ã = 0, stated the rice supply quantity data series () was non-stationary at the zero degree; while the alternative hypothesis, Ha: ã '" 0, stated that the rice supply quantity data series () was stationary at the zero degree. Using the same method, the stationarity test was applied to all time-series data used in this present study.

When the DF test indicated that the data were not stationary at the zero degree, non-stationary data had to be transformed to stationary data through the data differentiation process. The stationary data test through this differentiation process is called the integration degree test (Widarjono, 2007). The formula for the DF integration degree test is as follows:

$$\Delta 2LQSb_{it} = a_{i0} + \gamma_i LQSb_{it-1} + \sum_{m=2}^{p} \beta_{i1} \Delta 2LQSb_{it-(1+1)} + e_{it}$$

(constant) (11)

$$\Delta 2LQSb_{it} = a_{i0} + a_{i1}T + \gamma_i QLSb_{it-1} + \sum_{m=2}^{p} \beta_{i1} \Delta 2LQSb_{it-(1+1)} + e_{it}$$

(trended constant) (12)

$$\Delta 2LQSb_{it} = \Delta 2LQSb_{it} - \Delta 2LQSb_{it-1} \quad (13)$$

The proposed hypothesis, Ho: ã = 0, stated that the rice supply quantity data series () was non-stationary at the first difference, while the alternative hypothesis, Ha: ã ‘“ 0, stated that the rice supply quantity data series () was stationary at the first difference. If the first difference the data were not stationary, a further test was conducted at the second or higher difference until the data were found stasionary.

The rice supply in each region largely originates from the rice production in their respective areas. The rice production is the result of the multiplication of the rice harvesting area with the rice productivity.

$$Prg_{it} = APrg_{it} * Yrg_{it} \quad (14)$$

where Prg is the rice-grain production (millon ton/years), APrg is the rice harvesting area (million ha/year), Yrg is the rice productity(ton/ha/year), i is the rice producing region (i=1 to 8), and t stands for time.

The rice production total in this research was obtained by substracting the loss of 10% from the rice production and then multiplied with a conversión index. The conversion index was 65%, indicating the amount of grain which becomes rice through the milling process (Tsujii and Darwanto, 2003; and Irawan, 2005). The rice production total was formulated as follows:

$$Pr_{it} = (0.9 * 0.65) *Prg_{it} \quad (15)$$

where Pb is the rice production (million tons/year) and Prg is the rice-grain production (millions tons/year).

The rice supply in a rice-producing region in Indonesia is a function of the rice retail price, the prices of substitution/complementary goods (corn, cassava, soybean, sweet potato, and peanut), the price of urea fertilizer, the precipitation, the technology, the monetary crisis dummy and the government rice/rice-grain purchasing policy dummy.

$$LQSr_t = á_0 + á_1 LRPr_t + á_2 LPc_t + á_3 LPcs_t + á_4 LPs_t + á_5 LPsp_t + á_6 LPp_t + á_7 LPuf_t + á_8 LPrec_t + á_9 LT_t + á_{10} DMC_t + á_{11} DPP_t + e_{\backslash t} \quad (16)$$

where á is a regression coefficient, QSr is the rice supply in a rice-producing region in Indonesia (million tons/year), RPr is the rice retail price Rp/Kg), Pc is the corn price (Rp/kg), Pcs is the cassava price(Rp/kg), Ps is the soybean price (Rp/kg), Psp is the sweet potato price (Rp/kg), Pp is the peanut price (Rp/kg), Puf is the urea fertilizer price (Rp/kg), Prec is the precipitation (000 mm/year), T is the technology, which is represented by the rice productivity proxy (ton/ha), DMc is the monetary crisis dummy, DPP is the output price policy dummy, e is the error term, t is time (year), L is the

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natural logarythm. The expected parameter are á$_{1}$, á$_{8,}$ á$_{9}$, á$_{11}$ > 0; á$_{2}$, á$_{3,}$ á$_{4}$, á$_{5,}$ á$_{6,}$ á$_{7}$, á$_{10}$ < 0.

Cointegration Test

A cointegration test was conducted upon the formulated Equation (16). To discover whether the residual in Equation (16) was stationary or not, a regression test was conducted upon the equation to obtain its residual. Then, a stationary test was conducted upon the residual with the same method used in the unit root test at the zero difference.

$$\Delta e_t = \delta\, e_{t-1} + \sum_{m=2}^{p} \phi_1 \Delta e_{t-(1+1)} + v_t \qquad (17)$$

$$\Delta e_t = e_t - e_{t-1} \qquad (18)$$

$$\Delta e_{t-1} = e_{t-1} - e_{t-2} \qquad (19)$$

The hypothesis was Ho: ä = 0, the residual series () was non-stationary, while Ha: ä '" 0, the residual series () was stationary, so the observed variables were mutually cointegrated or they had long-term relationship.

The estimation was conducted with the Ordinary Least Square (OLS) method, so with the approach developed by Engle dan Granger the error correction method *(ECM)* was obtained as in the following:

“LQSr$_{t}$ = â$_{0}$ + â$_{1}$ “LRPr$_{t}$ + â$_{2}$ “LPc$_{t}$ + â$_{3}$ “LPcs$_{t}$ + â$_{4}$ “LPs$_{t}$ + â$_{5}$ “LPsp$_{t}$ + â$_{6}$ “LPp$_{t}$ + â$_{7}$ “LPuf$_{t}$ + â$_{8}$ “LPrec$_{t}$ + â$_{9}$ “LT$_{t}$ + â$_{10}$ “DMC$_{t}$ + â$_{11}$ “DPP$_{t}$ + â$_{12}$ ECT + w (20)

The regression analysis of the short-term rice supplies in rice-producing regions in Indonesia used the ECM with the panel data. This was meant to combine the time-series data and the cross-sectional data so that more data could be obtained. According to Widarjono (2007), in general the panel data regression estimation produces different intercepts and slopes. This research used the fixed effect regression model which assumes different intercepts but similar slopes among provinces.

(1) Ho: â$_{12}$ e” 0, which states that the Error Correction Term/ECT is statistically insignifican t, which means that the ECM model is not valid. â$_{12}$ < 0, which states that Error Correction Term/ECT is statistically significant, which means that the ECM model is valid.

(2) Ho: á$_{11}$, â$_{11}$ e” 0, which means that the government rice-price policy does not have any negative effect towards the long-term or short-term rice supply; and Ha: á$_{1}$ á$_{11}$, â$_{11}$ < 0, which means that the rice-price policy has a negative effect to both the long-term and short term rice supply. If the obtainted t > t$_{table}$, Ho is refuted. On the other hand, when the obtained t < t$_{table}$, Ho cannot be refuted.

(3) For the independent variables which have positive influence to the dependent variables Ho: á$_{1,}$ á$_{8,}$ á$_{9}$, â$_{1,}$ â$_{8,}$ â$_{9}$ d” 0, which means that the independent variables do not have any positive influence to the dependent variable, and Ha: á$_{1,}$ á$_{8,}$ á$_{9}$, â$_{1,}$ â$_{8,}$ â$_{9}$ > 0, which means that the independent variables have positive influence to the dependent variable. For the independent variables which have negative influence to the dependent variable, Ho: á$_{2}$, á$_{3,}$ á$_{4}$, á$_{5,}$ á$_{6}$, á$_{7}$, á$_{10,}$ â$_{2}$, â$_{3,}$ â$_{4}$, â$_{5,}$ â$_{6}$, â$_{7}$, â$_{10}$ e” 0, which means that the independent variables do not have any nevative influence to the dependent variable, and Ha: á$_{52}$, á$_{53,}$ á$_{54}$, á$_{55,}$ á$_{2}$, á$_{3,}$ á$_{4}$, á$_{5,}$ á$_{6}$, á$_{7}$, á$_{10,}$ â$_{2}$, â$_{3,}$ â$_{4}$, â$_{5,}$ â$_{6}$, â$_{7}$, â$_{10}$ < 0, which means that the independent variables have negative influence to the dependent variable. If the obtained t > t$_{table}$, Ho is refuted. On

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the other hand, if the obtained $t < t_{table}$, Ho cannot be refuted.

RESULTS AND ANALYSIS

Based on the ADF test, it was found that thal not all the data included in the analysis of the rice supplies in the rice-producing regions in Indonesia were stationary at the zero difference, but the data were stationary at the first difference. Based on the cointegration test for the rice supply equation with the ADF test, it was found that the residual was stationary (p = 0,01), so it can be stated that there was a long-term equilibrium relationship between the rice supply and the independent variables.

The provinces included in this research were rice-producing provinces in the islands of Sumatra, Java, and Sulawesi, so the rice supplies in the rice-producing regions in Indonesia originated from their respective local areas. Table 1 presents the regression results for factors influencing the long-term rice supplies in the rice-producing regions in Indonesia, while Table 2 presents the regression results for factors influencing the short-term rice supplies in the rice-producing regions in Indonesia in the short term. In Table 1, the adjusted R^2 value is 0.9935, which means that the independent variables included in the model can explain the long term variation of the rice supplies in the rice-producing regions in Indonesia which was 99.35%. The obtained F was significant (p = 0.01), which indicates that the independent variables which were included in the model collectively influenced the rice supplies in the rice-producing regions in Indonesia. In Table2, the adjusted R^2 value is 0.3703, which means that the independent variables included in the model can explain the variation of the short-term rice supplies in the rice-producing regions in Indonesia which was 37.03%. The obtained F value was significant (p = 0.01), which means that the independent variables included in the model collectively influence the short-term rice supplies of the rice-producing regions in Indonesia.

The error correction term (ECT) of the previous year in Table 2 shows that the rice supply adjustment rate was high when there was a short-term imbalance. From the empirical results it was found out that the value ECT_LQSb(-1) in the rice supply equation was significant (p = 0.01) with a negative regression coefficient. The coefficient value ECT_LQSr(-1) of the rice supplies in the rice-producing regions in Indonesia was -0.6778, which means that the rise of the actual rice supplies in the rice-producing regions in Indonesia of 1% above the equilibrium would be adjusted/reduced automatically 0.6778% by the changes of the rice retail price, the cassava price, the soybean price, the technology, and the monetary crisis towards a long-term dynamic equilibrium, and vice versa.

Based on the t-test for the regression analysis of the long-term rice supplies in the rice-producing regions in Indonesia (Table 1), it was found out that the government rice-grain purchasing price policy dummy variable had a negative regression coefficient (p = 0.05), while for the short term (Table 2), this dummy variable was not significant. This means that the government purchasing price policy caused the reduction of the long-term rice supplies in the rice-producing regions in Indonesia.

Based on the t-test on the regression analysis for the long-term rice supplies in the rice-producing regions in Indonesia (Table 1), it was found that the rice retail price had a positive influence to the rice supply (p = 0.01) with a regression regression of

http://dx.doi.org/10.18196/jgp.2015.0006

0.1562; the cassava price had a negative influence (p = 0.01) with a regression coefficient of -0.1579; the soybean price had a negative influence (p = 0.05) with a regression coefficient of -0,1085; the precipitation had a positive influence (p = (0.05) with a regression coefficient of 0.0086; the technology had a positive influence to the rice rice (p = 0.01) with a regression coefficient of 1.8493. These results show that the technology (rice productivity) had the biggest influence to the long-term rice supply.

Based on the t-test on the regression analysis for the short-term rice supplies in the rice-producing regions in Indonesia (Table 2), it was found that the rice retail price had a positive influence to the rice supply (p = 0.01) with a regression regression of 0.1307; the cassava price had a negative influence (p = 0.01) with a regression coefficient of -0.1431; the soybean price had a negative influence (p = 0.05) with a regression coefficient of -0,1085; the precipitation had a positive influence (p = (0.05) with a regression coefficient of 0.908; the technology had a positive influence to the rice supply (p = 0.01) with a regression coefficient of 1.0197, the monetary crisis dummy variable had a negative coefficient (p = 0.05).

The coefficient value ECT_LQSr(-1) for the rice supplies in the rice-producing regions in Indonesia was -0.6778, which means the actual increase of the rice supplies in the rice-producing regions in Indonesia which was 1% above the equilibrium would be adjusted/reduced automatically by 0,6778% by the changes of the rice retail price, the cassava price, the soybean price, the technology, and the monetary crisis toward the long-term dynamic equilibrium, and vice versa.

The short-term actual rice supply imbalance would be automatically adjusted due to the changes of the rice retail price, the cassava price, the soybean price, the technology, and the monetary crisis towards the long-term equilibrium. Considering the ECT coefficient value (-0,6778), it can be concluded that the short-term rice supply imbalance adjustment was made in a relatively short time.The rice supply adjustment towards the long-term equilibrium was largely influenced by the price variable.

The government has been concerned with the control of the rice-grain price for stabilizing the price at the producers' and consumers' levels by ensuring the adequate domestic rice supply while prioritizing the domestic product for meeting the domestic demand. During the New Order era, the the rice/rice-grain price stabilization policy was conducted by determining the floor and ceiling prices.The policy was meant to guarantee that the rice/rice-grain price was above the market price during the harvesting period so that farmers would be encouraged to increase their production and their earnings. Meanwhile, the ceiling price was meant to protect the consumers' price particularly during the hard times. According to Mulyana and Rahcman (2011), the price policy was also meant to drive the national economic growth.

In 2001, the government issued Presidential Instruction No. 9 of 2001on the the Rice Policy-Making which included the issuance of the Government Purchasing Floor Price for rice/rice grain, which was effective in January 2002. In its development, in 2005 the policy was changed into the Government Purchasing Floor Price for Rice/Rice-grain, which was issued by the Government in the form of Presidential Instruction No.2 of 2005. Periodically, the Rice-Grain Floor Price and the

Government Purchasing Price for rice/rice grain were raised to match the input price and inflation. The Government Purchasing Floor Price for rice/rice-grains in 2005 was aimed at anticipating the fuel price hike and to protect the price of farmers' rice grain particularly during the harvesting season. In the period of 2003 to 2010, the evectiveness of the Government Purchasing Price Policy experienced ups and downs. According to Simatupang, Mardianto, Kariyasa, and Maulana (2005), the implementation of the Government Purchasing Price Policy, which was based on Presidential Instruction No 2 of 2005, was efective because: (1) the actual prices of harvest-time dry grain and mill-ready dry grain at the farmers' level were higher than the the Government Purchasing Price, (2) the actual price of harvest-time dry grain and mill-ready dry grain at the farmers' level were relatively stable, (3) the increase of the actual prices of harvest-time dry grain was higher than the increase of the mill-ready dry grain (which indicated that the farmers' earnings increased because most farmers sold harvest-time dry grain, (4) the margin between the the actual price of harvest-time dry grain and the actual price of mill-ready dry grain was getting smaller (this condition indicated that the occurring price increase was enjoyed by farmers).

However, according to Mulyana and Rahcman (2011), the effectiveness of the Government Purchasing Price Policy in the period of 2007 to 2009 decreased. In this period, the increase of the actual prices of harvest-time dry rice grain and the mill-ready dry rice grain was slow, while the price increase of medium-quality rice was getting faster. This was suspected to be the result of the traders' tricks. When conducting transaction with traders, farmers never used any refraction table. Farmers and traders had their own perception toward the quality of rice/rice grain. This condition was not favorable for farmers. In 2010, the Governmeng Purchasing Price Policy for harvest-time dry ricegrain was effective to maintain the price stability at the farmers' level, but the policy was not effective for mill-ready dry rice grain and rice because the government price for harvest-time dry grain was considered too high and was only used by the Logistic Bureau and its partners, so that the policy was considered not beneficial for farmers.

From the above, it is clear that the effectiveness of the Government Purchasing Price Policy for rice-grain at the farmers' level experienced its ups and downs, while the results of the present research have shown that the Government Purchasing Price Policy for rice/rice grain in the long term had caused the decrease of the rice supplies in the rice-producing regions in Indonesia. This indicated that the rice supply during the enforcement of the Government Purchasing Price Policy was lower than the supply during the enforcement of the Rice-Grain Floor Price Policy. This condition could not be separated from the government support towards the price policy. The Rice-Grain Floor Price Policy was supported with input subsidy, investment, research, and information dissemination activities. The government through the Logistic Bureau purchased farmers' rice grain at a predetermined price and channeled the rice to civil servants/Armed Forces members/police officers. The consequence of this policy was the needs for substantial fund and supporting instruments. The price stabilization policy through the Rice-Grain Floor Price Policy managed to bring Indonesia to rice self-sufficiency though it failed to be main-

http://dx.doi.org/10.18196/jgp.2015.0006

tained. In the end of 2001, the government changed the national rice policies. The Rice-grain Floor Price Policy was changed into the Government Purchasing Floor Price Policy which in its development changed again into the Government Purchasing Price policy. The cost in the implemention of the Government Purchasing Price Policy was relatively lower than that of the Rice-Grain Floor Price Policy. The Government Purchasing Price for rice/rice-grain was only a price reference for the Logistic Bureau in storing domestic rice, the rice purchase by the Logistic Bureau was adjusted to the existing funding. In addition, several support policies, such as Bank of Indonesia's liquidity assistance, were discontinued, and the fertilizer subsidy was abolished/reduced. The results of the present research proves that in order for a rice/ricegrain price policy to function as an incentive for farmers to increase their rice production (rice supply), the policy must be supported with other supportive instruments, such as research, irrigation investment, irrigation investment, information dissemination, and input subsidy for farmers.

Based on the results of the regression analysis for factors which can influence the rice supply, it can be observed further that the rice retail price had a positive influence to the rice supplies in the rice-producing provinces in Indonesia both in the long and short terms. The rice retail price increase of 1% increased the rice supply of the Rice-producing regions in Indonesia up to 0.16% in the long term and increased the rice supply up to 0.13% at the short term. This is in line with the supply theory, namely that the increase/decrease of an item price will cause the increase/decrease of the supply of the item. The rice retail price is an incentive for farmers to increase their production (rice supply) both in the long term and short term. However, what needs to be examined further was how many percents of the rice retail price increase was truly enjoyed by farmers and what was its impact in the consumers' welfare decrease.

In this research it was found out that several commodities could be complements for the rice supplies in the Indonesian rice producing regions. The rise of cassava price of 1% in the long term decreased the rice supplies in the Indonesian rice producing regions up to 0.16% and in the short term 0.14%. Meanwhile, the rise of soybean price of 1% in the long term decreased the rice supplies in the Indonesian rice producing regions up to 0.11% and in the short term 0.09%. Those are indications that cassava and soybean can be substitutes for rice in the Indonesian rice producing regions both in the long term and in the short term.

Precipitation is the most dominant climate element and it has a quite high diversity both spatially and temporally. Temporal diversity is shown in the precipitation fluctuation between the the rainy to the dry season. The high precipitation dynamics and diversity have impacts not only on productivity and production but also on the systems of rice plantation from region to region and from time to time. This is related to the characteristics of rice plants which need much water throughout its growth. In the dry season, rice can be planted in ricefields but only in those with regular irrigation (Soemartono, Bahrinsamad, and Hardjono, 1981). From the the examination on the rice supplies based on the panel data, it is found out that precipitation had a positive influence to the long term rice supply in the Indonesian rice producing re-

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gions. The increase of precipitation of 1% in the long term increased the supply of rice in the Indonesian rice producing regions up to 0.01%. This indicates that rice planting in the Indonesian rice producing regions still depends on precipitation. Adequate water supply can be used to increase the rice planting intensity, which eventually influences the increase of rice in the regions.

Rice productivity in this research was used as a proxy of the use of technology in rice cultivation. The results of the panel data analysis indicated that technology influenced the rice supply in the Indonesian rice producing regions both in the long and the short terms. The rise of rice productivity of 1% in the long term increased the supply of rice in the Indonesian rice producing regions up to 1.85% and in the short term 1.02%. This result indicates that the long-term and short-term rice supply in the Indonesian rice producing regions is responsive to the use of technology. Considering the extent of the contribution of technology (rice productivity) to the rice supply, there should be efforts to develop the rice production technology which leads to the increase of rice production through various intensification programs. A similar opinion is stated by Maulana (2004), who argues that to incease crop productivity the development of agricultural technology has a very strategic role. The increase of rice productivity is agronomically caused by two factors, namely the use of rice varieties with high productivity and the improvement of rice cultivation management.

The monetary crisis caused the decrease of the short-term rice supplies in the Indonesian rice producing regions. This is in line with the proposed hypothesis that a monetary crisis will decrease the rice supply. This hypothesis is based on the idea that in time of a monetary crisis the public purchasing power decreases, including their rice cultivation financing ability, which eventually influences the decrease of rice production and supply.

CONCLUSION AND POLICY IMPLICATIONS

All the data used in the supply analysis were stationary at the first difference and passed the cointegration test. The use of the Error Correction Model (ECM) in the rice supply managed to show the Error Correction Term (ECT) value, namely the actual increase of rice supply up to 1% above the equilibrium which was adjusted/decreased 0.68% automatically by the changes of the rice retail price, the cassava price, the soybean price, the technology, and the monetary crisis towards the long-term dynamic equilibrium, and vice versa. In the long term, the Government Purchasing Price Policy for rice/ricegrain had caused the decrease of the rice supply in the Indonesian rice producing regions. The rice supply during the enforcement of the policy was a little smaller than the period of the enforment of the Government Floor Price. The applied Error Correction Model (ECM) managed to show the difference between the long-term and the short term rice supply elasticity in the Indonesian rice producing regions. The factors influencing the long-term rice supply in the Indonesian rice producing regions included the rice retail price, the price of cassava, the price of soybean, the precipitation, the technology and the Government Purchasing Price Policy dummy, while in the short term the supply was influenced by the changes of the rice retail price, the price of cassava, the price of soybean, the precipitation, the technology and the

Government Purchasing Price Policy, and the error correction term. The rice retail price and technology managed to increase the rice supply both in the long term and in the short term. The precipitation also contributed to the increase of the rice supply but only in the long-term, while the monetary crisis had a negative impact on the short-term rice supply. Soybean and cassava were substitutes for rice both in the long and short terms.

From the research results, several rice supply policy implications can be presented as follows: (1) There should be policies on the rice/rice grain price which are directly beneficial for farmers so that they can be incentives for farmers to increase the supply of local rice which is affordable for consumers; 2) There is a need for developing rice cultivation technology because technology has positive contribution to the increase of the rice supply both in the long and short terms; (3) There should be economic stability to support the increase of the rice supply because the monetary crisis has indeed negative impacts on the short-term rice supply; (4) There is a need for post-harvest technology in order to maintain the rice quality because such is need to compensate the rice supply increase when precipitation is high.

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TABLE I. REGRESSION RESULTS OF FACTORS INFLUENCING LONG-TERM RICE SUPPLY IN RICE-PRODUCING REGIONS IN INDONESIA

Independent Variable	Symbol	Expected Sign	Regression Coefficient	
Constant	C		-2.0799	***
Rice Retail Price	LRPc	+	0.1562	***
Corn Price	LPc	-	-0.0121	
Cassava Price	LPcs	-	-0.1579	***
Soybean Price	LPs	-	-0.1085	**
Sweet Potato Price	LPsp	-	0.0449	
Peanut Price	LPp	-	0.0064	
Urea Fertilizer Price	LPuf	-	0.0597	
Precipitation	LPrec	+	0.0086	**
Technology	LT	+	1.8493	***
Monetary Crisis Dummy	MCD	-	0.0134	
GPP Policy Dummy	PPD	+	-0.0401	**
Fixed Effecs (Cross)	N.SUM--C		-0.0365	
	S.SUM--C		0.4300	
	LAMPUNG--C		-0.5472	
	W. JAVA--C		0.8371	
	C. JAVA--C		0.5314	
	E. JAVA--C		0.6097	
	S. SULA--C		0.0376	
	N. SULA--C		-1.9565	
Adjusted R-squared			0.9935	
Durbin-Watson stat			1.5778	
F Statistic			1488.9400	***
ADF Test Statistic			50.2615	***

Source: Secondary Data Analysis, 2011
Notes:
***: Significant at the 99% confidence level
**: Significant at the 95% confidence level
*: Significant at the 90% confidence level
L: Natural Logarythm

TABLE 2. REGRESSION RESULTS OF FACTORS INFLUENCING SHORT-TERM RICE SUPPLY IN THE RICE-PRODUCING REGIONS IN INDONESIA

Independent Variable	Symbol	Expected Sign	Regression Coefficient
Constant	C		0.0171 **
Rice Retail Price Change	ΔLRPr	+	0.1307 ***
Corn Price Change	ΔLPc	-	0.0324
Cassava Price Change	ΔLPcs	-	-0.1431 ***
Soybean Price Change	ΔLPs	-	-0.0908 **
Sweet Potato Price Change	ΔLPsp	-	-0.0047
Peanut Price Change	ΔLPp	-	0.0028
Urea Fertilizer Price Change	ΔLPuf	-	0.0013
Precipitation Change	ΔLPrec	+	0.0058
Technological Change	ΔLT	+	1.0197 ***
Adjustment	ECT_LQSr(-1)	-	-0.6778 ***
Change in the monetary cirisis dummy	ΔMCD	-	-0.0348 **
Change of GPP Policy Dummy	ΔPPD	+	-0.0086
Fixed Effecs (Cross)	_NSUM--C		0.0001
	_SSUM--C		0.0089
	_LAMPUNG--C		0.0042
	_WJAVA--C		-0.0089
	_CJAVA--C		-0.0075
	_EJAVA--C		-0.0085
	_SSULA--C		0.0019
	_NSULA--C		0.0111
Adjusted R-squared			0.3703
F-statistic			6.0142 ***
Durbin-Watson stat			2.0503

Source: Secondary Data Analysis, 2011
Notes:
*** : Significant at the 99% confidence level
** : Significant at the 95% confidence level
* : Significant at the 90% confidence level
L : Natural Logarythm
: *First difference*