

# Econometric Model of Rice Policy Based On Presidential Instruction

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**Abstract.** The objective of research is to build an econometric model based on Presidential Instruction rice policy. The data was monthly time series from March 2005 to September 2009. Rice policy model specification using simultaneous equation, consisting of 14 structural equations and four identity equation, which was estimated using Two Stages Least Squares (2SLS) method. The results show that: (1) an increase of government purchasing price of dried harvest paddy has a positive impact on to increase in total rice production and community rice stock, (2) an increase community rice stock lead to decrease the rice imports, (3) an increase of the realization of the distribution of subsidized ZA fertilizers and the realization of the distribution of subsidized NPK fertilizers has a positive impact on to increase in total rice production and community rice stock and to reduce rice imports, (4) the price of the dried harvest paddy is highly responsive to the water content of dried harvest paddy both the short run and long run, (5) the quantity of rice imported is highly responsive to the imported rice price, both short run and long run.

## 1. Introduction

According to Timmer [19], most government intervention in their economies to raise resources, at least an indirect effect on food prices facing consumers or crops prices facing farmers. Streeten[17] argued that policymakers are confront with a fundamental dilemma, between high prices for food or lower price food. Tobias et al, [18] described many Asian countries through policy instrument to achieve rice self-sufficiency and stabilize domestic prices. They discussed production policy in Indonesia such as fertilizers subsidy farmers, price supports and food subsidy for rice price.

Based on presidential instruction (*Inpres*), policymaker sets the objectives of rice policy are farmer's income, rural economic development, stabilization of national economy and food security Sembiring. [14]. Sembiring [13] constructed model of rice policy based on Inpres to describe the impact of government policies on farmers income, food price and food security. Dawe [2] discussed that the benefits of stabilizing food prices. Ellis [6] argued that in the cases Indonesian state, Bulog achieves an ostensibly difficult price stabilizations role.

Jha and Srinivasan [7] concluded that price stabilization is the most important element of food policy in India and many other countries in both developing and developed countries. Cumming et al, [1] argued that India, Indonesia, Pakistan and the Philippines are implementing the stabilization of grain prices, Poulton et al, [12] described the impact food price instability on household. The result show that poor consumers, high prices reduce real income, especially during low season

Before the 2010, research on rice policy based on Presidential Instruction (Inpres) was limited in Indonesia. With the development of behavioral equation, Sembiring [13,15] constructed economic analysis on rice policy based on Presidential Instruction. His derived from Timbergen framework policy analysis constructed simultaneous equation. The Timbergen framework is also known as the objectives-



constraints-instruments approach to policy analysis Ellis [5]. Sembiring [15] suggested that policy instrument to achieve food security an increase the government purchased price of dried harvest paddy, an increase distribution of fertilizers, an increase of the number household receive Raskin and to develop irrigation system.

The objective of this study is to constructed econometric model based on Timbergen policy analysis. This study is expected to describe the correlation policy objectives – constrains and policy instrument based on rice policy on presidential instruction.

## 2. Data and Methods

Data type is monthly time series data Sembiring [13]. The econometric model of rice policy uses a simultaneous equation, consisting of 14 structural equations and four identity equations. The identity equations in this model based on Sembiring [13]. According to Hallam [8], the process of econometric modelling consists of specification, estimation, validation, and finally application Rice policy model specification using simultaneous equation, consisting of 14 structural equations and 4 identity equation. System contains 18 equations (G) with 50 variabels (K). An equation retailer rice price containing 7 variables (M) and the counting rule  $(K-M) > (G-1)$ , Koutsianis [11] gives  $(50-7) > (18-1)$ , retailer rice price equation is over identified. Therefore other equation is must over identified. When the equation is over identified it can be proved by 2SLS (Two Stage Least Squares).

## 3. Result and Discuss

According to Table 2, all the equation has the coefficient of determination  $R^2$  than those for quantity of rice import and rate of inflation more than 0.3366. The coefficient of determination  $R^2$  close to zero is 0.0704, it means that 7.04 per cent of the variation in quantity of rice import can be attributed to variations in price of import rice, community rice stock and lagged quantity of rice import, Thomas [20]. Definition of variables, as shown in Table 1.

According to Table 2, each lagged variable has a positive sign and significant at the 1 per cent confidence level whereas lagged quantity of rice import significant at the 15 per cent confidence level. According to the estimated equation, all the equation has statistic F than those for quantity of rice import and rate of inflation are significant at the 1 per cent. It means that the explanatory variables of each equation together can explain the endogenous variables well. According to the “(1)” paddy harvested area depends positively and significantly on HPGP, CHIT and LLAPT but for the HJRT variable is negative and significant. Based on the “(2)” yield of paddy depend negatively and significantly HPZA and HPNP, but for T and LYPIT is negative and significant. This is consistent with Sembiring et al, [16], their found that the government policies to increase NPK fertilizers by 15 per cent lead on decrease paddy harvested area 0,288 per cent

**Table 1.** Definition of the Variables

Variable	Definition	Variable	Definition	Variable	Definition
LAPT	Paddy Harveste Area	QPIT	Paddy Production	QBIT	Rice Production
HJRT	Price of Producen Corn	QCBB	Bulog Rice Stock	QCBG	Government Rice Stock
QMBT	Quantity of Rice Import	QCBD	Community Rice Stock	YPIT	Yield of Paddy
HGKP	Price of Dried Harvest Paddy	HBRT	Price of Retailer Price	HMBT	Price of Import Rice
INFT	Rate of Inflation	HPBB	Bulog Purchases Rice	T	Trend of Technology
CHIT	Average Rainfall	INFB	Rice Contribution to Inflation	STBF	Bulog Rice Final Stock
STOB	Bulog Operational Stock	EXRT	Rupiah Exchange Rate	STGF	Government Rice Final Stock
RAST	Rice for Poor People	SDBI	Indonesia Rice Surplus	D	Dummy Market Operation
HPGP	Government Purchase Price of Dried Harvest Paddy	HPZA	Price of Subsidized ZA Fertilizers	HPNP	Price of Subsidized NPK Fertilizers
RGHZ	Rasio HPGP to Ceiling	RGHN	Ratio HPGP to Ceiling Retailer	RTRA	Number of Household Receive Raskin
DCBP	Retailer Price of ZA Fertilizers	QBLD	Price of NPK Fertilizers	PBPT	PBPT
	Distribution of Government Rice		Rice for Seed, Shrinkage and Others		
RPZA	Realization of the Distribution of Subsidized ZA Fertiizer	RPNP	Realization of the Distribution of Subsidized NPK Fertilizer	KAGP	Dried Harvest Paddy with Water Content
LLAPT	Lagged Paddy Harvested Area	LYPIT	Lagged Yield of Paddy	LHBRT	Lagged Price of Retailer Price
LQMBT	Lagged Quantity of Rice Import	LINFT	Lagged Rate of Inflation	LQCBG	Lagged Government Rice Stock

LRAST	Lagged Rice for Poor People	LHPZA	Lagged Price of Subsidized ZA Fertilizer	LHPNP	Lagged Price of Subsidized NPK Fertilizer
LHGKP	Lagged Price of Dried Harvest Paddy	LDCBP	Lagged Distribution of Government Rice	LHMBT	Lagged Price of Import Rice
LSTBF	Lagged Bulog Rice Final Stock	LSTGF	Lagged Government Rice Final Stock		

All coefficients sign as in “(7)” than STGF agree with prior expectations and all variable than RTRA are statistically significant. The negative sign of STGF indicates that it leads to reduce RAST and significant at the 1 per cent confidence level. The coefficient of RTRA variable is positive and insignificant. All coefficients sign as in “(8)” and in “(9)” agree with prior expectations. In “(8)” all variable than QCBD are statistically significant. In “(9)” all variable than those for HBRT and INFB are statistically significant. The positive sign of QMBT indicates that it leads to increase HMBT and insignificant. This result is similar to Dawe finding [3] found that an increase of Indonesian rice import by one million ton increased price of word rice by US \$ 8,56 per ton, while Dawe [4] found that price of word rice increase by US \$ 12,38 per ton.

As in “(5)” all variable except QCBB are statistically significant and all coefficients agree with prior expectations. Price of dried harvest paddy depend negatively and significantly on the KAGP. The coefficient of HPGP, and LHGKP are positive and significant but for QCBB is insignificant. As in “(6)” show all variable except QCBB are statistically significant and all coefficients than DCBP agree with prior expectations. The coefficients of HMBT, HGKP, STBF, and LHBRT are positive but the coefficient of DCBP is negative, tending to contradict the hypothesis. Price of retailer rice depends negatively and significantly on RAST. The negative coefficient of RAST means the increase in RAST reduce price retailer rice.

All coefficients sign as in “(7)” than STGF agree with prior expectations and all variable than RTRA are statistically significant. The negative sign of STGF indicates that it leads to reduce RAST and significant at the 1 per cent confidence level. The coefficient of RTRA variable is positive and insignificant. All coefficients sign as in “(8)” and in “(9)” agree with prior expectations. In “(8)” all variable than QCBD are statistically significant. In “(9)” all variable than those for HBRT and INFB are statistically significant. The positive sign of QMBT indicates that it leads to increase HMBT and insignificant. This result is similar to Dawe finding [3] found that an increase of Indonesian rice import by one million ton increased price of word rice by US \$ 8,56 per ton, while Dawe [4] found that price of word rice increase by US \$ 12,38 per ton.

**Table 2.** The estimated econometric model of rice policy based on presidential instruction

#### EN<sup>#</sup> The structural and identity equation

- (1)  $LAPT = -82,7540 + 0,2726 HPGP^{*****} - 0,0583 HJRT + 0,8625 CHIT^{*****} + 0,5614 LLAPT^*$ ,  
(0,488/1,113) (-0,310/-0,297) (0,147/0,334)  
 $R^2 = 0.33665$ , DW = 1.7571, F = 6.22\*
- (2)  $YPIT = 17,6361 - 0,0007 HPZA^{*****} - 0,0005 HPNP^{**} + 0,0259 T^* + 0,6816 LYPIT^*$ ,  
(-0,281/-0,882) (-0,377/-1,185) (0,155/0,486)  
 $R^2 = 0.89721$ , DW = 1.7670, F = 106.92\*
- (3)  $HPZA = 314,4367 + 19,7054 RGHZ - 0,8266 RPZA^{*****} + 0,8333 LHPZA^*$ ,  
(0,020/0,121) (-0,026/-0,156)  
 $R^2 = 0.71429$ , DW = 1.8594, F = 41.67\*
- (4)  $HPNP = 686,0720 + 71,7761 RGHZ - 1,9149 RPNP^{****} + 0,8241 LHPNP^*$ ,  
(0,022/0,122) (-0,029/-0,168)  
 $R^2 = 0.69947$ , DW = 1.8740, F = 38.79\*
- (5)  $HGKP = 2590,6480 + 0,1527 HPGP^{***} - 131,7160 KAGP^* + 0,0076 QCBB + 0,8422 LHGKP^*$   
(0,127/0,806) (-1,096/-6,951) (0,005/0,034)  
 $R^2 = 0.94945$ , DW = 1.6793, F = 230.08\*
- (6)  $HBRT = 83,8785 + 0,0139 HMBT^{****} + 0,5390 HGKP^* + 0,3464 DCBP^{****} - 0,1781 RAST^{***} + 0,0288 STBF^{***}$

- (0,010/0,036) (0,250/0,919) (0,001/0,003) (-0,007/-0,026) (0,008/0,031)  
+ 0,7280 LHBRT\*,  $R^2 = 0.99559$ , DW = 1.7138 F = 1769.69\*
- (7) RAST = -15,1637 + 0,8692 STOB\* + 0,0005 RTRA - 0,7067 QCBG\* + 0,6998 STGF\* + 0,1365 LRAST\*  
(0,955/1,106) (0,039/0,045) (-1,509/-1,747) (1,458/1,689)  
 $R^2 = 0.96650$ , DW = 2.4375, F = 277.00\*
- (8) QMBT = 134,9944 - 0,0203 HMBT\*\*\*\* - 0,0008 QCBD + 0,1536 LQMBT\*\*\*\*  
(-1,440/-1,701) (-0,046/-0,055)  
 $R^2 = 0.07043$  DW = 2.0606, F = 1.26
- (9) HMBT = -118,9950 + 0,0453HBRT + 0,0120 QMBT + 0,0050 SDBI\*\* + 0,9392 LHMBT\*  
(0,064/1,056) (0,0001/0,003) (0,004/0,060)  
 $R^2 = 0.94732$ , DW = 1.4393, F = 220.28\*
- (10) INFT = 1,7776 - 0,0002 HBRT\*\*\*\*\* + 2,3971 INFB\* + 0,00003 EXRT\* + 0,0822 LINFT  
(-1,286/-1,401) (0,164/0,178) (-0,397/-0,432)  
 $R^2 = 0.15795$ , DW = 1.9606, F = 2.30
- (11) DCBP = - 11,5089 - 0,0027HBRT + 17,8076 D\* + 0,0526 QCBG\*\*\* + 1,8137INFT + 0,4888 LDCB\*  
(-1,356/-2,652) (0,684/1,338) (2,189/4,283) (0,133/0,260)  
 $R^2 = 0.44954$ , DW = 1.8251, F = 7.84\*
- (12) STBF = - 31,2846 - 0,4063HBRT + 0,6202 HPBB\* + 0,6276 STOB\*\*\* + 0,7046 LSTBF  
(-1,380/-4,671) (1,606/5,439) (0,092/0,311)  
 $R^2 = 0.71080$ , DW = 1.9574 F = 30.11\*
- (13) STGF = 43,7619 - 0,4436 DCBP\*\*\* + 0,9147 LSTGF\* ,  $R^2 = 0.80437$ , DW = 2.0353, F = 104.85\*  
(-0,011/-0,128)
- (14) QCBG = -8,6144 + 0,9318 PBPT\* + 0,0212 STBF\* + 0,9276 LQCBG\*  $R^2 = 0.95181$ , DW = 1.4655 F = 329.20\*  
(0,030/0,415) (0,075/1,030)
- (15) QPIT = LAPT x YPIT  
(16) QBIT: Fk x QPIT  
(17) QBLD = Fp x QBIT  
(18) QCBD = QBIT - QBLD

Note: \* significant 1%, \*\* significant 5%, \*\*\* significant 10%, \*\*\*\* significant 15%, and \*\*\*\*\*significant 20%.

In this table the number in parentheses are short run and long run elasticity , and italic number is long run elasticity, Intriligator [9 ] ; the coefficient of determination  $R^2$ , Durbin-Watson statistics are given as DW, and F statistic value. # equations numbering.

Based in “(10)” and “(11)”, the effect of retailer rice price on INFT is found to significant and negative as was not theoretically expected, in addition, the coefficient HBRT on DCBP is negative and is not significant as was not theoretically expected. In “(10)” all variable than those for EXRT and LINFT are statistically significant and in “(11)” all variable than those for HBRT and INFT are statistically significant.

All coefficients sign in “(13)” and “(14)” all variables agree with prior expectations and are statistically significant. Whereas in “(12)” the coefficient of the HBRT and STOB are wrong sign and all variable than those for HBRT and LSTBF are statistically significant. The remaining fourth equations are identities. In “(15)” is total paddy production, in “(16)” total rice production, in “(17)” rice for seed, shrinkage and other, and in “(18)” Community rice stock is the difference between total rice production and rice for seed and others.

The elasticity estimates are shown in Table 2. According to the study on elasticity both short run and long run, there are 6 structural equation have highly responsiveness between endogenous variable and explanatory variables, both short run and long run elasticity: (i) the estimates of the elasticity of HGKP with respect to the KAGP are -1,0969 and -6,951, respectively in equation 5. It means, increasing KAGP by 1 per cent reduce HGKP by more than 1,0969 per cent in short run and 6,951 per cent in long run. (ii) the short run and long run elasticity RAST are -1,509 and -1,747 with respect to QCBG, and 1,458 and 1,689 with respect to STGF in “(7)”, (iii) the estimates of the elasticity of QMBT with respect to the HMBT are -1,440 and -1,701, respectively in equation 8. This indicates that, increasing HMBT by 1 per cent reduce QMBT by more than 1,440 per cent in short run and 1,701 per cent in long run (iv) the short run and long run elasticity INFT are -1,286 and -1,401 with respect to SDBI in “(10)”,

(v) the short run and long run elasticity DCBP are -1,356 and -2,652 with respect to HBRT, and 2,189 and 4,283 with respect to QCBG in “(11)”, and (vi) in “(12)”, the short run and long run elasticity STBF are -1,380 and -4,671 with respect to HBRT, and 1,6068 and 5,4399 with respect to HPBB.

An increase of HPGP has a positive impact on the LAPT, and an increase of the LAPT affects an increase of YPIT. The increase in YPIT was followed by an increase in QBIT, although QBLD increase, QCBD also increased. An increase in QCBD leads to the QMBT to decrease. The increase of HPGP has a positive impact on HGKP. An increase HGKP pushed up the HBRT. In terms of input usage, an increase in RGHZ and RGHN to increase HPZA and HPNP, respectively. Whereas, an increase RPZA and RPNP to reduce HPZA and PHNP, respectively, followed an increase YPIT. An increase YPIT, to increase QPIT and QBIT and QCBD. An increase QCBD to reduce QMBT.

#### 4. Conclusion

An increase of government purchasing price of dried harvest paddy has a positive impact on the increase of total rice production and community rice stock. An increase community rice stock leads to decrease the rice imports. An increase of the realization of the distribution of subsidized ZA fertilizers and the realization of the distribution of subsidized NPK fertilizers have a positive impact on the increase in total rice production and community rice stock and to reduce rice imports. The price of the dried harvest paddy is highly responsive to the water content of dried harvest paddy both in the short run and long run.

#### 5. Another Section of Your Paper

Policy instrument to achieve the objective policy are increasing the government purchased price of dried harvest paddy, distribution of fertilizers, and improve technology.

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