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Integration of Rice Market Inter-Provinces of Rice Production Center in Indonesia

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Abstract. A study on integration model in Indonesian rice market is one way to understand the structure, behavior and effectiveness of the market. The result will help the government to determine the proper price policy. Based on that, the study aims to analyze retail rice market integration between the provinces of rice production centers in Indonesia by using the VAR/VECM. The study used secondary data are monthly data average price of rice in Jakarta and 8 retail area of rice production centers. The results showed that there are two cointegrations of the nine variables that occur in rice prices, it means there are two linear equations in the long run, indicating the market integration is not full. The retail market of rice between the provinces of rice production centers in Indonesia has not fully integrated. There is an independent and interdependence with one another in Indonesia rice market, meaning that the market in imperfectly competitive structure. Government intervention in the rice market should always be to maintain price stability. Disturbances in Jakarta rice market will impact on the rice market of other provinces. The government needs to pay attention to price fluctuations in Jakarta for efficiency of rice pricing policy.

Keywords: Integration, Rice retail market, VAR, VECM

1. Introduction

Rice was the food that gets top priority in the Indonesian government food policies. This is caused by: (1) rice farming provides employment for 21 million families of farmers, (2) is the principal food for about 95 percent of Indonesia's population, and (3) approximately 30 percent of the income of poor families was allocated to purchase rice. The strategic role of rice making price fluctuations will have an impact on farm income, the welfare of farmers and poor families (Bustaman, 2003). When the price left entirely to the market mechanism, the price will fall in the harvest season and increased in a bad season. This instability will harm farmers at harvest time and burden consumers in a bad season, therefore the government tried to control prices through a price policy.

A study on integration model in Indonesian rice market is one way to understand the structure, behavior and effectiveness of the market in order to know the relative strength of a market as well as the propagation mechanism of the price of one market to another, this will help the government to determine the proper price policy. Based on it then objectives of this study was to analyze the retail rice market integration between the provinces of rice production centers in Indonesia.

2. Literature Review

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Several studies have been done related to the topic of this research, whether conducted by the researchers themselves and by other researchers. Studies on the rice market integration has been done by Irawan and Rosmayanti (2007) in Bengkulu Province; Aryani (2009) in South Sumatra. The study concluded that the rice markets in the two regions are not yet fully integrated. This means that the rice markets in the region are independent and there is a mutual dependency with each other. If the rice market is not fully integrated it is means the market is not perfectly competitive. This condition indicates there are exogenous influences that can affect the price of rice.

The research results from Bustaman (2003) show that the rice market in Indonesia provinces integrated each others, in the long and short run. This shows that all provinces in Indonesia are connected into a single integrated trading system, so that the condition of equilibrium in a market will affect the balance each other in other markets. Good integration can be used as an indicator that the performances of the domestic rice marketing of commodities as a whole work efficiently. Provinces that have a relationship self sufficient-deficits and surpluses-deficits, have the highest degree of integrity, while the self sufficient-self sufficient provinces have the lowest degree of integration. This condition reflects the natural market integration. It is happened because the market that the deficit will bring rice from the surrounding market, mainly from surplus areas to meet their consumption needs. Relatively self-sufficient province will bring rice from surplus areas, so that trade opportunities with fellow self-sufficient province to be low.

Formulation model integration in Indonesian rice markets are conducted in this study are expected to provide an overview of the mechanisms of propagation in price from one market to another between the provinces of rice production centers that can help governments to determine proper pricing policy.

3. Research Method

Secondary data was collected in this study, the data are monthly data average price of rice in Jakarta and 8 retail area of rice production centers namely the province of East Java, West Java, Central Java, South Sulawesi, North Sumatra, South Sumatra, Lampung and West Sumatra. Monthly data from January 2000 to December 2008 is the time series data. The data was collected using the documentation method are obtained by collecting data, records and reports objective data obtained from the source. Data collected from relevant agencies of the Ministry of Trade of Indonesia.

Model of this research is analyzes the time series data. This study used analysis tools the Vector Autoregression (VAR) using Eviews.5.1 Program. Stages carried out in data processing are:

- Stationary testing data, performed with the unit root tests. For this purpose use Dickey-Fuller test (DF) and Augmented Dickey-Fuller (ADF) (Thomas, 1997).
- Determination of optimal lag level could use some information criteria, namely: (1) Akaike Information Criterion (AIC), (2) Schwartz Information Criterion (SC), (3) Hannan-Quinn Criterion (HQ), (4) Likelihood Ratio (LR), and (5) Final Prediction Error (FPE).
- Multiple cointegration test, performed based on the non restriction VAR model with p dimensions and lag orders k (developed by Johansen).
- Analysis of VAR/VECM, requires a modeling every endogenous variable as a function of the lag of all endogenous variables in the system. VAR with order p and n dependent variables in the t periods can be modeled as follows:

  $Y_t = a_o + a_1 Y_{t-1} + a_2 Y_{t-2} + \ldots + a_p Y_{t-p} + \varepsilon_t$

  Notes:

  Yt = vector of dependent variables (Y1.t, Y2.t,..., Yn.t), size n x 1
  ao = intercept vector size n x 1
  ai = parameter matrix size n x m for each i = 1, 2,..., p
  εt = residual vector (ε1.t, ε2.t,..., εn.t) size n x 1
  n = number of rows in the matrix n x m
  m = number of columns in the matrix n x m

4. Result and Discussion

In this study analyzed the rice market integration doing by the equilibrium prices that occurred in each market. The integration market is a concept in which the market players in different regions are driven by

supply and demand conditions. This condition is indicated by cross-border movement of goods, services and factors of production are increasing rapidly in the region. In the perfectly homogeneous market for goods and services, the intensity of market integration in a region is measured by the level of price convergence in the region (Pelkman, 2001 in Winantyo et al. 2008).

The integration of the retail market of rice among the provinces in Indonesia rice production centers are spatially integrated market. It is described as price relationship of markets that are geographically separated can be interpreted as the level of linkage relationships between the regional market and others. Evaluation of spatial market integration in theis study was conducted by the concept of cointegration for the nonstationary data series. Time series data are not stationary at level but stationary in the data difference and was kointegrating that indicate the presence of long run relationship between the variables, then the analysis performed by the cointegration method and Vector Error Correction Model/VECM. VAR is a regression equation model that uses time series data. Problems that arise in time series data related to the stationary of data and cointegration.

4.1. Stationary Testing Data

To find stasionary data can be done by several ways, among others, by using a graphical method or using the unit root method (Winarno, 2007). In this study to test stationary data do by unit root test based on the Augmented Dickey Fuller (ADF) test. Data is stationary when the probability value less than 0.05 (5 percent). Results of analysis also compares the absolute value of t-statistic values with critical test value at 1 percent, 5 percent or 10 percent. The data are stationary and ready for further analysis if the critical values are greater than the value of t-statistic. At the level can be concluded that the data are not stationary. To make stationary, data must be differencing. The results indicate that the data was used in this study are not stationary at levels but stationary at first difference. Stationary time series data happened if the average, variance and covariance at any lag are still constant at any time (Widarjono, 2007). the analysis can be continued on the next step, it is determination of optimal lag level.

4.2. Determination of Optimal Lag Level

Based on the SC criteria, optimal lag candidate is lag 1. Based on LR, FPE, AIC, and HQ candidate of optimal lag is lag 9. According to the procedures analysis when more than one candidate optimal lag exist, we must see the value of R^2 from the VECM analysis. Based on the results of VECM analysis using lag 1, the R^2 value obtained is better. It can be concluded that the lag 1 is the optimal lag for this model. The use of lag 1 as the optimal lag on the model of the economy means implies that all variables in the model influence each other not only in the present period, but these variables are also interrelated in a previous period.

4.3. Cointegration Analysis

The existence of cointegration relationships in a system indicated there is an Error Correction Model in the systems that describes the short run dynamics is consistent with long run relationship. Cointegration test in the study was conducted through Johansen test approach is to compare the trace statistic with critical value or by comparing the maximum eigenvalue to the critical value used is 5 percent. There is cointegration in the system if the trace statistic or maximum eigenvalue greater than the critical value.

According to the trace test and maximum eigenvalue test are indicate the existence of two cointegration at rank = 0 (none) and rank = 1 (at most 1) significant at level 5 percent. There are two cointegrations of the nine variables that occur in rice prices, it means there are two linear equations in the long run, indicating the market integration is not full. It can be concluded that the rice market in Indonesia has not fully integrated. There are independent and mutual interdependence rice market in Indonesia. Irawan and Rosmayanti (2007) said when the rice market is not fully integrated; it means the market in imperfectly competitive structure. This condition indicates there are exogenous influences that can affect the price of rice. To keep prices stable, government intervention is required in the national rice market.

There are two cointegration vectors (Vector Autoregression) or a stationary linear combination of the retail market of rice, so the long run analysis of cointegration vectors can be specified for the rice price in Jakarta and East Java. This is because Jakarta is the capital of the state so that the rice trade in Jakarta as a city trade centers will affect the rice trade in other provinces in Indonesia. As for the rice market in East Java

is the largest rice production centers in Indonesia. The existence of trade between provinces and islands in Indonesia resulted East Java rice market give big influence to the rice markets in other provinces.

The existence of cointegration in models of retail rice market integration between the provinces of rice production centers in Indonesia can be interpreted that there is a long run relationship or balance between each of the variables in the model, in the short run there may be an imbalance (disequilibrium). The imbalance is often encountered in economic behavior. It means what is economic players desired is not necessarily the same as actually happened. There are difference of what is desirable with actually happened will require an adjustment. Models that include adjustments to correct for the imbalance referred to as error correction model (ECM) (Widarjono, 2007).

4.4. VECM Analysis

VECM analysis describes the dynamic equilibrium relationship of Short Run (SR) and Long Run (LR) in a system of equations. Although there is a LR balance inter market, but there are deviations from the SR equilibrium relationship. It can be conclude that VECM is a combination of SR and LR relationship between the prices of different markets (Nagubadi *et al*. 2001 in Anwar, 2005).

VECM will regretion changes in the price variable lagged deviation from LR equilibrium relationship and also lag deviation of prices SR period. Deviation from equilibrium, as the reflection coefficient by VECM, it will bring changes to the balance between these variables cointegration. The coefficients of ECT in the VECM are a measure of the adjustment speed toward LR equilibrium relationship between markets (Enders, 1995). According to Anwar (2005), the speed of adjustment is shown by the absolute value of ECT, which is interpreted as disequilibrium between the actual prices with LR equilibrium level. The larger coefficient is indicates the speed of adjustment toward LR equilibrium and vice versa. Disturbance previous period price changes on some markets in the model can be interpreted as an adjustment to SR, while the market is in LR equilibrium with other markets.

Cointegration equation shows the LR equilibrium relationship between the rice prices in the nine regions of the sample. Table 1 shows the LR cointegration equation (CE) of rice price in Indonesia. Jakarta rice market affects the entire rice market in other areas, seen from the results of the analysis CE1 it is significantly influence the changes of rice prices in West Java, Central Java, South Sulawesi, North Sumatra, South Sumatra, Lampung and West Sumatra. While the CE2 analysis results showed that the East Java rice market significantly influences the changes of rice prices in North Sumatra, South Sumatra, Lampung and West Sumatra. As the nation's capital, Jakarta is the center of commerce that will affect trade, especially of rice in other provinces. It means if there is disturbance or instability in the Jakarta rice market it will affect to the another rice market. To maintain the stability of rice prices in Indonesia, the government should conduct supervision of rice price fluctuations in Jakarta. The stable rice price in Jakarta it will have implications on the stability rice price in other provinces.

Table 1: Long run cointegration equation model of Rice Retail Market Integration Inter Provinces Rice Production Center in Indonesia

Cointegrating Equivalent (CE)	CE1		CE2	
JAKARTA(-1)	1.0000		0.0000	
JATIM(-1)	0.0000		1.0000	
JABAR(-1)	-1.0645	[-6.0751]**	0.0033	[0.0242]
JATENG(-1)	-1.1608	[-4.1704]**	-0.2920	[-1.3472]
SULSEL(-1)	1.5544	[7.3959]**	-0.2514	[-1.5359]
SUMUT(-1)	-1.6608	[-5.7872]**	-1.4473	[-6.4766]**
SUMSEL(-1)	3.2782	[10.7225]**	1.2704	[5.3361]**
LAMPUNG(-1)	-1.2866	[-5.5117]**	-0.5279	[-2.9039]**
SUMBAR(-1)	-0.5963	[-6.7289]**	0.1523	[2.2065]**

Notes: ** significant at level 5%; [ ] t-statistic

Table 2 shows the results of VECM coefficient value of rice retail market integration inter provinces rice production center in Indonesia. T-statistic values obtained were compared with t-table where the value used is the 5 percent level of significancy (t-table = 1.96) and 10 percent (t-table = 1.67). If the t-statistic obtained is greater than value of the t-table, it means that these variables have a significant effect.

The ECT coefficients describe the speed of adjustment towards the LR equilibrium per period. In the rice market samples of nine regions in Indonesia, the coefficient of ECT each region has value smaller than one. It can be interpreted that each market given a small effect but all the coefficient significant affects the prevailing price changes in every market at 5 percent level of significancy. This is indicates the importance of LR cointegration relationship in the process of determining rice price in Indonesia.

Changes in prices prevailing at the columns D(JAKARTA), D(JATIM), D(JABAR), D(JATENG), D(SULSEL), D(SUMUT), D(SUMSEL), D(LAMPUNG), and D(SUMBAR) with rows D(JAKARTA(-1)), D(JATIM(-1)), D(JABAR(-1)), D(JATENG(-1)), D(SULSEL(-1)), D(SUMUT(-1)), D(SUMSEL(-1)), D(LAMPUNG(-1)), and D(SUMBAR(-1)), are describe the magnitude of adjustment for price changes the price of SR in the period prior to changing the price goes (dependent variables).

Changes in rice prices each market on model beside influenced by the LR relationship are also influenced by changes rice prices in other areas at lag 1. Changes of Jakarta rice price is influenced by the rice price of Central Java and North Sumatra. East Java rice price is influenced by changes in rice prices of Jakarta, Central Java, North Sumatra and West Sumatra. Changes in West Java rice price is influenced by the price of rice in Central Java and North Sumatra. Central Java rice price changes is influenced by the rice price of Jakarta, North Sumatra, West Sumatra and Central Java itself. Rice price changes in South Sulawesi is influenced by itself and the rice price changes in East Java, Central Java, and South Sumatra. North Sumatra rice price changes is influenced by the price of rice in East Java, Central Java, South Sulawesi, Lampung and its own price changes. Changes in South Sumatra rice price are influenced by the rice price of Central Java and South Sulawesi. Lampung rice price changes are influenced by the rice price of Central Java and North Sumatra. Changes in West Sumatra rice prices are influenced by the rice price of Central Java and its own rice prices. From the description can be interpreted that the rice market of each region are influenced by changes in previous prices itself and also influenced by other local rice market.

Table 2: VECM coefficient value of Rice Retail Market Integration Inter Provinces Rice Production Center in Indonesia

Error Correction	Endogen Variable								
	D (JAKARTA)	D (JATIM)	D (JABAR)	D (JATENG)	D (SULSEL)	D (SUMUT)	D (SUMSEL)	D (LAMPUNG)	D (SUMBAR)
ECT1	0.0319 [0.5429]	0.1448 [2.8565]**	0.2363 [3.7768]**	0.2135 [4.1810]**	-0.0479 [-1.5022]	0.0852 [2.9763]**	0.1177 [2.0130]**	0.2573 [3.2427]**	0.34497 [4.2168]**
ECT2	-0.1546 [-1.4597]	-0.3557 [-3.893]**	-0.3061 [-2.715]**	-0.2894 [-3.144]**	-0.0181 [-0.3141]	-0.0206 [-0.3994]	-0.5228 [-4.960]**	-0.3802 [-2.658]**	-0.2740 [-1.8583]*
D(JAKARTA(-1))	-0.1849 [-1.1731]	-0.3046 [-2.239]**	-0.0653 [-0.3889]	-0.2412 [-1.7594]*	0.0511 [0.5961]	-0.0195 [-0.2531]	-0.2357 [-1.5019]	-0.3094 [-1.4528]	0.3343 [1.5228]
D(JATIM(-1))	-0.0794 [-0.3627]	-0.0438 [-0.2322]	-0.0025 [-0.0107]	0.1157 [0.6079]	-0.2132 [-1.7915]*	-0.1816 [-1.7023]*	0.0154 [0.0707]	-0.1359 [-0.4599]	-0.2175 [-0.7135]
D(JABAR(-1))	-0.0647 [-0.3890]	-0.0451 [-0.3142]	-0.1203 [-0.6795]	-0.0299 [-0.2072]	-0.0547 [-0.6055]	-0.0682 [-0.8415]	-0.0235 [-0.1423]	0.1342 [-0.5979]	-0.0865 [-0.3738]
D(JATENG(-1))	0.5994 [2.493]**	0.5266 [2.5394]**	0.5437 [2.1244]**	0.3842 [1.8385]*	0.2764 [2.1147]**	0.4559 [3.8915]**	0.6845 [2.8608]**	0.6818 [2.0998]**	0.7914 [2.3641]**
D(SULSEL(-1))	0.0192 [0.0952]	0.1394 [0.8016]	-0.1829 [-0.8519]	-0.1534 [-0.8749]	0.2987 [2.7245]**	0.2741 [2.7890]**	0.5525 [2.7525]**	0.1069 [0.3923]	0.3291 [1.1721]
D(SUMUT(-1))	0.8419 [3.428]**	0.6431 [3.0360]**	0.9156 [3.502]**	0.8172 [3.8280]**	0.0908 [0.6800]	0.4497 [3.7577]**	0.0794 [0.3247]	1.0743 [3.2391]**	-0.0259 [-0.0759]
D(SUMSEL(-1))	0.0417 [0.2068]	0.0910 [0.5227]	0.0400 [0.1864]	-0.1809 [-1.0313]	0.3435 [3.1293]**	-0.0310 [-0.3151]	0.0741 [0.3686]	-0.1276 [-0.4682]	-0.0910 [-0.3238]
D(LAMPUNG(-1))	0.0585 [0.3912]	-0.1377 [-1.0679]	-0.0720 [-0.4528]	0.0181 [0.1394]	-0.1134 [-1.3957]	-0.1341 [-1.8416]*	-0.1372 [-0.9221]	-0.1189 [-0.5894]	-0.0415 [-0.1994]
D(SUMBAR(-1))	0.0525 [0.6186]	0.1595 [2.1782]**	0.0779 [0.8631]	0.1587 [2.1507]**	-0.0421 [-0.9114]	-0.0177 [-0.4273]	0.0457 [0.5414]	-0.0733 [-0.6394]	0.2426 [2.0525]**
R^2	0.3995	0.3665	0.3994	0.3988	0.3396	0.4198	0.3224	0.3152	0.4224
F-Statistic	6.3220	5.4967	6.3191	6.3026	4.8860	6.8764	4.5205	4.3739	6.9497

Notes: ECT=*Error Correction Term*; D= first difference operator; [ ] t-statistic
** Significant at level 5%; * significant at level 10%

5. Conclusion

Based on the results of research it can be concluded that the retail market of rice between the provinces of rice production centers in Indonesia has not fully integrated. There is an independent and interdependence with one another in Indonesia rice market, meaning that the market structure is not perfectly competition. Government intervention in the rice market should always be to maintain rice price stability in Indonesia. For efficiency of rice price policies, the government should pay attention to price fluctuations in Jakarta, because disturbances in Jakarta rice market will impact to the other provinces.

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