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Prices Cointegration Analysis between Rice and Paddy in Indonesia: A Preliminary Study

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Abstract: The purpose of this research is to investigate whether integration between rice grain market and rice paddy market occurs. It can be known from the presence, or absence of cointegration between rice price with paddy price. With the knowledge, the government could make the right policies to protect paddy producers, or rice consumers. The research concludes that paddy and rice markets cointegrate. This study uses secondary data survey, of daily paddy and rice prices in various producing areas in Indonesia. This study is also a preliminary phase of a further emprical research in Kabupaten Indramayu, Province of West Java; planned for 2013.

Key words: price; cointegration; market; rice; paddy

JEL code: Q11

1. Introduction

Rice, and paddy is a strategic commodity in Indonesia. Rice is the main food of the Indonesian society; paddy is the most important product for Indonesian farmers. Understandably, the consumers prefer low cost, as opposed to the producers. Since all rice products came from paddy, if the price of paddy is expensive the price of rice will follow. Price of rice is a “price leader” for Indonesian economics. The rise of rice price even causes the rise of inflation. However on the other hand, farmers need to secure their family income. If the rice and paddy market integrated, so would the price of both. This means Government Interventions would be unnecessary (Yang et al., 2000).

2. Literature Review

Studies of similar cases in other countries, such as “Testing for the law of one price: rice market integration in Bangladesh” by Dawsonand Dey (2002); “Unilateral reforms, trade blocs, and law of one price: MERCOSUR rice markets” by Bierlen et al. (1998), in Argentina-Brazil, between two countries using Law of One Price theory; and “The Spatial Integration of Paddy Markets in Vietnam” by Baulch et al. (2002) for paddy market study. The conclusion is an integrated market integration between northern and southern Vietnam. The Studies shows that

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there are many integrated market between paddy and rice, even between two countries.

In agricultural market, there are many studies to analyze integrated markets. For example: “Market integration and convergence to the law of one price in the North American onion markets” by Dwi Susanto et al. (2004). The analysis shows an increase in the speed of price convergence over time, eproofing the market is integrated. Another study of integrated market is “Vertical integration and non-linear price adjustments: The Spanish poultry sector” by Ben-Kaabia et al. (2005). The result of this study shows that in the short run, price adjustments between the feed and the farmer levels are fairly symmetric and are representative of a cost-push transmission mechanism. On the other hand, retailers benefit from any shock, whether positive or negative, that affects supply or demand conditions when price spreads are increasing, while price behavior is closely related to competitive markets when faced with declining price spreads. The conclusion is many market are integrated in agricultural product. Mananyi and Struthers (1997) state thata problem in testing market efficiency is that the relevant economic data series may be non-stationary. Under these circumstances, conventional statistical procedures for testing market efficiency are no longer appropriate. Wei and Xiu (2006) study shows that there is a long-run co-integration relationship between domestic sugar markets, and between world sugar spot market and China’s domestic sugar market. Even the integrated market is proved in non agricultural product; For example the study by Martín (2007), law of one price in retail banking. The result of this study shows the interest rates of twenty five different bank loan and deposit products adjust rather rapidly to their long-term values in response to external shocks, as the relative version of the Law of One Price predicts, but the evidence runs contrary to the absolute version of the Law.

3. Material and Methods

Materials in this research is the price of rice and price of paddy data. The Methods is survey by secondary data taken from reports of rice price by Indonesian Department of Agriculture, using Its Internet Database (http://database.deptan.go.id) as the source. The price of rice shown is the price that day in the that region in medium quality. What considered as The price of paddy is the milled paddy, still with husk; In Indonesian, “*gabah*”. The price of *gabah* are also obtained from the same source (http://database.deptan.go.id). The data covers reports from 30 major paddy producing regions in Indonesia, from January 1, 2012 to December 31, 2012; of Ciherang, IR42, IR64, Ciliwung, and Surya rice paddy variety. Not all regions have daily data.

The cointegration analysis uses E Views program. The program can only excute data from Tapanuli Selatan because other regions have incomplete data. Precondition of cointegration analysis requires establishing that each individual data is nonstationary and integrated on an order of 1 (Yang et al., 2000). Test of A non stationary data used by the augmented Dickey-Fuller (ADF) regression model. Second test the integrated on an order of 1 by the testing for a unit root in time series regression. The null hypothesis tests states that the price series has a unit root. Therefore, if the reported test statistics probability to reject null hypothesis larger than 0.05, the null hypothesis cannot be rejected. The analysis of unit root test is calculated by E-views program.

4. Result and Discussion

The result of cointegration analysis with E Views program is as following:

Table 1 The First Test is Non Stationary Data: The Result of Unit Root Test

Null Hypothesis: Y has a unit root				
Exogenous: Constant				
Lag Length: 6 (Automatic - based on SIC, maxlag = 16)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.448085	0.0003
Test critical values:	1% level		-3.448363	
	5% level		-2.869374	
	10% level		-2.571011	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(Y)				
Method: Least Squares				
Date: 05/10/13 Time: 19:53				
Sample (adjusted): 1/08/2012 12/31/2012				
Included observations: 359 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y(-1)	-0.159457	0.035849	-4.448085	0.0000
D(Y(-1))	0.077414	0.048879	1.583808	0.1141
D(Y(-2))	0.076771	0.048862	1.571175	0.1170
D(Y(-3))	0.079730	0.048839	1.632513	0.1035
D(Y(-4))	0.077706	0.048839	1.591074	0.1125
D(Y(-5))	0.078461	0.048815	1.607313	0.1089
D(Y(-6))	-0.405207	0.048797	-8.303944	0.0000
C	1535.472	440.7809	3.483527	0.0006
R-squared	0.275577	Mean dependent var		-2.367688
Adjusted R-squared	0.261130	S.D. dependent var		6019.632
S.E. of regression	5174.328	Akaike info criterion		19.96284
Sum squared resid	9.40E+09	Schwarz criterion		20.04938
Log likelihood	-3575.330	Hannan-Quinn criter.		19.99725
F-statistic	19.07481	Durbin-Watson stat		1.964351
Prob(F-statistic)	0.000000			

The result of analysis do not have unit root, because probability rejected the null hypotesis is > 0.05. The result of this analysis is the data are not stationary.

The result of the unit root test with first different for price levels with Augmented Dickey-Fuller test statistic that the probability is < 0.05. Then the null hypothesis can rejected, the data is non stationary. Second test the integrated on an order of 1. The null hypothesis is no co integration price between milled paddy and Rice. Null hypothesis can't rejected if p > 0.05. To calculate the test used E-views program. The variable of X is the price of rice, and the variable of Y is the price of milled paddy. The result of co integrated analysis is p > 0.05. Then the null hypothesis is rejected, the price of milled paddy and rice is integrated. The Results are as following:

Table 2 The Second Test Is Cointegration Analysis

Date: 05/11/13 Time: 11:28				
Sample (adjusted): 1/06/2012 12/31/2012				
Included observations: 361 after adjustments				
Trend assumption: Linear deterministic trend				
Series: X Y				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.120584	52.08316	15.49471	0.0000
At most 1 *	0.015654	5.695705	3.841466	0.0170
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.120584	46.38745	14.26460	0.0000
At most 1 *	0.015654	5.695705	3.841466	0.0170
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b = I):				
X	Y			
-0.000437	0.000114			
0.002976	1.46E-05			
Unrestricted Adjustment Coefficients (alpha):				
D(X)	6.205357	-12.32877		
D(Y)	-2081.463	-8.227598		
1 Cointegrating Equation(s):		Log likelihood	-5799.322	
Normalized cointegrating coefficients (standard error in parentheses)				
X	Y			
1.000000	-0.261670			
	(0.03802)			
Adjustment coefficients (standard error in parentheses)				
D(X)	-0.002714			
	(0.00233)			
D(Y)	0.910355			
	(0.13123)			

5. Research Implication

The result of this study concludes that the price of rice is integrated with the price of milled paddy. Therefore, price increased in rice consumer level is linked with the fluctuation of price in producer level, and vice-versa. But the question is, how elastic is the price? How much percentage the rise of price of paddy by impact of the rising of price of rice, if elasticity of price is one? In another word, are there same percentage price of rice and price of paddy; which in The Law of One Price theory indicates the perfect competition market.

The Agricultural Market seems to be a monopsonistic market, because bargaining position of farmer is less than the traders. The market structure is important, because in monopsony market rising the price of rice have a little impact for the farmer profit. Explanation of this statement as follows:

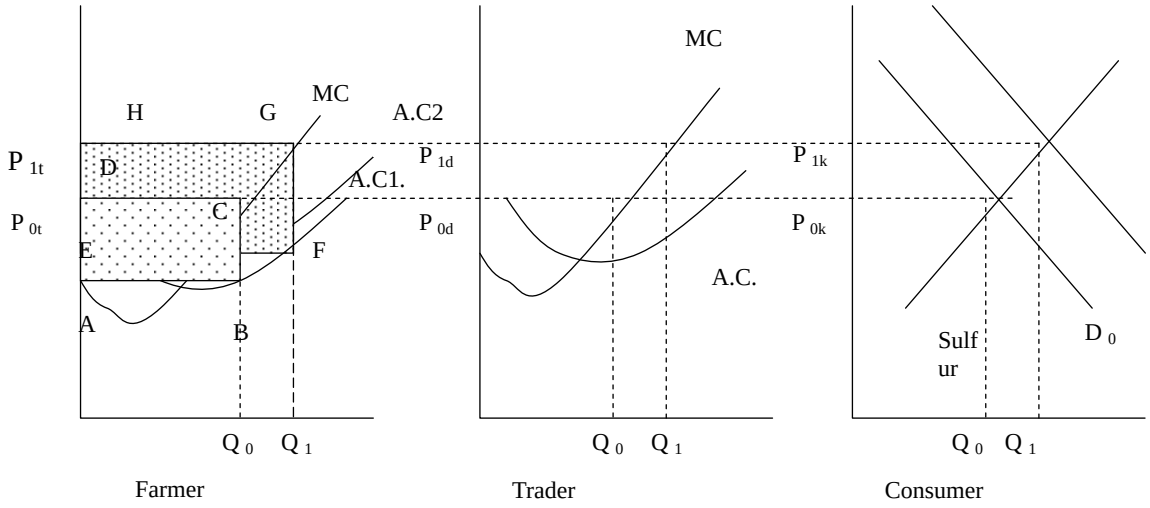

Figure 1 Perfect Competition Market

The Figure 1 is in perfect competition market. In the perfect competition market, rising price in consumer market is equal to rising price in farmer market. The farmer profit is rising from ABCD to EFGH square. But in monopsony market rising of price in consumer market is unequal in farmer market as shown in Figure 2.

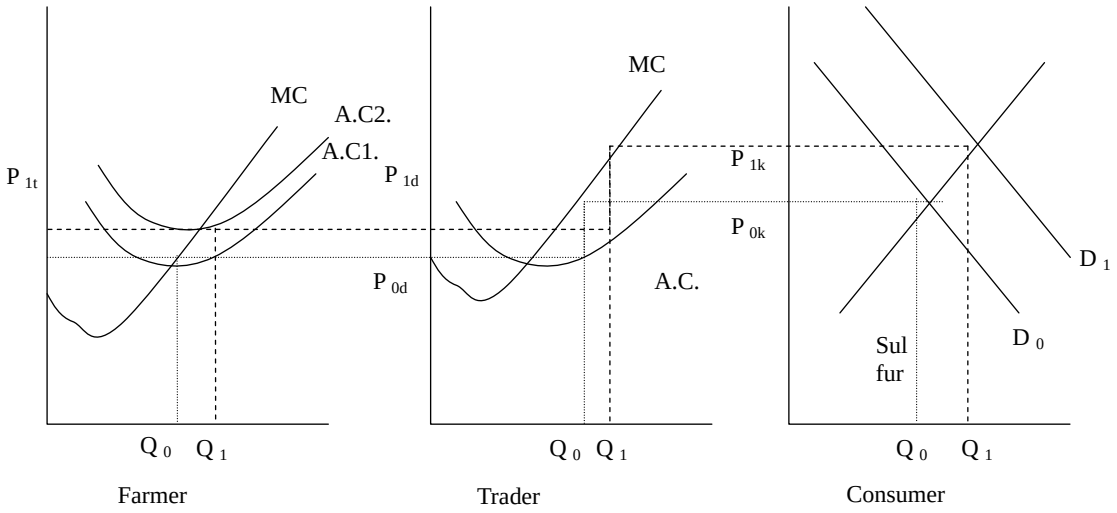

Figure 2 The Monopsony Market

In the monopsony market the farmer does not gain profit, since the price from trader is in equal average cost. If the price is rising in consumer market, the price rise in the farmer market is unequal.

Here are the result analysis from 12183 data of price rice and price of milled paddy from regions of Indonesia at 2012. The X variable is price of rice and the Y Variable is price of paddy. Price elasticity in farmer market is as following:

Table 3 The Result of Price Elasticity

Dependent Variable: LOG(Y)				
Method: Least Squares				
Date: 05/12/13 Time: 18:29				
Sample: 1 12183				
Included observations: 12183				
LOG(Y)=C(1)+C(2)*LOG(X)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	6.175123	0.126447	48.83584	0.0000
C(2)	0.229290	0.014239	16.10322	0.0000
R-squared	0.020845	Mean dependent var		8.211127
Adjusted R-squared	0.020764	S.D. dependent var		0.193834
S.E. of regression	0.191811	Akaike info criterion		-0.464452
Sum squared resid	448.1549	Schwarz criterion		-0.463236
Log likelihood	2831.212	Durbin-Watson stat		1.887468

The result of price elasticity is 0.23, it means that if the price of rice rise 1 percent; the price of paddy is rising 0.23 percent. Influence of X variable to Y variable is significant, because probability is less than 0.05. The result indicates unequal rising, meaning there is no perfect competition in farmer market. From this analysis, since the common bargaining position of farmers is less than trader, therefore the agriculture market is a monopsony market.

6. Conclusion, Limitation and Further Research

The research concludes that there is integrating market, cointegration between price of paddy and rice exists. This finding should be factored in by the government in making HPP (Government Purchase Price) policy on rice; Policies related with rice price stabilization; as well as rice and paddy trade regulations. This research have a weakness in data; it uses secondary data and many data have missing value. It is suggested that, the research should be corrected and amended by researches using better data. This study is also a preliminary phase of a further emprical research in Indramayu District, Province of West Java; which the writers shall carry out from May till December 2013, funded by ITB Capacity Enhancement Research Programme, The study titled: Market Structure Effect on The Integration of Rice and Paddy Price, and The Impact towards Rice Farmer Income.

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