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INTEGRATION AMONG REGIONAL VEGETABLE MARKETS IN INDONESIA

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ABSTRACT

Horticulture played an important role in the Indonesian economy. Its share of GDP, which was dominated by vegetables and fruits, tended to increase since 2003 up to 2008. However Indonesian per capita consumption of vegetables was still under FAO recommendation. The study of price integration among regions is important in order to increase the marketing efficiency of vegetables in Indonesia. Government intervention is needed both at the producer and consumer level, especially in determining the efficient prices. The success of this intervention depends heavily on government's understanding of price transmission in the fruits market. This research measured the integration level of regional vegetables markets in Indonesia. Engle-Granger test showed that all vegetable prices at PIKJ integrated with producer's prices, except red chili price. Ravallion model showed that integration did not exist for all commodities. However, there was no significant difference of the market integration performance between the highest and the lowest production area.

Key words: spatial integration, Ravallion model, cointegration

INTRODUCTION

Horticultural commodities have quite a large agricultural potential because they have high economic value and have many added values compared to other commodities. Vegetables are one of the commodities from the horticultural sub sector. Indonesia is known as one of the tropical vegetables producing countries and has vegetables producing center areas in almost all its regions.

The contribution of the horticulture sector in Indonesia's Gross Domestic Product tended to increase during the last decade. Two major contributors were fruits and vegetables, followed by floriculture and herbs. In 2003 the GDP from the horticulture sector was Rp 53.89 trillion, and then increased to Rp 80.29 trillion in 2008. However, the per capita consumption of vegetables in Indonesia was still low, about 40 kg in 2008. This was below the FAO recommendation for developing countries which is 73 kg per year. One of the conditions that must be satisfied when increasing the households' consumption is the price must be affordable for the people in the country (Purwoto, 2001).

Vegetables are a very important and strategic commodity because this type of commodity is a primary need for humans; it must be available at all times in an adequate amount and quality, it must be safe for human consumption, and the price must be within the range of the people's budget. The prices that tend to fluctuate not only have negative impacts for the people, but also increase the possibility of the farmers experiencing loss if the price information in the marketing chain does not reach the farmers. Thus the linkage between producer and market is very important in order to increase farmer's welfare (Tru, 2012).

The government's intervention, especially in the form of pricing policies, especially in the producer level, is much needed in ensuring the stability of vegetables prices. In Indonesia, some vegetables such as large red chili and shallots are classified by Bank of Indonesia (2010) as major contributors on inflation. The government's ability to determine the most suitable pricing policy is strongly influenced by how profound the decision makers' understanding of the market structure, behavior and effectiveness is. One of the methods to understand the structure, behavior, and effectiveness of the market is by understanding the relative strength of a market and the price diffusion from one market to another through a market integration study among regions in a country.

According to Tomek and Robinson (1972), the relationship between prices in different markets which are separated geographically could be analyzed using the spatial market integration concept. This can be done by utilizing the spatial equilibrium model. This model is developed by using the excess demand and excess supply curves from two regions involved in trade so that it is possible to make forcasts of the prices formed in each market and the amount of the commodities to be traded.

Spatial price integration may be defined as price transmissions between markets which are reflected in the shifts in prices in market geographically different for the same commodities. According to Ravallion (1986), if there is trade between two regions and the price at the importing region equals the price at the exporting region plus transportation costs due to shipment between the two, it can be said that there is spatial integration between the two regions.

Some of the previous studies concerning the market integration of agricultural commodities referred to the Ravallion model. Due to the developments in econometrics, many studies have been using the time-series approach in order to see whether two or more markets are integrated (Nyange, 1999; Sarker and Sasaki, 2000; Myae, et al, 2005; Kilima, 2006; Rufino, 2008). The Ravallion model is used to observe the price transmission from the reference market to the regional markets. The Engle-Grangel analysis is used to observe whether a co-integration is happening between the (wholesale) price at the reference market and the (producer) price at the regional level market (Jaleta, 2012). This study employs both approaches.

In general, this study aims to identify whether market integration exists among regional vegetables markets in Indonesia and to describe the movement of prices at the vegetables producer level (provinces level) and the prices of the vegetables at wholesale market *Pasar Induk Kramat Jati* (PIKJ) in Jakarta, Indonesia. Some of the main vegetables were selected in this study. They are: (1) shallots; (2) large red chili (3) potatoes; (4) cabbage and (5) tomatoes.

METHODOLOGY

Data and the Data Processing

The data used in this study is obtained from PIKJ; Ministry of Agriculture Indonesia and Indonesian Central Statistic Agency. In this tudy, PIKJ is assumed as the central market, because mostly vegetable traders bring their products from production area in Sumatera and Java islands into this market.

The data mainly used is the secondary time-series data, which comprises of the monthly data from 2001 to 2008. It includes the wholesale price data and the supply volume at PIKJ and also the price at the producer level in each production center province data. Eventhough vegetables are highly seasonal, because PIKJ is a wholesale market located in Jakarta, everyday traders from production centers supply the products into this market. In this study, four provinces which produced the largest and the lowest production were selected. In Table 1 and 2, two provinces which produced the largest are coded with number 1 and 2, while the other provinces with number 3 and 4. This study employs the cointegration and the Ravallion model. Data processing is done using the EViews 6 software.

The Co-integration Approach

The first approach is done using the Engle-Granger co-integration procedure. This procedure uses the following regression equation:

$$P_t = \alpha + \beta_1 R_t + \beta_2 t + e_t \qquad (1)$$

where P_t = the producers' price in the production center province during the time *t*
R_t = the wholesale price at PIKJ during the time *t*
t = the time trend
e_t = random error

This is followed by a testing for the random error using the Augmented Dickey-Fuller (ADF)-test :

$$\Delta e_t = \lambda e_{t-1} + \sum_{k=2}^{n} \Theta_k \Delta e_{t-k} + \mu_t \qquad (2)$$

where
Δe_t = $e_t - e_{t-1}$
μ_t = the random error of Δe_t

The hypotheses in this procedure are:
$H_0 : \lambda = 0$
$H_1 : \lambda \neq 0$
If the zero hypothesis is rejected, this means that both markets are integrated.

The Ravallion Model

The Ravallion model which is empirically applied by Heytens (1986) has been used widely, developed, and discussed within the market integration analysis. According to Tahir and Riaz (1997), studying market integration using the Ravallion model could also be used to determine the leading market among the local markets. It is begun from the following equation:

$$R = f\,(P_1, P_2, P_3, ..., P_n, X) \qquad (3)$$
$$P_i = f_i\,(R, X_i),\ i = 2,.....,n \qquad (4)$$

In this case, *n* is the regional markets with the price *P*; *R* is the price at the reference market. In thi case, n are markets in provinces and PIKJ is assumed as reference market. X_i is the vector showing the other factors which might affect the price at market *i* (including the reference market and the markets at the other production center regions). Because equation (3) and (4) only measure the price at the present time, the time lag influence inserted to the price will form a more dynamic structure. But if the lag period is too long, the model will become more complicated so that the the prices at each market is assumed to have only one lag phase, which is:

$$P_t = a_i P_{t-1} + b_{i0} R_t + b_{i1} R_{t-1} + c_i X_t + \varepsilon_t \qquad (5)$$
for $i = 1, 2, ..., n$

Equation (5) is sensitive towards the occurrence of multi co-linearity when the prices at the production center and the reference market strongly correlate. Making assumptions in the form of a first difference will decrease the effect of the multi co-linearity as $(R_t – R_{t-1})$ and $(P_t – P_{t-1})$ usually have weak correlation compared to R_t and P_t. this transformation will result in:

$$P_t - P_{t-1} = a_i P_{t-1} - P_{t-1} + b_{i0} R_t + b_{i1} R_{t-1} + c_i X_t + \varepsilon_t \quad (6)$$

The $b_{i0}R_{t-1}$ is added to the right side of the equation

$$(Pt - Pt_{-1}) = (a_i - 1)(Pt_{-1} - R_{t-1}) + b_{i0}(R_t - R_{t-1}) + (a_i + b_{i0} + b_{i1} - 1) R_{t-1} + c_i X_t + \varepsilon_t \quad (7)$$

Equation (7) may be simplified to:

$$(P_t - P_{t-1}) = ß_1(P_{t-1} - R_{t-1}) + ß_2(R_t - R_{t-1}) + ß_3 R_{t-1} + ß_4 X_t + \varepsilon_t \quad (8)$$

where:

$a_{i-1} = ß_1$
$b_{i0} = ß_2$
$a_i + b_{i0} + b_{i1} - 1 = ß_3$ and $c_i = ß_4$

In this study, the X_t variable is the supply volume at PIKJ. More specifically, the Ravallion model in this study may be formulated as:

$$(P_t - P_{t-1}) = ß_1(P_{t-1} - R_{t-1}) + ß_2(R_t - R_{t-1}) + ß_3 R_{t-1} + \beta_4 X_t + \beta_5 X_{t-1} + \varepsilon_t \quad (9)$$

In order to obtain a clearer interpretation, equation (9) is re-written to

$$P_t = (1 + ß_1) P_{t-1} + ß_2(R_t - R_{t-1}) + (ß_3 - ß_1) R_{t-1} + \beta_4 X_t + \beta_5 X_{t-1} + \varepsilon_t \quad (10)$$

where:

$b_1 = 1 + \beta_1$
$b_2 = \beta_2$
$b_3 = \beta_3 – \beta_1$

Equation (10) may be written as:

$$P_t = b_1 P_{t-1} + b_2(R_t - R_{t-1}) + b_3 R_{t-1} + b_4 X_t + b_5 X_{t-1} + \varepsilon_t \quad (11)$$

In order to show the effect of previous prices in the regional market towards the formation of the producers' price in the regional market at a certain time, the Index of Market Connection (IMC) is utilized. The IMC was developed by Timmer (1987) which is defined as the ratio of the regional market coefficient to the reference market coefficient, i.e.;

$$IMC = \frac{b_1}{b_3} \quad (12)$$

If IMC value of less than one indicates short term integration. In this case, b_2 is the measurement of the rate of price change at the reference market which is transmitted to the regional market. This parameter measures the long term integration and the value expected is one or nearing one. If the value of the b_2 coefficient is one ($b_2 = 1$), both markets are completely integrated in the long term. The difference between the two indicators is that b_2 shows the percentage of the price change happening in the reference market which is transmitted to the regional market. The IMC shows the current relative percentage of the producers' price at the regional market which is obtained through the previous producers' price at the regional market and the wholesale price at the reference market, PIKJ.

In this approach, the short term integration is formulated as follows:

$H_0 : b_1/b_3 = 0$
$H_1 : b_1/b_3 \neq 0$

The value of $b_1/b_3 = 0$ if the value of $b_1 = 0$, so the hypothesis above can be written as:

$H_0 : b_1 = 0$
$H_1 : b_1 \neq 0$

Statistical test used is:

$$t_{statistic} = \frac{b_1 - 0}{S(b_1)}$$

If the zero hypothesis is rejected, it means that the market is not integrated in the short term. For long term integration, the hypothesis is formulated as:

$H_0 : b_2 = 1$
$H_1 : b_2 \neq 1$

The value of $t_{statistic}$ is obtained from:

$$t_{statistic} = \frac{b_2 - 1}{S(b_2)}$$

If the zero hypothesis is rejected, it means that the market is not integrated in the long term.

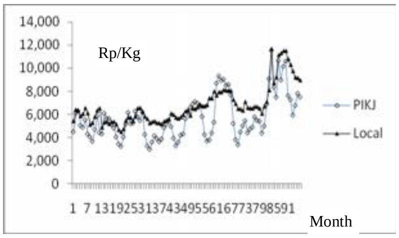
RESULTS AND DISCUSSION

The Correlation Analysis

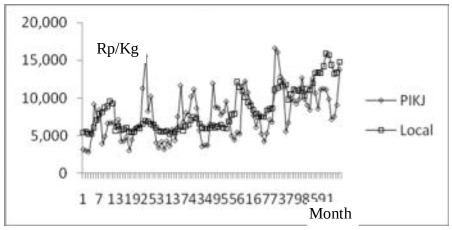
In Indonesia, there are five kinds of vegetables which can potentially yield large crops annually, shallots, large red chili, potatoes, cabbage, and tomatoes. These five commodities are produced in almost all of the provinces in Indonesia. Based on the data from the Ministry of Agriculture, the production of these five vegetables is inclined to be fluctuative. In the period of 2002 to 2008, based on the average production, the largest to the smallest production is: cabbage, potatoes, shallots, large red chili, and, lastly, tomatoes.

From the data in PIKJ, the prices of those vegetables during the 2001 to 2008 period experienced a relative increase. Every year, large red chili reaches the highest price followed by shallots. The movement of five vegetable prices at PIKJ and producer level along that period (96 months) can bee seen in Figure 1.a - 1.e. In this case, the producer level prices are average price from four production centers. All figures generally show that the commodity prices at PIKJ and producer level fluctuated in similar direction. However, the prices at producer level are average price, where the statistic analysis below may give different conclusion.

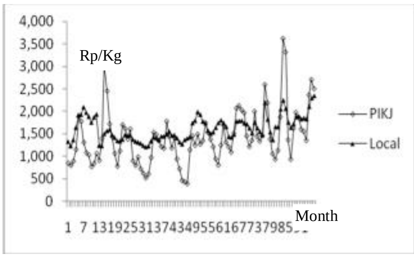
Furthermore in order to see the close relationship between variables analyzed in this study, the correlation analysis is conducted. Some results from the correlation coefficients are as follows. In the case of shallots, the strongest correlation is between the previous month's wholesale price with the current wholesale price at PIKJ. Besides that, a strong correlation also occurs between the previous month's wholesale price at PIKJ and the current price in Central Java and East Java. When compared to the shallots, the large red chili's correlation between the previous month's price and the current price in the regional markets is weak. Besides that, the supply volume at PIKJ has a weak relationship with the producers' price in production center provinces.



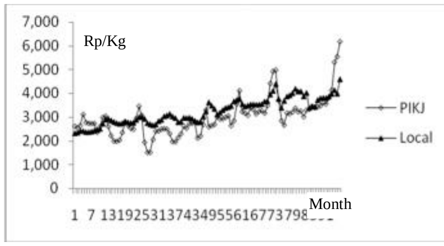
a. Plot of Shallots Price



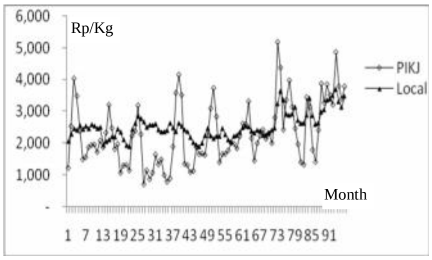
b. Plot of Red Chili Price



c. Plot of Potatoes Price



d. Plot of Cabbage Price



e. Plot of Tomatoes Price

Fig. 1. The Plots of Vegetable Prices in PIKJ and Producer's Price, 2001-2008

As for potatoes, the price from the producers in West Java and Central Java has a fairly strong correlation to the price at the reference market, seen from their high correlation values. However the supply volume of potatoes has a weak correlation to the producers' price and the PIKJ price between the current month's price and the previous month's price. As for the case with cabbage, besides the correlation between the current month and the previous month at PIKJ, the correlation of all of the variables is weak. The correlation between the supply of cabbage at PIKJ and the all the variables is weak, even though some of the correlation coefficients are negative.

The correlation between variables for potatoes is not too different from that of cabbage. Compared to other other commodities, the price of tomatoes at PIKJ the current month compared to the price at PIKJ the previous month has the lowest degree of correlation. This means that the sellers at PIKJ almost never use the information of the previous price in determining the current price. The correlation between the supply and the price at PIKJ is negative and is higher than other commodities.

The Cointegration Analysis

Testing using the Engle-Granger cointegration analysis is done to observe any indications of long term integration between the wholesale prices at PIKJ with the producers' prices at the production center provinces. In this case, the number of lag is chosen based on the minimum Akaike Information Criteria statistic. Table 1 shows the results of the ADF test for market integration for all the commodities studied. From the ADF test results, the commodity of shallots' zero hypothesis is rejected, meaning that the producers' price at the production centers cointegrate with the price at PIKJ.

Table 1. The Co-integration Test Results between PIKJ and Producer's Prices

Commodity	The Production Center Province	$T_{statitsic}$	T_{table} (critical value)	
Shallots	1. Central Java	-3.518[a]	1% level	-4.058
	2. East Java	-4.238[a]	5% level	-3.458
	3. Lampung	-3.986[a]	10% level	-3.155
	4. South East Sulawesi	-3.494[a]		
Large red chili	1. West Java	-2.807		
	2. North Sumatra	-3.813[a]		
	3. Central Sulawesi	-1.217		
	4. South East Sulawesi	-2.425		
Potatoes	1. West Java	-3.949[a]		
	2. Central Java	-3.771[a]		
	3. Lampung	-3.859[a]		
	4. Bengkulu	-2.616		
	1. West Java	-4.444[a]		
Cabbage	2. Central Java	-3.244[a]		
	3. D.I Yogyakarta	-4.218[a]		
	4. East Nusa Tenggara	-2.693		
Tomatoes	1. West Java	-4.430[a]		
	2. North Sumatra	-4.055[a]		
	3. D.I Yogyakarta	-3.842[a]		
	4. Central Sulawesi	-3.894[a]		

Note: [a] is significant at the real level of 10%

For the large red chili commodity, the only zero hypothesis rejected is the the producers' in North Sumatra. This means only the producers' price in North Sumatra is cointegrated with the price of large red chili at PIKJ. In contrast, for potatoes, only Bengkulu's zero hypothesis is not able to be rejected. This means that the prices at the potato production centers except in Bengkulu are cointegrated with the price at PIKJ.

For cabbage, the producers' prices in all provinces are integrated with the price at PIKJ, except for East Nusa Tenggara's. For tomatoes, all zero hypotheses are rejected, meaning that the price of tomatoes in all provinces is integrated with the price of tomatoes at PIKJ.

The Ravallion Model Analysis

From the regression estimate result with the Ravallion Model, the IMC value for the foru production center provinces is much larger than 1. The testing of the $b_1 = 0$ hypothesis supports this (see the IMC testing in Table 2). In this case, the zero hypothesis is rejected which means there is no short term integration between the price of vegetables at the production center and the price at PIKJ. The rejected zero hypothesis and the IMC value which is much larger than 1 shows that the producers' price during the previous month at the production center has more influence on the current month's vegetables price compared to the price at PIKJ.

Table 2. Index of Market Connection of PIKJ and Producer's Price.

The Production Center Province	IMC	(b_2)-1[a]	T_{stat} [b]	t T_{stat} [c]	T_{table}	R^2-*adj*	DW-$_{stat}$[d]
Shallots							
1. Central Java	3.514	-0.570	10.399	12.419	2.576	0.868	1.941
2. East Java	2.745	-0.460	8.945	6.747	2.576	0.803	2.114
3. Lampung	10.915	-0.826	14.838	14.86	2.576	0.833	2.096
4. South East Sulawesi	16.079	-0.965	25.556	22.838	2.576	0.946	2.209
Large red chili							
1. West Java	5.656	-0.757	16.713	16.735	2.576	0.842	1.861
2. North Sumatra	7.449	-0.879	15.278	16.102	2.576	0.814	1.468
3. Central Sulawesi	25.646	-0.942	33.630	30.264	2.576	0.960	1.812
4. South East Sulawesi	15.011	-0.982	27.187	23.126	2.576	0.932	2.100
Potatoes							
1. West Java	4.664	-0.802	13.480	16.453	2.576	0.863	1.851
2. Central Java	3.463	-0.685	10.819	10.603	2.576	0.823	1.872
3. Lampung	-341.88	-0.926	27.211	9.929	2.576	0.907	1.962
4. Bengkulu	9.331	-0.969	19.224	14.685	2.576	0.878	1.606
Cabbage							
1. West Java	4.911	-0.745	8.826	17.393	2.576	0.677	2.023
2. Central Java	11.08	-0.664	15.193	10.039	2.576	0.737	1.834
3. D.I Yogyakarta	20.539	-0.827	16.761	12.789	2.576	0.807	1.815
4. East Nusa Tenggara	86.826	-0.972	23.117	47.477	2.576	0.873	2.414
Tomatoes							
1. West Java	3.791	-0.818	9.554	30.224	2.576	0.800	2.112
2. North Sumatra	-402.286	-1.001	13.031	36.958	2.576	0.638	1.495
3. D.I Yogyakarta	2.700	-0.710	11.379	26.237	2.576	0.823	1.817
4. Central Sulawesi	26.026	-0.963	12.164	35.563	2.576	0.672	2.029

Note: [a] the coefficient value
[b] the $t_{statistics}$ value for coefficient b_1
[c] the $t_{statistics}$ value for coefficient (b_2)-1
[d] the value of dl = 1,425 ; du = 1,641

The result of the long term integration test with the zero hypothesis $b_2 = 1$ is also rejected at all vegetables production centers (see coefficient P_{t-1} in Table 3). This also means that the vegetables producers' price in the four production center provinces observed do not integrate in the long term with the price of vegetables at PIKJ. This means that the price changes in PIKJ are not well transmitted to the producer level at the production centers. It can be said that the marketing efficiency has not been fully obtained for the vegetables commodity in Indonesia. This may be caused by the vegetables producers' lack of access to information of the price movements at PIKJ. Besides that, the pressure from higher level marketing institutions also makes the prices received by the producers not parallel to the prices at PIKJ.

Table 3. The Ravallion Model Regression Equation Estimation Results

The Production Center Province	Coefficient					
	Intercept	P_{t-1}	$(R_t - R_{t-1})$	R_{t-1}	X_t	X_{t-1}
Shallots						
1. Central Java	0.251	0.711[a]	0.430[a]	0.202[a]	0.029	0.004
2. East Java	0.510	0.678[a]	0.540[a]	0.247[a]	0.016	-0.006
3. Lampung	-0.261	0.815[a]	0.174[a]	0.075[a]	0.050	0.031
4. South East Sulawesi	-0.160	0.957[a]	0.035	0.060[a]	0.037	-0.033
Large red chili						
1. West Java	-0.883	0.840[a]	0.243[a]	0.148[a]	-0.102	0.166[a]
2. North Sumatra	-2.893	0.833[a]	0.121[a]	0.112[a]	0.010	0.213[a]
3. Central Sulawesi	-3.238	0.967[a]	0.058[a]	0.038	0.134[a]	0.072
4. South East Sulawesi	-2.009	0.931[a]	0.018	0.062	-0.084	0.217[a]
Potatoes						
1. West Java	0.958	0.736[a]	0.198[a]	0.158[a]	-0.011	0.005
2. Central Java	0.554	0.716[a]	0.315[a]	0.207[a]	-0.010	0.013
3. Lampung	0.707	0.931[a]	0.074	-0.003	-0.013	0.005
4. Bengkulu	-0.231	0.888[a]	0.031	0.095[a]	-0.008	0.034
Cabbage						
1. West Java	1.398	0.673[a]	0.255[a]	0.137[a]	-0.050	0.051
2. Central Java	-0.283	0.843[a]	0.336[a]	0.076	-0.304[a]	0.362[a]
3. D.I Yogyakarta	1.767	0.865[a]	0.173[a]	0.042	0.050	-0.124
4. East Nusa Tenggara	0.091	0.934[a]	0.028	0.011	-0.012	0.035
Tomatoes						
1. West Java	1.868	0.628[a]	0.182[a]	0.166[a]	-0.058	0.035
2. North Sumatra	2.868	0.820[a]	-0.001	-0.002	-0.090	-0.004
3. D.I Yogyakarta	-3.096	0.722[a]	0.290[a]	0.267[a]	0.182	0.025
4. Central Sulawesi	4.333	0.777[a]	0.037	0.030	-0.134	-0.050

Note: [a] is significant at the 10% level

The difference in the analyses results using the two approaches is due to the difference in the point of view in understanding market integration. The co-integration model only sees whether the price movements in the two markets are parallel or not. The Ravallion model sees the two integrated markets, observing whether the price change in provincial market is more affected by the previous price changes in the same location or by the price changes at the reference market (PIKJ).

CONCLUSIONS AND RECOMMENDATIONS

Some conclusions can be derived from this study. In exception of the large red chili, this study shows a difference in the results of the market integration analyses using two different approaches, the co-integration model and the Ravallion model. The cointegration models show that the producer prices integrate with the reference market (PIKJ). However the results from the Ravalllion model show that there is no integration behavior between the market at the producer level and the PIKJ. Furthermore the supply volume at PIKJ does not have much influence in affecting the producers' price formation in production center provinces.

The different results may be due to different objectives of analysis. The cointegration model can be used to investigate the long-run relationship between commodity prices among regions. The Ravallion model is further aimed to determine whether a central market can be reference or barometer for some local markets. Also in the Ravallion model some variables can be included such as volume of production to observe the impact of supply on price movement.

Two analyses from this study show that the large red chili commodity should receive more attention as both approaches show that market efficiency has not yet been reached. In other words, PIKJ has not yet become the price barometer for this commodity. The analysis matches with the latest report from the Bank of Indonesia, where large red chili price was categorized as one of the major contributor to Indonesian general price volatility.

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REFERENCES

Bank of Indonesia. 2011. Monetary Policy Report Quarter IV: 2-3.

Heytens, P. J. 1986. Testing Market Integration. Food Research Institute Studies 20, 25-42.

Jaleta, M., Gebremedhin, B. 2012. Price co-Integration Analyses of Food Crop Markets: the Case of Wheat and *Teff* Commodities in Northern Ethiopia. African Journal of Agricultural Research Vol. 25, 3643-3652.

Kilima, F. T.M. 2006. Are Price Changes in the World Market Transmitted to Markets in Less Developed Countries? As Case Study of Sugar, Wheat and Rice in Tanzania. IIIS Discussion Paper no. 160: 1-35.

Myae, A.C., T. Yutaka, S. Fukuda, S. Kai. 2005. The Spatial Integration of Vegetables Markets in Myanmar. Journal of the Faculty of Agriculture, Kyusu University 50, 665-683.

Nyange, D. A. 1999. Estimation of Inter-regional Maize Market Integration in Tanzania and its Determinants. Journal of Rural Problems 135, 59-71.

Purwoto, A, H., P.S. Rachman, S. H. Suhartini. 2001. Price Correlation and Spatial Integration of Food Prices in South Sulawesi. Research Report. Indonesian Center for Agriculture Socio Economic and Policy Studies.

Ravallion, M. 1986. Testing Market Integration. American Journal of Agricultural Economics 68, 102-109.

Rufino, C.C. 2008. Inter-Regional Integration of the Philippine Rice Market. DLSU AKI Working Paper Series 2008-06. De La Salle University, Manila, Philippines.

Sarker, A.L., T. Sasaki. 2000. Spatial Integration of Fruit and Vegetables Markets in Bangladesh. Journal of the Faculty of Agriculture, Shinshu University 36, 31-38.

Tahir, Z., Riaz, K. 1997. Integration of Agricultural Commodity Markets in Punjab. The Pakistan Development Review 36, 241-262.

Thru, N. A., D. T. M. Hanh, D. T. K Hoa, N. V. Phuong, T. H. Cuong. 2012. Linkages in production and distribution of exported vegetables: Perspectives of farmers and firms in Luc Nam District, Bac Biang Province, Vietnam. J. ISSAAS 18, 113-130.

Timmer, C. P. 1987. Corn Marketing: Chapter 8 in The Corn Economy of Indonesia. Cornell University Press, Ithaca, New York, USA.

Tomek, W.G., K.L. Robinson. 1972. Agricultural Product Prices. Cornell University Press, Ithaca, New York, USA.