Spatial Market Integration and Price Transmission of Meat in Indonesia

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Abstract:

Food balance in the country tend to be deficit for main food staples as well "luxurious foods" like red meat. Food deficit has been prevailing until currently. Being the net importer of meat products, Indonesia is challenged to meet two pressing goals, first to protect farmers and secondly to secure meat availability. Trade flows between regions and access to information are challenging becuase Indonesia is an archipelagic country with high economic dispersion and inequality. This study aims to analyze spatial integration and price transmission of meat market in Indonesia. The data is a monthly prise series of meat from 7 provinces containing 50 observations. The data was analyzed using Vector Error Correction Model (VECM). This study reveals that there is a long run relationship among market price in seven provinces and the high long run relationship was found among provinces in Java island. The short run was also found among provinces. This findings represents that meat market in Indonesia was spatially integrated. This study recommends the goverment to formulate policies which providing infrastructure to avoid market exploitation and spread price information along provinces in Indonesia. This will help in enhancing efficiency of the marketing system in agricultural commodities and reduce market distortions.

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ABSTRACT

Domestic meat production which has not fulfilled domestic consumption causes price fluctuation in consumer level. The price fluctuation will cause instability of domestic economy condition such as inflation. Therefore, this study aims to analyze spatial integration and price transmission of meat market in Indonesia. To address these aims, monthly prise series data of meat from 7 provinces containing 50 observations from March 2012 to April 2016 was obtained. The data was analyzed using Vector Error Correction Model (VECM). This study reveals that there is a long run relationship among market price in seven provinces and the high long run relationship was found among provinces in Java island. The short run was also found among provinces. This findings represents that meat market in Indonesia was spatially integrated. This study recommends the goverment to formulate policies which providing infrastructure to avoid market exploitation and spread price information along provinces in Indonesia. This will help in enhancing efficiency of the marketing system in agricultural commodities and reduce market distortions.

Keywords— meat, price transmission, VECM, spatial integration

INTRODUCTION

Despite a remarkable economic growth, the government of Indonesia (GoI) is still facing a food security concern food. With exception for few food items, food balance in the country tend to be deficit for main food staples as well "luxurious foods" like red meat. Food deficit has been prevailing until currently. As a result, Indonesian food status has often been distorted by market shock in term in terms of price fluctuations. The situation has been representing a typical case of beef market. Besides availability issue of marker access has been typical of beef market in Indonesia. In order for the government to be able to cope with the potential problem of food security, the government of Indonesia is in urgent need of market information, with special attention of beef market.

Being the net importer of meat products, Indonesia Policy maker is challenged to meet two pressing goals, first to protect farmers as to encourage meat domestic production and secondly, to secure meat availability in order to prevent consumer of paying high price. Adding to that, the problems of effective of trade flows between regions and access to information are challenging due to the fact that Indonesia is in fact an archipelagic country with high economic dispersion and inequality. Good trade flows and increasing access of market information would make markets more effectively integrated. One of market study relevance to current Indonesia concern is spatial price transmission. Indonesia needs to study spatial price transmission in order to help filling the information gap, namely information on the causes of changes in prices that is necessary to address root causes, information bases to help forecast prices based on trends in related prices, and information that helps diagnose poorly functioning markets.

Related to the above situation, one effort to understand market distributional behavior is to make a market integration analysis.

In recent years, meat prices have fluctuated so it is increasingly important for policymakers to understand the extent of price shocks on consumers can be transmitted on local producers. Market structure, trading patterns, geographic patterns, and triggers the transmission of price shocks become an important factor in determining policy in the process of food price stability. According to the World Bank study on market integration, areas in Java has a speed adjustment to the price shock the world's fastest. One clear sign that the two markets are integrated is when shocks occur in one market to the other market is transmitted (Fackler and Goodwin 2001). Besides production deficit, inequality in the provision of food to the people is believed be trigger of rising food price. Given the issues the study on market transmission will link food security and market integration. If two sparable markets are integrated there exists a trade flow: the movement of food in response to supply/demand imbalances. The integration of market enables price signals to be transmitted from one market to another. This implies a stable price. A stable price ensures food security, as Households especially the poor ones can still plan a shopping budget or can even obtain food at more affordable prices.

The concept of efficiency implicit in the initial analysis of market integration. Roll (1979) was the first to overcome the effects of the gain efficiency for commodity markets in spatial price linkages (Fackler and Goodwin 2001). If there is efficiency, all information about supply and demand conditions (including transaction costs) must be embodied in market prices. Often, the alleged inefficiency caused by the failure of individuals to rationally respond to financial incentives (Fackler and Goodwin 2001). However, other factors can lead to such things as the amount of the transaction costs of trade. It is important to note that individuals can hardly affect the transaction costs are very high. Some possible reasons for high transaction costs quoted by Fackler and Goodwin (2001) are as follows: 1) the weak performance of the contract; 2) protection of inadequate policies; 3) corruption; 4) taxes are too high; and 5) transport and communications infrastructure is inadequate.

Research on the integration of markets is generally done to understand the market conditions. The information generated from these empirically related to economic modeling, determining the status of market competition, and the occurrence of policy intervention in the short term and long term. It can be seen in the following research which has the purpose to analyze spatial integration and price transmission on the meat market in Indonesia.

RESEARCH METHODS

Data Collection

This study used monthly price data of meat (Rp/kg) from 7 provinces in Indonesia containing 50 observations from March 2012 to April 2016. There are seven markets representing the provincial economies; namely, West Nusa Tenggara (NTB), East Nusa Tenggara (NTT), East Java, Central Java, West Java, South Sulawesi,and Jakarta selected for this study. Those data are used in logarithmic form and collected from website such aswww.pasarjaya.co.id, www.pertanian.go.id, disnak.jabarprov.go.id, aplikasi.pertanian.go.id dan siskaperbapo.com.

Stationarity Test

In general, the time series data have unit roots, where its mean and variance are random over time. Non stationary data will lead to wrong conclusion/spurious regression (Enders 2004 and Gujarati 1995). Augmented Dickey Fuller test is conducted to verify presence of unit root in the individual series data.The test is applied by running a regression of the two forms (Juanda 2012):

ADF test equation with intercept

$$\Delta Y_t = \gamma Y_{t-1} + \beta_i \sum_{t=1}^{\rho} \Delta Y_{t-i} + \varepsilon_t \qquad [1]$$

ADF test equation with constant and trend.

$$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \beta_i \sum_{t=1}^{\rho} \Delta Y_{t-i} + \varepsilon_t \qquad [2]$$

If the coefficient γ is not statistically different from zero, then the series data is nonstationary. The meat price on particular markets were tested for stationarity as in the equation above, where the dependent variable (Y_t) depics meat price of some markets and i shows the amount of markets. Then, the price series tested using Johannsen's cointegration, to determine whether those data are co-integraated.

Johansen-Julius Multivariate Test

Cointegration is long term relationship among nonstationary variables, but the linear combination of those variables can be stationary (Thomas 1997(2010bwb; Gopal et al2009). Johansen-Julius method was used to examine whether long-run equilibrium relationship exist between markets (Goodwin 1992 and Ismet et al 1998). This method is preferred to the others because it addresses endogeneity and simultaneity problems associated with other bivariate models as well as its ability to test more than two variables at a time (Acquah and Owusu 2012). Johansen-Julius test was conducted by comparing between trace statistic value and critical value. Trace test measures a number of cointegration vectors in the price series that using matrix cointegration rank as follow (Enders 1995):

$$\lambda_{trace\ (r)} = -T \sum_{t=r+1}^{n} \ln\ (1-\lambda_t\ ) \qquad [3]$$

$$\lambda_{max\ (r,\ r+1)} = -T\ \ln\ (1-\lambda_{r+1}) \qquad [4]$$

Where: $\lambda_{t:}$*eigenvalues* values as result from estimation of π matrix, T: a number of obsevations and r:rank which indicates a number of cointegration vector. H_0 is the number of missing cointegration vectors $\leq$ r as common alternative. if λ*trace* < λ*tabel* then accept H_0 which means cointegration occurs in rank r. While at λmax test, H_0 is the number of cointegration vector = r is the alternative of cointegration vector r+1 (Enders, 1995).

Granger Causality Test

Granger's causality was used to examine the existence of causality relationship between two variables (Grenger 1969). Beside showing the causality relationship, this test also shows the direction of causality between two variables. The test was conducted by using F-test to examine whether information lag in Y variable provides significantly statistic information about X variable on explaining changes in X variable. If not, there is no Granger's causality with X (Firdaus 2011).

***Vector Error Correction Model* (VECM)**

VECM is restricted VAR, where the restriction has to be given an information into its specification, because the series is not stationary instead of cointegrated. The terms of Vector Error Correction Model (VECM) comes from the existance of gradually correction through short term adjustment on the deviation of long run equilibrium model(Juanda 2012). That short term correction was depicted by Error Correction Term (ECM). The error correction term thus captures the adjustment towards long-run equilibrium (Acquah and Owusu 2012). VECM of spatial integration of meat price among 5 markets in Indonesia as follow:

$$\Delta P_{it} = \varphi_1 + \delta_1 t + \lambda_1 e_{t-1} + \gamma_{11}\Delta P_{it-1} + ... + \gamma_{1p} \Delta P_{it-p} + \omega_{11}\Delta P_{xt-1} + ... + \omega_{1q}\Delta P_{xt-q} + \varepsilon_{1t} \quad [5]$$

Where: P_{it}:analyzed variable on research(meat price on West Java, East Java, Jakarta, Central Java, NTB, NTT, and South Sulawesi). P_t: variable except analyzed variable(Rp/kg), φ_x:intercept vector, γ_{2p} ; ω_{2q} :regression coefficient vector, t:time trend, γ_{2p}: αxβ' where b' containing long term cointegration equation,Y_{t-1}; $X_{t-1:}$variable*in-level,* λ_x:regression coefficient matrix which showed the existance of short term integrationandε_t:*error term.*

The equation above concluded that in this reasearch there was VECM equation system consisted of five equations where the five equations contained West Java, Central Java, East Java, Jakarta, NTT, NTB, and South Sulawesi equations.

RESULT AND DISCUSSION

Graph 1 shows the co-movement of price series in individual province of Indonesia in period from march 2012 to Apil 2016. The Graph also shows the symmetric pattern in the movement of prices in all markets of the country in analyzed period. Jakarta has the highest mean compare to the others; meanwhile, the lowest mean was detected in NTT.The increasing tendency of the price series of meat is connected with situation that the demand of meat in Indonesia has not been fullfiled. In addition, the demand of meat in Indonesia has increasing tendency that is caused by the increasing of percapita income.Analysis result showed that meat has an elasticity value more than 1 which is meant that meat is luxurious thing where the increasing of people income will increase meat direct and indirect consumption (RPJMN bidang pangan dan pertanian 2015 – 2019).

Stationarity test used to examine wheather there is a unit root for prices series. Stationarity test is the first step before estimating VECM. The equations were estimated with intercept and intercept and trend for each price series. The null hypothesis of non stationary was tested based on the critical values reported by Mackinnon (1990). The ADF test result is presented in Table 1. The result confirms the presence of unit root in the price series. But after differencing, all the prices series were found to be stationary.

The results of stationarity test shows that all of price series are stationary in their first difference I(1), which is a pre-requisite for the cointegration test. Lag optimal lenght was estimated before estimating cointegration test. This test was conducted bacause the result of cointegration test can be quite sensitive to lag lenght (Suryaningrum, et al 2013). This study used the Schwartz (SC) information criteria which obtained lag length 2.

Before conducted co integration test, correlation among price series was examined to know the short-run integration (Ardeni 1989, and Zanias 1993 and Sendhil et al 2014). The degree of short run integration can be depicted by coefficient correlation between pair of price series (Table 3). Correlation analysis shows a positive sign between the meat price series, apriori. In addition, the result of correlation test indicates a high degree of short run integration between different market prices which are spatially separated.

Result of the Johansen's test are presented in Table 2. The result shows that there are two cointegrated in different meatmarket prices. In other words, there are two linear equation that can reveal the existance of cointegration relationship among markets in the model. Meanwhile, in the short run, all of meat market prices tend to adjust each other, to obtain its long run equilibrium, That information about markets are cointegrated among themselves, therefore information flow (price transmission) occurs among them (Paul and Shinha 2015).

To find out more tendency of long run movements which occur among price series, so that it is done bivariate cointegrated test. The result of bivariate cointegration test is presented in Table 3. Table 3 shows that meat prices in Java island have long run relationship. In other words, market cointegration of five markets in Java Island showed the existance of long run spatial market cointegration. This is based on Fackler and Goodwin's theory in Rapsomanikis et al (2004) which stated that if there are two spatially separated market, there was a tendency which was happened in the same movement on long run between both of them based on linearity relation. Meanwhile, spatial integration among markets in Java Island and outside Java Island have just happened among Jakarta-NTB, Jabar-NTB, Jabar-NTT, Jatim-NTT and Jatim-Sulsel. This finding are consistent with Mappamiring (2006) who stated that the eastern Indonesian region is less integrated than western.

The cointegration test result of meat market prices justifies the usage of vector error correction model (VECM) to study the transmission among the markets. This is based on Gujarati (2013) who stated that if two variables X and Y are cointegrated, then the relationship between the two can be expressed using the error correction.

In this study, the result of VECM was differed into long run and short run. This is based on Liu (2008) who states that VECM is used to differ between long run effect and short run effect. The result of VECM is presented in Table 4.

In the long run, meat price of Jakarta was affected significantly by lag price of Jabar, Jatim, Jateng, NTB, NTT and Sulsel (Table 4). This was suitable withcurrent condition that Jakarta is consumption region. In which, the fuldillment rate for buffalo, cattle, goat, and sheep meat have just reached 13% (Ditjennak 2015). It is caused due to the supply insufficient from Jakarta region itself, while the growth rate of meat consumption reached 4.9%. That percentage was higher than the national growth rate of meat consumption, which reached 4.7%.In other words, Jakarta ismeat net importer which imports meat from the others provinces.

Table 4 also shows the value of vector error correction coefficient (long run). That value depics the ability of the prices for adjustment from the long run equilibrium.The estimated VECM reveals that price adjustment for Jatim was more quickly compared to the others markets. The estimated VECM also indicated that most of the ECM coefficients were negative and positive only for Jateng. Positive sign indicates that those series diverge from equilibrium, meanwhile, negative coeffcient converge to equilibrium in the short run.In addition, the coefficient of ECM measures the ability of prices to incorporate shocks or price news available in the market (Sendhil et al 2014). In other words, Jatim was more efficient than the others markets in terms of reaction to news on price. It is based on the biggest magnitude of the coefficient of ECM which shows the information flow.

The long run integration among these markets confirms the presence of Granger Causality effects among them (Paul and Sinha 2015). Granger Causality test shows the direction of price transmission between two of meat markets and related spatial abitrage. The result of Granger Causality test is presented in Table 5.

Result of Granger Causality test reveals that there was no causal relationship among those markets, undirectional causality instead. In addition, Jakarta generally was affected by all of price series. This implied that Jakarta was market follower. This fact in accordance with Zainuddin (2015) who stated that domestic price represents consumer price atconsumption region (Jakarta) which is market follower.

CONCLUSION AND POLICY IMPLICATION

The purpose of this study was to examine whether there is spatially market integration of meat in Indonesia. Examination of this issue was done through cointegration and *Vector Error Correction Model*. The cointegration test shows that there is a long run relationship among market price in seven provinces. The high long run relationship was found among provinces in Java island. The short run integration was also found among price series, it is based on correlation test. These findings indicate that meat market in Indonesia was spatially integrated. In other words, the law of one price holds true for meat markets across Indonesia.

In addition, the VECM shows that Jakarta was affected by the other regions. In other words the price information was transmitted along the other regions to Jakarta as market follower, not vice versa. The speed of convergence of meat prices to equilibrium was found varies, where only provinces in Java island has high magnitude of adjustment coefficient. The others provinces can not adjust the price changes quickly.

Based on these findings, this study recommends the goverment to formulate policies which providing infrastructure to avoid market exploitation and spread price information along provinces in Indonesia, especially on eastern Indonesia. This will help in enhancing efficiency of the marketing system in agricultural commodities and reduce market distortions.

Finally, further research along this may consider to examine vertical integration on meat markets across provinces in Indonesia. This conducted to provide general overview about current condition of meat in Indonesia.

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TABLE

PICTURE

TABLE 1

Summary of price series

Region	Descriptive Statistics			
	Mean	Std. Dev.	Maximum	Minimum
Jakarta	96764.31	11382.63	120122	64557
Jabar	89648.16	10819.84	111044	63837
Jateng	86365.02	13835.35	110357	58366
Jatim	86921.90	13631.66	106945	57267
NTB	79114.86	12004.42	106682	60252
NTT	71489.58	13947.44	91667	47000
Sulsel	83426.40	11645.67	100913	66362

TABLE 2

Augmented Dickey Fuller (ADF) test for price series

Variables	Constant		Constant and Trend	
Jabar	-2.769	0.070	-3.443	0.057
D(Jabar)	-8.428**	0.000	-8.776**	0.000
Jakarta	-2.512	0.119	-5.240***	0.000
D(Jakarta)	-10.94**	0.000	-10.83***	0.000
Jateng	-3.187	0.027	-3.312	0.076
D(Jateng)	-10.33	0.000	-5.828	0.000
Jatim	-2.556	0.107	-2.091	0.538
D(Jatim)	-8.047	0.000	-5.387	0.000
NTB	-0.749	0.824	-2.895	0.173
D(NTB)	-12.11	0.000	-11.98	0.000
NTT	-1.314	0.671	-1.799	0.690
D(NTT)	-8.490	0.000	-8.600	0.000
Sulsel	-1.280	0.631	-2.514	0.320
D(Sulsel)	-6.930	0.000	-6.881	0.000

TABEL 3

Price correlation among meat markets in Indonesia

Correlation	Sulsel	NTT	NTB	Jkt	Jatim	Jateng	Jabar
Sulsel	1.000						
NTT	0.919	1.000					
NTB	0.830	0.849	1.000				
Jkt	0.747	0.815	0.828	1.000			
Jatim	0.883	0.942	0.869	0.820	1.000		
Jateng	0.918	0.938	0.863	0.799	0.962	1.000	
Jabar	0.814	0.880	0.866	0.839	0.952	0.918	1.000

TABEL 4

The result of Johansen cointegration trace test

Hypothesized No.of CE(s)	Eigenvalue	Trace Statistic	0.05 CV	Prob **
None*	0.785	172.66	125.61	0.000
At most 1*	0.493	100.38	95.754	0.023
At most 2	0.442	68.463	69.819	0.063

TABEL 5

The Result of Bivariate Cointegration test

Variables	Trace Statistic			Max. Eigen Statistic		
	H_0	H_1	Prob.	H_0	H_1	Prob.
Jakarta/Jabar	r=0	r≥1	0.000*	r=0	r≤1	0.001*
Jakarta/Jateng	r=0	r≥1	0.056	r=0	r≤1	0.001
Jakarta/Jatim	r=0	r≥1	0.005*	r=0	r≤1	0.003*
Jakarta/NTB	r=0	r≥1	0.020*	r=0	r≤1	0.015*
Jakarta/NTT	r=0	r≥1	0.083	r=0	r≤1	0.150
Jakarta/Sulsel	r=0	r≥1	0.237	r=0	r≤1	0.286
Jabar/Jateng	r=0	r≥1	0.018*	r=0	r≤1	0.107
Jabar//Jatim	r=0	r≥1	0.020*	r=0	r≤1	0.135
Jabar/NTB	r=0	r≥1	0.007*	r=0	r≤1	0.009*
Jabar/NTT	r=0	r≥1	0.036*	r=0	r≤1	0.156
Jabar/Sulsel	r=0	r≥1	0.056	r=0	r≤1	0.128
Jateng/Jatim	r=0	r≥1	0.005*	r=0	r≤1	0.06
Jateng/NTB	r=0	r≥1	0.327	r=0	r≤1	0.435
Jateng/NTT	r=0	r≥1	0.055	r=0	r≤1	0.137
Jateng/Sulsel	r=0	r≥1	0.299	r=0	r≤1	0.528
Jatim/NTB	r=0	r≥1	0.133	r=0	r≤1	0.284
Jatim/NTT	r=0	r≥1	0.001*	r=0	r≤1	0.058*
Jatim/Sulsel	r=0	r≥1	0.040*	r=0	r≤1	0.289
NTB/NTT	r=0	r≥1	0.616	r=0	r≤1	0.715

NTB/Sulsel	r=0	r≥1	0.656	r=0	r≤1	0.662
NTT/Sulsel	r=0	r≥1	0.085	r=0	r≤1	0.157

TABEL 6

The Result of Vector Error Correction Model

Variables	Long run effect		Short run effect
	Coeffcient	t-value`	Error Correction Estimates
Jkt	1.000		-0.214(-0.623)
Jabar	-1.299	-10.325*	-0.202(1.143)
Jatim	1.817	9.889*	-0.506(-3.913)*
Jateng	-0.918	-5.651*	0.292(1.316)
NTB	-0.308	-5.028*	-0.008(-0.031)
NTT	-0.760	-10.360*	-0.058(-0.298)
Suls	0.772	8.328*	-0.441(-2.897)*
El			

TABEL 7

Granger causality test of vector error correction model

Marktes	F-statistic	Prob.	Direction
Jakarta -> Jabar	1.427	0.251	Undirectional
Jabar -> Jakarta	4.925	0.012*	
Jakarta-> Jateng	0.532	0.591	Undirectional
Jateng -> Jakarta	4.286	0.020*	
Jakarta -> Jatim	0.464	0.631	Undirectional
Jatim -> Jakarta	5.161	0.009*	
Jakarta -> NTB	1.133	0.331	Undirectional
NTB -> Jakarta	7.171	0.023*	
Jakarta -> NTT	0.555	0.557	Undirectional
NTT -> Jakarta	4.010	0.025*	
Jakarta -> Sulsel	0.971	0.386	Undirectional
Sulsel -> Jakarta	2.075	0.137	
Jateng -> Jabar	0.792	0.459	Not significant
Jabar -> Jateng	2.383	0.104	
Jatim -> Jabar	1.379	0.262	Not significant
Jabar -> Jatim	1.187	0.314	
NTB -> Jabar	4.435	0.017*	Undirectional
Jabar -> NTB	3.037	0.058	
NTT -> Jabar	1.296	0.284	Not significant
Jabar -> NTT	2.562	0.088	
Sulsel -> Jabar	0.749	0.478	Not significant

Jabar -> Sulsel	1.639	0.206	
NTB -> Jateng	0.854	0.432	Not significant
Jateng -> NTB	2.978	0.061	
NTT -> Jateng	1.274	0.432	Not significant
Jateng -> NTT	2.978	0.061	
Sulsel -> Jateng	0.119	0.887	Undirectional
Jateng -> Sulsel	8.445	0.000*	
NTB – Jatim	0.381	0.685	Not significant
Jatim -> NTB	1.458	0.243	
NTT -> Jarim	1.056	0.356	Undirectional
Jatim -> NTT	6.900	0.002*	
Sulsel -> Jatim	0.059	0.942	Not significant
Jatim -> Sulsel	3.123	0.054	
NTT -> NTB	0.824	0.443	Not significant
NTB -> NTT	0.942	0.397	
Sulsel -> NTB	1.658	0.202	Not significant
NTB -> Sulsel	2.652	0.082	
Sulsel -> NTT	0.367	0.694	Undirectional
NTT -> NTT	4.180	0.021*	

PICTURE 1

Meat price trend from 7 provinces of Indonesia