

INTEGRATION AND TRANSMISSION OF LOCAL GRANULATED SUGAR PRICES BETWEEN SURPLUS AND DEFICIT AREAS

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ABSTRACT

The imbalance of supply and demand for sugar can be a threat to regions that only rely on supplies of outside their region such as East Nusa Tenggara (NTT), Indonesia. Study examines the market integration and transmission speed of local sugar prices spatially between prices in East Java and prices in NTT. Using time series monthly price for the period of July 2016 until January 2020. Using the integration analysis from Granger and Johansen and the VECM approach for the price transmission rate test. The result shows that the relationship between the price of sugar in East Java and NTT only has a unidirectional relationship. The price of sugar in East Java affects the price of sugar in NTT, but not the other way around. Price changes that occur are not transmitted immediately. Price response occurs very slowly to change. The condition of marketing infrastructure, transportation and asymmetric price information becomes an obstacle to price integration and transmission. It is necessary to improve infrastructure and openness of markets and prices in a transparent manner among market players.

Keywords: Local granulated sugar, market integration, price transmission, VECM

INTRODUCTION

Sugar is the most strategic food commodity in Indonesia after rice, as one of the determinants of inflation. The need for granulated sugar for industrial raw materials as well as for household consumption will continue to increase in line with population growth and on-going develop industrial. The balance of sugar demand in Indonesia and sugar production according to the International Sugar Organization (ISO) is still experiencing a deficit of 2.7 million tons, as reported by Wiyono (2020), which mean that more than half of the need for sugar that must be imported.

In 2020, it is estimated that Indonesia will experience a shortage of granulated sugar production because in 2018 and 2019 there was a decrease in sugarcane production due to drought. Sugarcane is the main raw material for local granulated sugar production. As, it predicted by the Ministry of Agriculture, it is estimated that in 2020 Indonesia will experience a decrease in sugar production by 10%. If this prediction happens, at 2020, Indonesia will

experience scarcity of local sugar availability, so that there is an opportunity for an increase in prices due to an imbalance in supply and demand.

The availability of local sugar also physically and economically the ease of access in each region and at any time from consumers in obtaining local sugar. Physical access means convenience access to local sugar, while economic access is related to people's purchasing power. Meanwhile, the inadequate structure of trade flows due to infrastructure and distances between regions as well as the oligopolistic local sugar market structure causes disparity and price fluctuation between large regions. Ideally, if there are two markets, or spatially, the price that changes in one market are responded quickly by the other markets efficiently so that the Law of One Price (LOP) can be applied. This is in line with the point of views from Ravallion (1986), Goodwin and Schroeder (1991), McNew (1996), Gitau & Meyer (2018), Fuje (2029), Salazar, et al., (2019).

The sugar trade in Indonesia involves several marketing agencies. Generally, the distribution chain for sugar trading in Indonesia is relatively long. Each region or province has a different food commodity distribution chain length. It depends on the number of institutions that involved. Each marketing agency in each region has an opportunity and strategy in a competition to seize profits by taking a large Margin of Trade and Transportation (MTT). An efficient market for each marketing institution receives a proportional, fair and well-integrated MTT. An efficient market is an integrated market, which means that any price changes that occur in a market are transmitted quickly to the next market. The spatially symmetrical flow of information on price changes between the two market players is the main trigger for integration and price transmission between them.

Several factors that influence market integration are border policies, price support mechanisms, transfer costs, exchange rates and market structure (Zorya et al., 2014; Ozturk 2020; Zalzar et al., 2020, Özdemir et al., 2020; Guo et al. , 2020; Gutema., 2020; Zhang et al., 2020). The price support policy by the government by applying the Highest Retail Price (HRP) and the lowest price will provide certainty in pricing by market players. Transfer costs that are large enough due to the distance between the distribution locations that are far away, also the trading infrastructure is not sufficient. Large transfer fees and MTTs can hinder price transmission. Indonesia, as an archipelagic country, one of the main obstacles is the distribution of goods and has weak port infrastructure as a result of high transfer costs. As happened between the local sugar trade between the provinces of East Java and East Nusa Tenggara. The exchange rate is one of important factor in market integration, because in the event of an import of granulated sugar due to a shortage of supplies, at the same time when there is a depreciation of the local currency against the dollar, it can hinders integration and price transmission. Market structures that are not perfectly competitive and concentrated on oligopolists will hinder integration and price transmission. The focus of this research is to observe the spatial integration of the market and the transmission of local granulated sugar prices between the East Java market as a surplus area and the NTT market as a deficit area (not a sugar producing area).

Research about market integration and price transmission for several food commodities are using various methods of approach has been widely carried out. Research conducted by Koutroumanidis, et al. (2009) was using the co-graded approach, Granger causality and ECM, the LSE - Henry general to specific model (GETS model), found that there is a long-term relationship between producers and consumers in the roundwood market in Greece. Granger causality analysis finds that consumer prices lead to producer prices. No causal relationship was found. The application of the GETS model found asymmetry in the price transmission

mechanism in the roundwood market in Greece. Chen & Saghaian's (2016) investigation of market integration and asymmetric price transmission by testing the monthly prices of export rice for Thailand, Vietnam, and the United States, using the Johansen cointegration test and the VECM test. To sum up, the world rice export market is integrated and the policies that need to be taken by the government. Other studies by Meyer & Von Cramon-Taubadel (2004), Chaudhary, et al. (2019), Zungo, et al. (2019), Zanin, et al. (2020), Ozturk, (2020), Huang & Xiong, (2020), Guo & Tanaka (2020), Zavale & da Cruz Macamo (2020), Roman (2020), Hao & Nye (2020), Bouchard (2020), Mulyana & Lastinawati (2020), Ahmed & Huo (2020) measure the integration of various markets and price transmission, using a cointegration approach, causality and VECM to measure whether there are price transmissions between markets. The research yields varying results depending on the commodity and the determinants of price integration and transmission. Research on market integration and spatial price transmission between two regions as a producer area (surplus) and a region as a consumer (deficit), namely East Java and NTT, is found not much in the literature. Another thing that is interesting from this research is that NTT as an archipelago, constraints on transportation and trade infrastructure, which cannot be ignored in terms of market integration and price transmission. With the result that there is an asymmetric price and information in the market sugar marketing system between the surplus and deficit areas.

The purpose of this study is to measure whether there is an integration of the local granulated sugar market between markets in East Java and NTT and the form of transmission of local sugar prices in East Java and NTT. The results contribute to market players and government in determining the right strategy in order to avoid risk and achieve marketing efficiency.

RESEARCH METHODS

This study uses monthly price data for local granulated sugar for the period of July 2016 till January 2020 in the East Java and in NTT province, from strategic food price information published in collaboration between BI and the Indonesian government. This study uses an integration analysis approach and a VAR-VECM approach. The process that is followed in the analysis of integration and price transmission goes through several stages, namely:

Data Stationarity Test

Data stationarity is tested to avoid spurious regression, because time series data are often not stationary. Makridakis, et al., (1999) stated that a series of data observations is called stationary if the process does not change with changing time. Data are not stationary if the mean, variance and covariance of the data are constant over time (Thomas, 1998). The data stationarity test is at a level or different by observing the ADF value, namely the variance is small, tends to be close to the average value (Nendissa et al, 2018; Enders, 1995)

The ADF test is used to observe whether there is a trend in sugar price movements, and is formulated as follows:

$$\Delta P_t = a_0 + y_1 P_{t-1} + \beta_1 \sum_{i=1}^m \Delta P_{t-i} + \varepsilon_{it}$$

Which:

P_t = Sugar prices in both markets in period t (Rp/Kg)

P_{t-1} = Price of sugar in both markets in the previous t period (Rp/Kg)

$\Delta P_t = P_t - P_{t-1}$

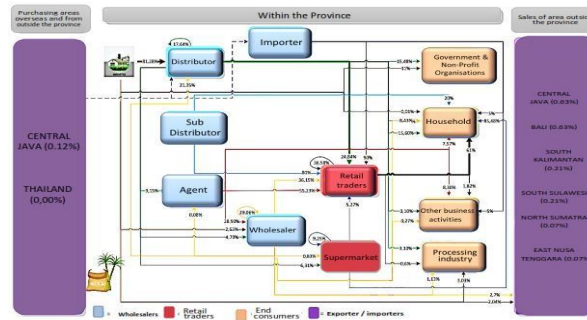


FIGURE 5

SUGAR OF TRADE DISTRIBUTION PATTERN IN EAST JAVA, (BPS '2020)

The local granulated sugar traded distribution pattern in NTT involves several marketing agencies, which are distributors and retailers to the final consumer, as shown in Figure 6. Distributors sell most of their local granulated sugar to retailers and the rest of it to households. Afterwards, the retailer sells most of the sugar back to the household.

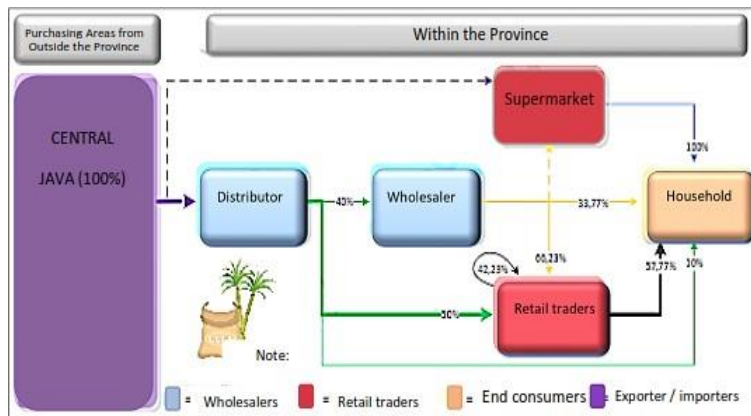


FIGURE 6

SUGAR TRADE DISTRIBUTION PATTERN IN NTT, (BPS '2020)

Market Integration and Local Quality Sugar Prices Transmission

Analysing the integration of the local sugar market among East Java and NTT by using time series data requires several test stages. The stationarity test uses the Augmented Dickey-Fuller (ADF) test, since generally time series data are not stationary. Hereinafter, the cointegration test and the Granger causality test. Followed by the VECM test to see the price transmission level that occurs among the two markets spatially.

Data Stationarity Test

The stationarity test result that based on ADF test showed that stationary data at 1st difference level, that shown in table 1

Source: Monthly analysis price data result for local sugar in East Java and NTT for the period July 2016 till February 2020).

Variable	Unit Root Test				Status
	Level		1st Difference		
	ADF	Prob	ADF	Prob	
East Java	-1.52752	0.5096	-6.47724	0.0000**	Stationary
NTT	-3.5569	0.0112*	-4.73985	0.0004**	Stationary

Source: Monthly analysis price data result for local sugar in East Java and *NTT* for the period July 2016 till February 2020).

The stationarity test result in table 1 that based on the ADF test value shows that the local sugar price variable in *NTT* is stationary at the level, while the East Java variable is stationary in the first difference condition. An existence of non-stationarity variable indicates a long-term cointegration between price variables. A cointegration test is necessary to ensure the existence of long-term relationship between the existing price variables.

Cointegration Test

Prior to the cointegration test, lag length which has to be done, was determined for estimating the VAR or Vector Autoregression mode (Gujarati & Porter, 2012; Basuki & Prawoto, 2017). Estimating by using VAR requires data to be stationary. The variable data is at stationary status in the 1st Difference level, so the estimation is expected to produce a valid model output. VAR model estimation begins with determining the appropriate lag length. Determination of the optimal lag is done by determining the smallest AIC value.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	- 483.3867	NA	1.76e+09	26.96593	27.05390	26.99663
1	- 470.8717	22.94426	1.10e+09	26.49287	26.75679*	26.58498
2	- 466.2611	7.940404	1.07e+09	26.45895	26.89882	26.61248
3	- 458.8635	11.91840*	8.88e+08*	26.27019*	26.88601	26.48513*
4	-456.961	2.853709	1.01e+09	26.38672	27.17848	26.66307
5	- 455.5352	1.980264	1.19e+09	26.52973	27.49744	26.86749

The result of the lag length test in VAR by adding AIC shows that the optimal lag length is lag 3 with an AIC value of 26.27019 *.

Based on the lag length above, by using the *Johansen's Cointegration Test* method for the cointegration test. The results of the cointegration test are presented in

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.473011	30.24468	15.49471	0.0002
At most 1 *	0.162093	6.543361	3.841466	0.0105

Source: *Data Sekunder Diolah*, 2020 Error rate (α)=0,05

Table 3 shows that the market price of local granulated sugar in East Java and NTT has cointegration in the long-term, showed by the value of Trace Statistic \gg Critical Value with a significance level of <5 percent, yet in the short term it may not happen.

Granger Causality Test

The causality test can be done by using Granger's Causality method and the Error Correction Model Causality. Causality testing is carried out to determine the direction of price transmission in vertical integration, price shocks caused by changes in demand (price transmission from downstream to upstream) will have a different effect on price transmission from shocks due to changes in supply.

Null Hypothesis:	Obs	F-Statistic	Prob.
NTT does not Granger Cause JAWA_TIMUR	39	0.88599	0.4588
JAWA_TIMUR does not Granger Cause NTT		9.99866	8.00E-05

Source: *Data Sekunder Diolah*, 2020 Error rate (α)=0,05%

The results of the Granger causality test, that are presented in Table 4, shows that the local sugar price in the *NTT* market does not affect the price of granulated sugar in East Java, but the sugar price in East Java affects the sugar price in *NTT*, which means that there is a short-term one-way relationship. This shows that those controlling the price of granulated sugar in East Nusa Tenggara are wholesalers and distributors in East Java and it is suspected that there is asymmetry information and lack of support from adequate trading facilities. Constraints on distance and sea transportation, which are the mainstays trade goods of transport between East Java and *NTT* as an archipelago, provide opportunities for slow and asymmetrical flow of information,

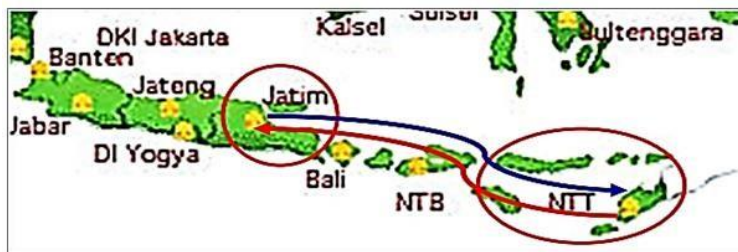


FIGURE 7

LOCAL SUGAR TRADE DISTRIBUTION MAP BETWEEN EAST JAVA AND NTT
 NTT province as a deficit area of sugar is more sensitive against price changes if there is a disruption in supply and demand that compared to East Java as a supply and surplus area.

Vector Autoregression Test (VAR-VECM)

The VAR test is intended because the non-stationary data has been derived based on the optimal lag, namely the optimal lag 3. The cointegration test variable data shows that there is no cointegration between all sugar price variables in both markets, this indicates that there is no relationship or there is no balance in the market East Java and East Nusa Tenggara for the long term. However, in the short term there is a possibility of integration, so it is necessary to apply a VAR / VARD test approach. The VAR / VARD test results are shown in Table 5.

	D(JAWA_TIMUR)	D(NTT)
D(JAWA_TIMUR(-1))	0.508937**	0.579902**
	(0.15935)	(0.11235)
	(3.19380)	(5.16152)
D(JAWA_TIMUR(-2))	-0.24649	-0.147464
	(0.20312)	(0.14321)
	(-1.21353)	(-1.02972)
D(JAWA_TIMUR(-3))	-0.341267	0.228060
	(0.17095)	(0.12053)
	(-1.99626)	(1.89213)
D(NTT(-1))	0.057257	0.143766
	(0.24280)	(0.17119)
	(0.23582)	(0.83983)
D(NTT(-2))	0.667241**	-0.336208
	(0.23031)	(0.16238)
	(2.89719)	(-2.07054)
D(NTT(-3))	-0.059576	-0.137241
	(0.14269)	(0.10061)
	(-0.41751)	(-1.36415)

Source: *Data Sekunder Diolah 2020.*

T_{table} error rate 5%=2.02809

The estimation results based on the VARD model in Table 5 show that in the short term, there are some changes in local sugar prices in East Java that are significantly influenced by the sugar price in the East Java market one month earlier, amounting to 0.5089 and also by the local sugar price in NTT for one month previously amounted to 0.5799. This value indicates that, each 1% increase in the price of local granulated sugar in East Java in the previous month, it will increase the price of sugar in the East Java market itself and the NTT market in the current period by 0.5089% and 0.5799%, respectively. Meanwhile, the local sugar price in the NTT market was significantly influenced by the local sugar price in the East Java market two months earlier, which was 0.667. This value indicates that every 1% increase in the price of granulated sugar in NTT in the previous two months, there will be an increase in the price of local sugar in East Java by 0.667%.

Vector Error Correction Model Test (VECM)

The VECM test results in Table 6, show that the ECT on the local sugar price in NTT is significant at the 5% error level, which is 1.1792 ($4.20309 > 2.03011$). while the ECT value for the East Java market was not significant at the 5% error level, namely -0.402522 ($-0.91179 < -2.03011$). The ECT significant value indicates the importance of a long-term cointegration relationship in the forming granulated sugar prices process among market players. ECT shows the speed of adjustment seen from the absolute value of ECT, which is defined as the imbalance between the actual price and the long-run equilibrium level (Enders, 1995). The greater the ECT coefficient, the faster the adjustment leads to long-term equilibrium and vice versa. The previous period price disruption changes in several markets in the model can be interpreted as a market short-term adjustment towards long-term equilibrium with other markets (Zainudin, 2015).

Error Correction	D(JAWA_TIMUR,2)	D(NTT,2)
CointEq1	-0.402522	1.179179**
	(0.44147)	(0.28055)
	(-0.91179)	(4.20309)
D(JAWA_TIMUR(-1),2)	0.300335	-0.402582
	(0.35662)	(0.22663)
	(0.84216)	(-1.77635)
D(JAWA_TIMUR(-2),2)	-0.02096	-0.515602**
	(0.26610)	(0.16911)
	(-0.07877)	(-3.04900)
D(JAWA_TIMUR(-3),2)	-0.290812	-0.15659
	(0.21957)	(0.13954)
	(-1.32446)	(-1.12222)
D(NTT(-1),2)	-0.617843	0.760754**
	(0.49117)	(0.31214)
	(-1.25791)	(2.43725)
D(NTT(-2),2)	0.344171	0.516454

	(0.41417)	(0.26320)
	(0.83100)	(1.96220)
D(NTT(-3),2)	-0.170053	0.066260
	(0.16028)	(0.10186)
	(-1.06095)	(0.65050)
C	8.604741	10.88641
	(35.6636)	(22.6642)
	(0.24128)	(0.48034)
R-squared	0.428278	0.684300
Adj. R-squared	0.290276	0.608097
Sum sq. resids	1298273.	524317.2
S.E. equation	211.5846	134.4615
F-statistic	3.103419	8.979929
Log likelihood	-246.1148	-229.341
Akaike AIC	13.73594	12.82924
Schwarz SC	14.08424	13.17755
Mean dependent	6.756757	6.756757
S.D. dependent	251.1535	214.7874
Determinant resid covariance (dof adj.)		6.73E+08
Determinant resid covariance		4.13E+08
Log likelihood		-472.0421
Akaike information criterion		26.48876
Schwarz criterion		27.27245

Source: *Data Sekunder Diolah* 2020.

T-table error rate 5% = 2.03011

Table 6 shows that changes in the granulated sugar price are influenced by the long-term relationship between the East Java market and the *NTT* market. The local sugar prices formation in *NTT* was significantly affected at the 5% level by the price in East Java in the previous month. The effect is 0.5156. This indicates that the previous price in East Java was used as a reference in determining or forming local sugar prices in *NTT*. If there is an increase of 1% in the sugar price in East Java in the previous two months, *NTT* will respond negatively by reducing the sugar price by 0.5156% in the current period. This indicates that the local granulated sugar price is very much determined by the price at the consumer level where if there is a price change at the consumer level, the producer will respond (price changes from downstream to upstream). Meanwhile, the local sugar price in *NTT* was influenced by the price in *NTT* itself one month earlier, which was 0.7607. If there is an increase of 1% in the local sugar price in *NTT* in the previous month, the local sugar price in *NTT* will respond positively by increasing the price by 0.7607% in the current period.

Price transmission analysis using the ECM method. A positive ECT indicates a condition of deviation above its long-term balance line, while a negative ECT indicates a deviation condition below its long-term balance line. Nonetheless, Meyer & von Cramon-Taubadel (2004), Ahmed & Hueo (2020), Alam & Jha (2020), Ben Abdallah, et al., (2020), Bittmann, et al.,

(2020), states that price transmission analysis using ECM can only describe asymmetric patterns in terms of adjustment time because the analysis of cointegration and ECM is a form of long-term balance, so that if asymmetric price transmission occurs in terms of the amount of adjustment, the data will not be co-integrated. Zanin, et al., (2020), used the ECM approach to measure the asymmetric price rice commodities transmission in Brazil, for 3 relationships, namely producer-retail, industry-producer and industry-retail. The ECM results occur contemporary asymmetry between industry-retail, asymmetric effects of being left behind and occur asymmetric contemporary and lagging producer-industry. Zungo & Kilima (2019) used ECM to see the causal relation among maize and rice prices in Tanzania. The result was found that there is a two-way causality in the long run between the two commodities (corn and rice). Furthermore, he stated that the effect of infrastructure and transportation improvements in reducing price transmission. The Ozturk study (2020) measures price transmission in the grain market in Turkey using the ECM of the Turkish rice market which is not cointegrated with the world rice market, while other commodity markets are weakly cointegrated. The results also show that the transmission of world price changes to domestic prices is relatively low in both the short and long run, and that adjustment to new equilibrium aftershocks is slow. Government intervention policies both at the border and due to domestic price support appear to be the cause of weak cointegration.

CONCLUSION

Sugar prices in East Java and *NTT* are moving unidirectional, but their movements are asymmetric. Prices in East Java affect prices in *NTT* but not the other way around. Price changes in East Java were not responded to immediately by the market in *NTT* but the changes took several weeks, possibly due to asymmetries of information and prices. The constraints of limited trade infrastructure and an inadequate goods transportation system are possible causes of asymmetry. Infrastructure improvements, transportation and price transparency policies are the most important parts to do.

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