

## Integration and Causality Price TSR20 Indonesia with World TSR20 Price

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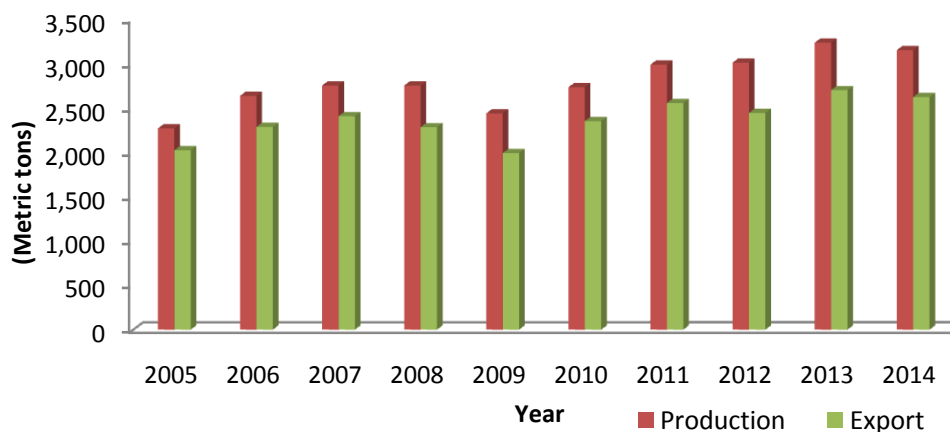
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**ABSTRACT:** This study aims to determine the relationship of integration and asymmetry between TSR20 rubber price in Indonesian market, SICOM and New York. The approach used in this research is using Granger Causality Test method. The data used were monthly time series, from 2010 until 2016. The result of the research shows that all of markets have been integrated. The relationship is that the SICOM market affected the Indonesian market, SICOM market and New York market as well as the Indonesian market with the New York market is mutually influential. Further research recommendations, in addition to seeing prices in the SICOM market and the New York, are important to see price causality in the Chinese market.

**KEYWORD:** Integration, Causality, TSR20, Rubber, SICOM

### INTRODUCTION

Natural rubber is an important commodity, because the role of natural rubber as the main raw material for various industries such as the automotive industry and the health industry (Herath et al. 2012). So with the growth of the automotive industry pushing increased demand for TSR20 (Darmawan 2012; Erni et al. 2012) So far Indonesia is the second largest natural rubber producer after Thailand, although, the area of Indonesian rubber plantation is wider than Thailand rubber plantation. Over the past few years, Indonesia's rubber production has tended to increase. Indonesia's rubber plant production in 2005 reached 2,270,891 tons and increased by 42.3% in 2015 to 3,231,825 tons. Changes in Indonesia's rubber production and exports from 2005 to 2015 can be seen in Figure 1.

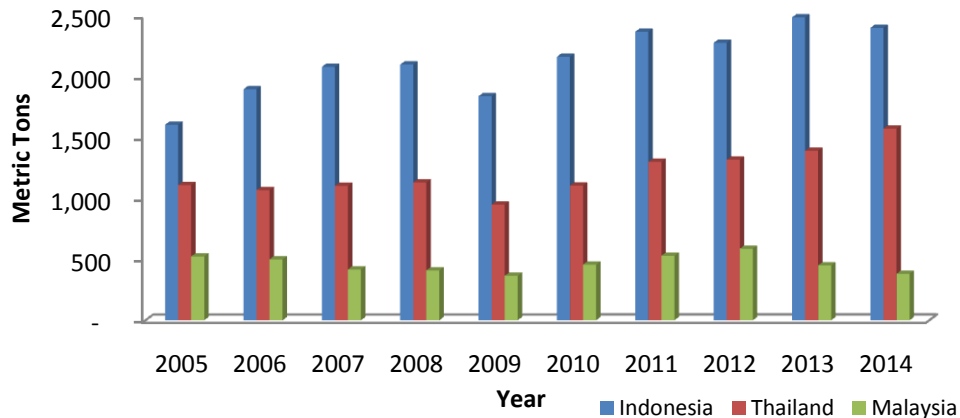


Source: Processed from Directorate General of Plantation 2016

Figure 1 Natural rubber production of Indonesia in 2005-2015 (ton)

Based on Figure 1, it can be seen that by 2014 natural rubber production of 3.606 million tons and 72.75% is exported abroad with 91.55% of total exports in the form of TSR20. Rubber TSR 20 is an important export commodity with HS 4001222000 code. The low consumption of TSR20 rubber in the country, causing market

TSR20 Indonesia is highly dependent on TSR20 world market. The dependence of TSR20 Indonesia market on TSR20 World market indicates that Indonesian rubber price is influenced by price changes in the world market. Indonesia and Thailand are natural rubber producers that have an important role for the World. Indonesia and Thailand in 2013 exported 75% of the world's rubber needs. Rubber produced in these two countries, exported to various countries with major importers are China and the United States. From the export volume, Indonesia mostly exported in the form of TSR20, so for rubber species TSR20 Indonesia is the largest exporter country. Details of rubber export of TSR20 can be seen in Figure 2.



Source: Statistics Indonesia (2007, 2009, 2011, 2014 & 2015), Statistics Thailand (2016) and Statistics Malaysia (2016) (processed).

Figure 2. TSR20 rubber export volume from major exporting countries.

Based on Figure 2 It is known that Indonesia is the largest exporter of rubber TSR20. As the most important producing country in the world's TSR20 trading market, Indonesia's total exports in the form of new TSR20 can be equal to the total exports from Thailand and Malaysia.

However, in reality until now the mechanism of natural rubber trade in Indonesia is still based on trading in physical market with mechanism of natural rubber price determination of Indonesia with tendency that is refer to rubber price that formed in Singapore Commodity Exchange (SICOM) (Fitrianti 2009). In addition, until nowadays the main market of TSR20 Indonesia rubber is the United States, with a market share of 24.21% of total exports of rubber TSR20 by 2015 (Indonesia Rubber Statistics, 2015). Therefore, it is important to know the price causality between Indonesia, SICOM, and the United States.

The purpose of this research is to analyze the integration and causality between TSRI, TSRS and TSARNY, using Cointegration test and Granger Kausality test.

## LITERATURE REVIEW

Price is one of the main indicators that can reflect the efficiency level of a market. Price transmission and market integration can be an indication of the efficiency that exists between two integrating markets, both vertically and spatially (Mayer and von Cramon-Taubadel, 2004).The absence of price integration among intercompany transactions will lead to inefficient allocation of resources and lower economic lags below the pareto balance point. In other words, the perfect price transmission will lead to an efficient market.Price is considered to provide an overview of the market and be an indicator of demand and supply (Chintia 2013).

Inter-market integration is commonly associated with inter-market price integration (Ravallion 1986).Market integration occurs when there are trade activities between two or more spatially segregated markets, then the prices in a market relate to one or more of the other markets.In this case the price in a market is partially or totally transmitted to other markets, both in the short and long term (Muwanga and Snyder 1997).If prices are well integrated then prices in both markets will be transmitted perfectly (Fazaria et al 2016). Changes that occur on the side of demand and supply in one market will affect the trade and selling price in other markets (Rapsomanikis et al, 2003).Market integration will be achieved if there is sufficient market information and quickly distributed to other markets so that the participants involved obtain the same information (fadhla et al.,

2008). The one price relationship between geographically separated markets for the same commodity can be analyzed using spatial market integration (Tomek and Robinson 1990).

Research for the integration of rubber commodity prices has been done by Fitrianti (2009), Malik et al.(2013), and Purnomowati et al.(2015). Fitrianti (2009) conducted research on integration of natural rubber price of Indonesia with price of natural rubber in futures market by using monthly data from year 2000 until 2009. The procedure used is to use VAR analysis, the results obtained that the physical market of Indonesia is integrated by world futures market but not transmitted directly because of the lag (time) adjustment. Putra (2012) by using partial adjustment model reveals that both in short and long term prices in International rubber have a negative and significant effect on price changes in Indonesia. Malik (2013) by using the VECM model reveals that the integration happening between the Singapore market and the auction market in Jambi Province is not perfectly integrated. While Purnomowati *et al.* (2015) conducted a study on the integration of the Indonesian rubber market with the international rubber market, the results obtained that Indonesian rubber prices are integrated both in the long term and in the short term only with the Singapore market.

## METHOD

### Framework

This study is based on the framework that a market that embraces the Law of One Price (LOP) then there will be price integration and have causality between one market with another market, so that if the price on a market have experience changes will affect other markets. But market power, access to information and other factors that inhibit causing imperfect price transmission (Asmarantaka 2012). Based on this view to know the change of rubber price of TSR20 in Indonesia, it is necessary to investigate TSR20 price integration with TSR20 Integration in Singapore Stock Exchange (SICOM) and consumer market located in New York market.

Figure 3 shows the frame of thought in this study. This framework illustrates the integration of prices between markets that sell commodities TSR20. In this research framework, we would like to see price integration between TSR20 Indonesia, TSR20 world futures exchange (SICOM) and consumption market (New York).

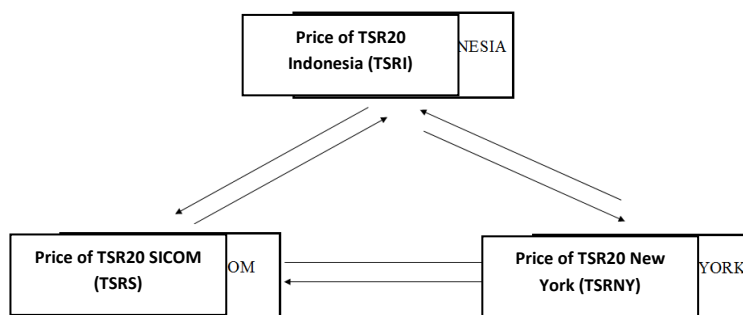


Figure 3 Framework

### Types and Sources of data

This study uses secondary data that is time series data monthly dengna period January 2010 until September 2016. Secondary data is obtained from *Badan Pengawas Perdagangan Berjangka Komoditi* Commodity (Bappebti) in the form of physical TSR20 price data of Palembang, Singapore futures market (SICOM) in the form of TSR20 data, UNCTADSTAT in the form of data of TSR20 New York, Mundi Index in the form of world rubber production data, world rubber consumption. *Direktorat Jendral Perkebunan* (Directorate General of Plantation) in the form of rubber production data, Bank Indonesia (BI) in the form of data of rupiah exchange rate against US dollar and inflation. The price data of TSR20 Indonesia is the physical price (spot price) Palembang. The data used as the variables in this study can be seen in Table 1 as below :

Table 1 Variables used in the study.

Nama Variable	Simbol	Satuan	Sumber
Rubber Pice TSR20 Indonesia	TSRI	Rp/Kg	Bappebti
Rubber Pice TSR20 SICOM	TSRS	Rp/Kg	SICOM
Rubber Pice TSR20 SICOM	TSRNY	Rp/Kg	UNCTAD

### **Data analysis method**

The method of analysis used in this research is quantitative method. Quantitative data processing used eviews 8. As for some data analysis used is analysis of Market integration and causality analysis TSR20 Indonesia, TSR20 SICOM and TSR20 New York using Cointegration test and Granger Causality Test.

### **Price transmission analysis**

Analysis method in this research is Cointegration test and Granger Causality test. Cointegration test analysis (Johansen test) aims to see the relationship of price TSR20 Indonesia, SICOM and New York in the long term. While Granger Causality test analysis is to see the relationship reciprocal (causality) between price of TSR20 Indonesia, SICOM and New York. In relation to the method, then the test of time series data behavior and its integration can be viewed as a prerequisite test for the use of Cointegration test method and Granger Causality test. Before conduct the estimation of both methods, then for the first conducted the steps as follows:

#### **1. Unit root test**

Before conducting cointegration test and granger causality test using time series data, it is necessary to test stationarity to all variables that exist in research. This test conducted by using unit roots test which aims to know whether the data contains unit roots or not. If the variable contains unit roots then the data is is not stationary data. In addition, for the determination of integration order can be done through unit root test so it can be known until how many differentiation should be done so that the data becomes stationary. The test method used to test the unit root in this study using Augmented Dickey Fuller test (ADF). The test is performed with the null hypothesis  $\delta = 0$  for the ADF. at least the data is based on the comparative statistical value of ADF obtained from the t-statistic coefficient  $\delta$  with the statistical critical value of Mac Kinnon. If the absolute value of the ADF statistic is greater than the critical value of Mac Kinnon then the data is stationary and if otherwise the data is not stationary (Gujarati, 2003).

#### **2. Cointegration Test**

Cointegration test aims to determine whether all the variables studied that is government expenditure and economic growth have a long-term equilibrium relationship (cointegrated) or not by using Johansen test. To determine the number of the cointegration direction, then Johansen suggests two statistical tests. For the first test statistic is the trace test (Trace test,  $\lambda_{trace}$ ) that is testing the null hypothesis which requires that the number of cointegration direction is less than or equal to p and this test can be done as follows :

$$\lambda_{\text{trace}}(r) = -T \sum_{i=r+1}^p \ln(1 - \lambda_i)$$

where  $\lambda_{r+1}, \dots, \lambda_n$  is the smallest value of eigenvectors (p-r).

The agreed null hypothesis is the number of the cointegration direction equal to the number of r. In other words, the number of cointegration vectors is less than or equal to ( $\leq$ ) r, where r = 0,1,2 and so on. The second statistical test is the maximum eigenvalue ( $\lambda_{\text{max}}$ ) test performed with the following formula:

$$\lambda_{\text{max}}(r, r + 1) = -T \ln(1 - \lambda_{r+1})$$

This test involves the null hypothesis test that there is r of the opposite cointegration vector (r + 1) with the cointegration vector. To see the cointegration relationship can be seen from the value of Trace statistics and Max-Eigen statistics compared with the value of the critical value at a confidence level of 5 percent.

### 3. Granger Causality Test

This test is used to see the relation of causality or reciprocity between two research variables so that can know whether those two variables, statistically interdependent (two-way or reciprocal relationship), has a one-way relationship or no relationship (does not affect each other). The model used to test the Granger Causality Test is as follows:

$$PE_t = \sum_{i=1}^m a_i PE_{t-i} + \sum_{j=1}^n b_j PP_{t-j} + \mu_t$$

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Where  $\mu_t$  and  $V_t$  are error terms that are assumed to not contain serial correlation and  $m = n = r = s$ . Based on the regression results of the two forms of the above linear regression model will produce four possibilities regarding the value of the regression as follows:

(1) if  $\sum_{j=1}^n b_j \neq 0$  and  $\sum_{j=1}^s d_j = 0$

Then there is the same causality from Y to X

(2) if  $\sum_{j=1}^n b_j = 0$  and  $\sum_{j=1}^s d_j \neq 0$

Then there is the same causality from Y to X

(3) if  $\sum_{j=1}^n b_j = 0$  and  $\sum_{j=1}^s d_j = 0$

Then X and Y are independent of one another

(4) if  $\sum_{j=1}^n b_j \neq 0$  and  $\sum_{j=1}^s d_j \neq 0$

Then there is a two-way causality between X and y

To strengthen the indication of the existence of various forms of causality as described above, then conducted F-test for each regression model 9 (Arief 1993) was performed.

## RESULTS AND DISCUSSION

### Price Integration TSR20 Indonesia, SICOM and New York

Table 2 is the result of cointegration analysis between Indonesian market, SICOM and United State. Having a long-term equilibrium relationship between related markets can illustrate that between one market and another the market has an integration relationship.

Table 2. Cointegration Test Results On TRS20 Price Data

Model	Hypothesized	Eigenvalue	Trace	0.05	Prob.**
	No. of CE(s)		Statistic	Critical Value	
TSRI & TSRS	None **	0.237	25.758	18.398	0.004
	At most 1 **	0.113	7.878	3.841	0.005
TSRI & TSRNY	None **	0.273	21.424	18.398	0.018
	At most 1	0.015	0.990	3.841	0.320
TSRNY & TSRS	None **	0.397	34.823	15.495	0.000
	At most 1	0.030	1.982	3.841	0.159

\*\* significant in the real 5%

Table 2 shows the cointegration relationship, for TSRI, TSRS and TSRNY the trace statistic value is greater when compared to the value of 5% critical value. based on the value indicates that in the long term there is a balance relationship. This indicates that the TSRI market with TSRS, TSRI with TSRNY and TSRS with TSRNY are integrated so that price changes in one market will affect other markets. This is in accordance with the law of one price (LOP) that the same level of commodity prices between one market and the other markets will be the same that distinguishes the cost of transport, inventory and packaging.

### Granger Causality Test Analysis

Based on Table 3 shows that there is a direct relationship between the price of TSRI and the price of TSRS. So it can be seen that the price of TSRI is influenced by the price of TSRS. This is in accordance with that disclosed by Fitrianti (2009) that the price of rubber TSR20 Indonesia influenced by the price formed in the stock SICOM. The influences of price of TSR20 Indonesia from Singapore can be attributed that the Singapore market is the reference market of the physical market price of Indonesia. Perfect price changes can reflect market integration. This, as indicated by price movements that occur in a market will affect other markets that sell the same commodities. The price changes will follow the price changes that occur in the reference market, in other words the price changes in the reference market is relatively the same as the price changes in the market followers (Vinuya 2007).

As for the Indonesian market with the New York market there is a mutual relationship between the two markets. This can happen because the New York market is the main export destination market for TSRI commodities and otherwise for Indonesia is a major exporter in meeting TSRNY rubber requirement. So that each price change between the two markets will affect other markets.

While on the market TSRS and TSRNY have a two-way relationship. This relationship can occur because New York from the side of the economy is a country with a large economy so

that changes that occur will affect other markets, and this country is one of the largest rubber consumption of TSR20 so that price changes in this market will affect the SICOM market. But for the SICOM market can affect the price of New York because of its strategic position. SICOM market is located in the main natural rubber producing countries. With these positions resulted, the SICOM market becomes a reference market especially for TSR20 rubber commodities. Fitrianti (2009) also revealed that SICOM market is a reference market in TSR20 rubber trade in the world.

Table 3. Result of Causality Test with Granger Test Method between price of TSR20 Indonesia, SICOM dan New York

Market	Lag	Relationship 1 HO , $\pi_1=0$	Relationship 2 HO , $\pi_2=0$	Causality
TSRI & TSRS	1	4,414 <sup>a</sup> (0,038 ) <sup>b</sup>	2,294 0,133	SICOM → TSRI
TSRNY & TSRI	2	9,422 0,000	4,604 0,012	TSRNY ↔ TSRI
TSRS & TSRNY	2	3,460 0,036	7,040 0,001	TSRS ↔ TSRNY

Description: a = f- statistic, b = probability value

## CONCLUSIONS AND SUGGESTION

### Conclusion

From the results of this study it is known that the three markets have been integrated, while the TSR20 rubber price transmission relationship between TSRI market, TSRS and TSRNY that is TSRI price is influenced by TSRS market, TSRNY market and TSRI market influence each other, TSRS and TSRS market influence one and others. This indicates if there is a change of price in the market TSRS then that will take effect is the TSRI market and TSRNY, so if there is a change in market prices TSRNY then the market will be affected is TSRI market and TSRS, but if the TSRI market changes the price to be affected only TSRS market.

### Suggestion

For further research it is necessary to look at integration relationships with other consumer markets such as China and Japan. In addition to looking at price integration relationships between markets, it is also necessary to examine price-building factors, so that the factors which affecting price changes are known so that the managerial aspects of price changes can be even better.

## REFERENCES

- [1] Herath K, Samita S, Wijesuriya W, Identification of Common Trends in Prices Demand and Supply of Natural Rubber An Approach Using Dynamic Factor Model, *Tropical Agricultural Research*. 24(1): 54-70
- [2] Darmawan MA, Wiguna W, Marimin, Machfud, Peningkatan Produktifitas Karet Alam dengan Pendekatan Green Productivity: Studi kasus di PT X, *Jurnal Teknologi Industri Pertanian*. 22 (2): 98-105

- [3] Erni N, Maarif MS, Indrasti NS, Machfud, Honggokusumo S, Model Prakiraan Harga dan Permintaan pada Rantai Pasok Karet Spesifikasi Teknis Menggunakan Jaringan Syaraf Tiruan, *Jurnal Al Azhar Indonesia Seri Sains dan Teknologi*, 1 (3), 116-123
- [4] Fitrianti W. Analisis Integrasi Pasar Karet Alam Antara Pasar Fisik di Indonesia dengan Pasar Berjangka Dunia, masters theses., Bogor Agricultural University, Bogor (ID), 2009
- [5] Direktorat Jendral Perkebunan. 2015. Statistik Karet Indonesia. Badan Pusat Statistik
- [6] Mayer J dan von Cramon-Taubadel S. Asymmetric Price Transmission: A Survey. *Journal of Agricultural Economics*. 55(3), 581-611
- [7] Chintia S, Guncangan Harga Minyak Mentah Dunia Terhadap Harga Beras Domestik, masters theses., Bogor Agricultural University, Bogor (ID), 2013.
- [8] Ravallion M. 1986. Testing Market Integration. *American Journal of Agricultural Economics Association*, 68 (1), 102-109
- [9] Muwanga GS, Snyder DL, Market Integration and The Law of One Price: Case Study of Selected Feeder Cattle Market, *Economic Research Institute Study Paper 97-11*, Utah State University
- [10] Fazaria DA, Hakim DB, Sahara. Analisis Integrasi Lada di Pasar Domestik dan Internasional. *Buletin Ilmiah Litbang Perdagangan*, 10 (2), 225-242
- [11] Rapsomanikis G, Hallan D dan Comforti P, Market Integration and Price Transmission in Selected Food and Cash Crop Market of Developing Countries: Review and Applications, *Commodity Market Review 2003-2004* FAO
- [12] Tomek W, Robinson KL. 1990, *Agricultural Product Price*. London. Cornell University Press
- [13] Malik A, Murdy S, Nainggolan S. 2013. Analisis Integrasi Pasar Crumb Rubber Singapura dan Pasar Lelang Karet Kabupaten Batang Hari Provinsi Jambi. Di dalam. *Peranan Teknologi dan Kelembagaan Pertanian dalam Mewujudkan Pembangunan Pertanian yang Tangguh dan Berkelanjutan*; 2013 November; Pekanbaru, Indonesia. Pekanbaru (ID): Universitas Riau. hlm 254-270
- [14] Purnomowati HD, Darwanto DH, Widodo S, Hartono S. 2015. Market Integration Analysis of Indonesian Natural Rubber in The World Market. *International Journal of Agriculture System*. 3 (2), 15-27
- [15] Putra MHI. Determinan Permintaan karet Indonesia. *Signifikan*. 1 (2): 127-138
- [16] Asmarantaka RW. 2009. *Bunga Rampai Agribisnis : Seri Pemasaran*. Bogor (ID). IPB Press
- [17] Gujarati DN. 2003. *Basic Econometric*. 4<sup>th</sup> ed. McGraw-Hill. New York
- [18] Vinuya FD, Testing for Market Integration and The Law Of One Price in World Shrimp Markets, *Aquaculture Economics and Management*, 11(3), 243-65.