World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

Integration of unorganized farming natural rubber markets in South Sumatra

Zetira Novriana [1], Mirza Antoni [2,*] and Laila Husin [2]

[1] *Master Program in Agribusiness, Faculty of Agriculture, Universitas Sriwijaya, Palembang, Indonesia.*
[2] *Department of Agribusiness, Faculty of Agriculture, Universitas Sriwijaya, Palembang, Indonesia.*

World Journal of Advanced Research and Reviews, 2023, 19(01), 1109–1119

Publication history: Received on 02 June 2023; revised on 11 July 2023; accepted on 13 July 2023

Article DOI: https://doi.org/10.30574/wjarr.2023.19.1.1389

Abstract

The income of rubber farmers from the sale of rubber processing material received by farmers who apply an organized and unorganized marketing system is different. The prices received by organized farmers are higher because they participate in the Processing and Marketing Unit for Rubber Processing Material (PMU) and carry out auction system sales and partnerships. The income of organized farmers is very different from that of unorganized farmers. The determination of the research location was carried out purposively. Farmer price data was taken in Banyuasin, Musi Banyuasin (Muba), and Ogan Komering Ilir Regencies, South Sumatra Province. The three districts have the largest rubber plantation area in South Sumatra and Indonesia. The data used are primary and secondary. Data processing is done quantitatively and qualitatively. The analysis tool used is multiple linear regression with panel data with the help of R-Studio software with the Vector Autoregression (VAR) or Vector Error Correction Model (VECM) method. There is long-term integration of the rubber market between the three regencies and short-term integration in the Banyuasin and Ogan Komering Ilir districts. However, there is no short-term integration between unorganized farmers' markets in Banyuasin, Musi Banyuasin, and Ogan Komering Ilir District. If the rubber price in one of the sample districts experiences a shock, the district experiencing the shock can return to normal on an average of the 14th period or 14 weeks after the shock occurred.

Keywords: Market integration; Natural rubber; Vector autoregression; Vector error correction model

1. Introduction

South Sumatra Province is the largest and largest rubber-producing province in Indonesia. Rubber prices in various South Sumatra districts continue to experience significant price fluctuations, affecting rubber production activities. Rubber is a plantation commodity with high economic value. Rubber is a raw material that is processed from the coagulation of the liquid sap from the rubber plant (latex), which can be in the form of chunks (boxes), sheets of rubber (sheets), or crumb rubber (crumb rubber) [1]. Through an organized rubber processing material market system, farmers will get a higher price share than traditional rubber processing material marketing. The average price share received is 80% FOB, for organized rubber processing material marketing and 50%-58% FOB for traditional rubber processing material marketing [2]. In South Sumatra, many farmers still need to follow the PMU or whose marketing system needs to be organized. If farmers follow the PMU, farmers sell rubber by auction instead of selling it to middlemen, brokers, traders, and others. Farmers do not have a playing position. A vertical market integration theory approach will be used to see rubber intermediary traders' misuse of market power [3]. Based on this theory, two interconnected markets (transactions) will be perfectly integrated.

Market integration or an integrated market is the level of price movement in different areas, where the same product will have the same price even though it is sold in different places and price signals and information market is evenly distributed [4]. The price formation of natural rubber at the producer level is mainly influenced by the price of natural rubber at the producer level. World natural rubber prices mainly influence natural rubber prices at the exporter level,

* email corresponding author: Mirza Antoni

then natural rubber prices at the producer level, while prices at the exporter level have minor variations. This shows that the price of natural rubber at the exporter level tends to be influenced by the price of natural rubber on the world market and between provinces in Indonesia [5–7].

This research is crucial because it will describe the integration analysis of the rubber market among unorganized farmers, which has yet to be done by previous researchers. However, market integration between international markets, producers and consumers, and price transmission has been carried out by several researchers before. As research conducted by [8,9] concluded that there had been long-term integration, but the inefficiency of Indonesian RSS marketing and integration of natural rubber prices only occurred between the Thai market, the Singapore futures market (Sicom), and the Japanese futures market (Tocom). Research on integrating Indonesia's SIR 20 natural rubber market with Sicom, Tocom, and New York was conducted by [10–12]using the vector error correction model (VECM) method, which analyzes market integration in various commodities. Based on the background above, an interesting problem to study is how market integration occurs at the farmer-producing level in the three districts in South Sumatra and how long it takes for the districts to return to regular prices if shocks occur.

2. Material and methods

2.1. Research Methods

This study used primary quantitative data from interviews with farmers who were not members of the PMU. In more detail, the variables used are shown in Table 1.

Table 1 Research Data Variables

No	Data Type	Unit	Source	Period	Data Period
1	Market Integration				
- Unorganized Producer Natural Rubber Market (Non-PMU)					
a	Banyuasin Regency	IDR/Kg	Primary data from farmer interviews	Weekly	January 1st, 2022, to August 8th, 2022
b	Musi Banyuasin Regency (Muba)				
c	Ogan Komering Ilir Regency (OKI)				

Market integration analysis uses the Vector Autoregression (VAR) or Vector Error Correction Model (VECM) methods. The VAR/VECM model is a system of equations that shows each variable as a linear function of the constants, the lag values (past) of the variables themselves, and the lag values of other variables in the system. Several stages of data processing using the VAR/VECM model are as follows.

2.1.1. Stationarity Test or Unit Root Test

This data stationarity test can be carried out using Augmented Dickey-Fuller (ADF) at the same degree (level or different) until stationary data is obtained, namely, data whose variance is not too large and has a tendency to approach the average value [13]. Stationarity of time series data is an essential requirement in analyzing econometric models in order to avoid spurious regression. [14,15] explained that the function of the ADF test is to see whether there is a trend in the movement of the data to be tested. The ADF test consists of a regression calculation which is formulated as follows.

2.1.2. Optimum Lag Determination

Furthermore, to find out the optimal number of lags used in the stationarity test, according to [13]. In determining the optimal lag using the information criteria, the criteria chosen are the criteria that have the smallest number of AIC and SBC among the various recommended lags. Some of these criteria are used, so there are additional criteria, namely the adjusted R2 of the VAR system.

2.1.3. Cointegration Test (Johansen Cointegration Test)

The cointegration test aims to determine whether non-stationary variables are cointegrated or not. The cointegration concept proposed by Engle-Granger is a linear combination of two or more non-stationary variables and produces a stationary variable. This linear combination is known as the cointegration equation and can be interpreted as a long-run equilibrium relationship between variables [16].

2.1.4. Estimation of VAR/VECM Models

The Vector Error Correction Model (VECM)is a restricted VAR model used for non-stationary variables but can potentially be cointegrated. After testing the cointegration of the model used, entering the cointegration equation into the model used is recommended. In time series data, most of them have a level of stationarity in the first difference or I(1) [17]. In VECM, there is a speed of adjustment from the short term to the long term, which is indicated by the Error Correction Model value. The VAR model can be constructed after the variables are seen for their stationarity, cointegration, lag, and suitability of the variables to be included in the model. The market integration VECM model specifications are as follows.

$PNB1t = \alpha 01 + i1PNBt\text{-}1 + i1PNMt\text{-}1 + i1PNOt\text{-}1 + \varepsilon 1t$
$PNM2t = \alpha 02 + i2PNBt\text{-}1 + i2PNMt\text{-}1 + i2PNOt\text{-}1 + \varepsilon 2t$
$PNO3t = \alpha 03 + i3PNBt\text{-}1 + i3PNMt\text{-}1 + i3PNOt\text{-}1 + \varepsilon 3t$

Information:
PNB: the price of natural rubber at the level of unorganized farmers in Banyuasin Regency (Rp)
PNM: the price of natural rubber at the level of unorganized farmers Musi Banyuasin Regency (Rp)
PNO: the price of natural rubber at unorganized farmer level Ogan Komering Ilir Regency (Rp)
α 0n, β0n, γ0n, … : parameter matrix of size mxn for every lag = 1,2,…,

The subsequent data analysis estimates the Impulse Response Function (IRF) and Forecast Variance Decomposition (FEVD). These pieces of information are usually the main objectives in estimating VAR/VECM. IRF confirms the response of all variables to a shock of one standard deviation in the variables in the system of equations. IRF shows how the response of an endogenous variable at present and in the future is a shock to the variable itself and other endogenous variables. IRF is used to see the contemporary effect of a variable if another variable gets a shock or innovation by one standard deviation [17].

3. Results and discussion

3.1. VECM Models Testing

3.1.1. Data Stationarity Test

The first unit root test for the variable uses Augmented Dickey-Fuller (ADF), tested in the first data condition (at level/original). As for the results of the unit root test, it is known that the results of the first stationarity test show that at the level using the intercept without trend, all data is not stationary at the 5% significance level (seen from the p-value). Since the price data for rubber in the three sample districts in South Sumatra were not stationary at the level, a first difference test was carried out using the Dicky-Fuller method, and the results obtained were that the variables in this study were stationary, as shown in the ADF test results in Table 2.

Table 2 Unit Root Test Results with Intercept with Trend

Variable	Dickey-Fuller	p-values	Conclusion
PNB	-3.6864	0.01088	stationary
PNM	-4.6803	0.01	stationary
PNO	-6.0808	0.01	stationary

Based on Table 2, it can be seen that the results of testing the stationarity of the data using intercept and trend criteria show that the variable stationarity testing at level one differentiation indicates that the variable is stationary because it has a p-value <critical value. If it is stationary with the Dicky-Fuller method first difference test, then VECM analysis is applied to this study.

3.1.2. Optimum Lag Test

Determining the optimal lag length is helpful for eliminating autocorrelation and heteroscedasticity problems in VAR/VECM systems. [13] stated that determining the number of lags used in the model uses the VARSelect function using the RStudio software. Determination of the length of the lag in this study was carried out using the Schwarz Criterion (SC) criteria. The following is the result of calculating the optimum lag length available in Table 3.

Table 3 Optimal Price Lag Criteria

AIC(n)	HQ(n)	SC(n)	FPE(n)
2	2	3	2

Table 3. indicates that the optimal interval to be used in the VAR/VECM model is lag 2. In determining the optimal lag, the criterion chosen is the criterion that has the smallest number of AIC and SBC among the various recommended lags. If the smaller the criterion value is, the expected value generated by a model will be closer to reality. The VECM model in the natural rubber price model at the producer level is lag 2. This means that all the variables in the model influence each other only in the next two periods (in this study, it means two weeks).

3.1.3. Cointegration Test

The cointegration test aims to determine whether the non-stationary variables experience cointegration or not. Two or more cointegrated variables mean that they have a long-term relationship or balance (long-run equilibrium). The cointegration test method in this study is based on the Johansen cointegration method. Based on the analysis using RStudio, the results of the Johansen cointegration test can be seen in Table 4.

Table 4 Johansen Cointegration Test Results

	test scores	Critical Value 10%	Critical Value 5%	Critical Value 1%
r <= 2	2.35	7,52	9,24	12.97
r <= 1	6,69	17.85	19.96	24.60
r = 0	8.85	32.00	4.91	41.07

Based on the results of the Johansen cointegration test in Table 4. it shows that the test value at r = 0 is 8.85, more significant than the critical value with a significance level of 5%. This means that there is one cointegration equation (long-term integration). Thus there is an equation that can explain the cointegration relationship in the variables in the model.

3.1.4. VECM Stability Testing

Testing the stability of the model is the next step before we use the VECM estimate. Testing the stability of the model, intended to test the validity of IRF (Impulse Response Function). Testing the stability of the VECM estimation can be shown in Table 5. as follows.

Table 5 VECM Estimation Stability Test Results

Variable	Stability test value
GNP	0.4689581
PNM	-0.1575075
PNO	0.06246644

From Table 5. above, it can be explained that the model used is stable. This can be seen from the stability test value with a value of less than one. Thus, the IRF (Impulse Response Function) analysis results are valid and further testing can be carried out.

3.2. Vector Error Correction Model Estimation Results

After carrying out a series of testing stages, namely data stationarity test, determination of lag length, cointegration test, and VECM stability, and the fact that there is one cointegration at the 5% test level in this study, the model used is the VECM (Vector Error Correction Model). The use of VECM estimation is in accordance with the formulation of the problem in this study, which is to identify short-term and long-term relationships between the effect of the independent variables on the dependent variable. The VECM specification restricts the long-term behavioral relationship between existing variables so that it converges into a cointegration relationship but still allows dynamic changes in the short term. Error correction means that if there is a deviation from the long-term balance, it will be corrected gradually

through short-term partial adjustments. Estimation is carried out on the variables of three districts in South Sumatra. The estimation results of the VECM model in the short term are shown in Table 6. as follows.

Table 6 Estimation Results of the Short-Term Vector Error Correction Model

Short-term			
Province of Influence	**Affected Provinces**	**Estimates**	**Pr(>|t|)**
PNB. d	PNB. dl1	-0.58234	0.01198 *
	PNO. dl2	0.15462	0.01573 *
	PNO. dl3	0.19536	0.00493 **
PNM. d	PNM. dl1	-0.50842	0.015944 *
	PNM. dl2	-0.97186	0.000392 ***
	PNM. dl3	0.79222	0.013189 *
PNO. d	PNO. dl2	-0.6131	0.0210 *

Source: primary data processing, 2022

In the short-term estimation, the VECM estimation shows that the Banyuasin Non-PMU variable at lag 1 has a negative and significant effect on the rubber market in the province itself and has a positive effect on unorganized farmers in OKI at lag two and lag 3 (price at two weeks and three weeks respectively). Then, Banyuasin will result in price changes in Banyuasin and OKI this month). Suppose the price increase in Musi Banyuasin Regency by one rupiah in the previous week will reduce the price in Musi Banyuasin Regency itself by 0.508. In that case, the price change two weeks ago can be inversely proportional to 0.971, and if the price three weeks ago in Muba Regency went up, then this week in Muba will also increase by 0.792. Whereas, the following picture shows price fluctuations between the three districts in South Sumatra.

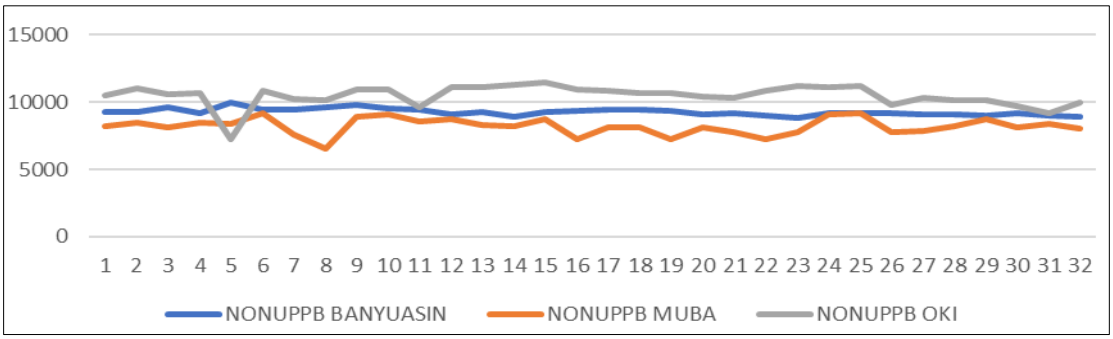

Figure 1 Fluctuations in Rubber Prices at the Farmer (Producer) Level in Three Regencies

Figure 1 reveals that Ogan Komering Ilir Regency has the highest price. Prices at the farmer level in Musi Banyuasin are not integrated with the other two districts when seen from the findings of short-term integration. Similar to Ogan Komering Ilir, prices at the farmer level in Musi Banyuasin have priced the highest in comparison to the other two sample districts. The market is crucial for unorganized farmers since, in contrast to farmers who follow PMU (selling rubber by auction), they generally sell rubber through middlemen, brokers, village collectors, or middleman traders. Because a farmer's ability to earn a high or low income depends primarily on whether they choose to participate in an organized market. Low market prices will cause good products to be wasted [18]. Due to capital attachment, inability to maintain quality uniformity, daily financial necessity to sell rubber, lack of farmer education, etc.

Farmers choose not to adhere to the PMU or there is no PMU in their area. After examining the short-term integration, we can move on to the long-term integration. This will be followed by an explanation of the adjustment procedure leading to a long-term balance that is corrected by the Error Term adjustment mechanism, with the effect being visible from the significance, magnitude, and direction of the Error Correction Term (ECT) coefficient. Table 7 displays the inter-provincial rubber market's long-term cointegration analysis.

Table 7 Estimating Results of the Long-Term Vector Error Correction Model

	Long-term		
Element	**Variable Natural Rubber Prices at Producer Level**		
	GNP	PNM	PNO
ECT	0.23628	0.80069	0.7111
Pr(>|t|)	0.04472 *	0.026807 *	0.01379
R-Squared	0.6219	0.7125	0.6688,

Source: Primary data processed, 2022

The test results on the unorganized producer market integration equation in Banyuasin, Musi Banyuasin, and Ogan Komering Ilir districts show that the equation is valid as evidenced by a significant ECT coefficient as seen in a probability smaller than 5 percent. The R-squared values in each district are 0.62, 0.71, 0.66, indicating that this equation can explain 62%, 71%, and 66% of the dependent variable based on the model used, and the rest are other variables not included in the model. R Square can be seen in the equation to determine validity in line with research [18].

The ECT coefficients describe the speed of adjustment per period toward long-term balance. The ECT coefficients in VECM measure the speed of adjustment towards long-run equilibrium relationships between markets [13]. In the market ECT variable in Banyuasin Regency, the estimated parameter value is 0.23628. It is significant at α = 5%, which means that the price adjustment process towards balance occurs on the first day by 23%, and 77% is corrected on the following days. For rubber prices in Muba Regency, it will be able to make an immediate correction of 80% on the first day towards a long-term balance. Likewise, OKI Regency made corrections on the first day of 71% to achieve a long-term balance. Thus, the model specifications used in this study are appropriate and can explain short-term and long-term relationships [19]. Therefore, the equation is valid, and there is no reason to be rejected. The significance of the ECT variable in the estimation of the ECM equation indicates that there is a correction for short-term errors that affect the process toward long-term balance.

3.3. Impulse Response Function

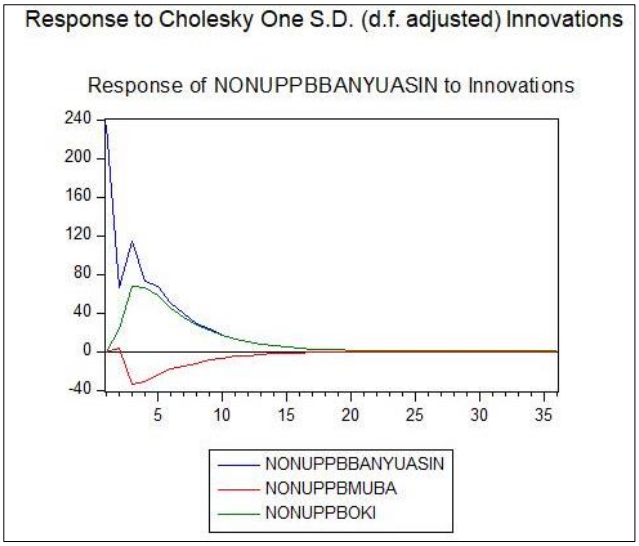

Figure 2 IRF plot of the unorganized market (non-PMU) in Banyuasin District

Impulse Response Function(IRF) shows the response of an endogenous variable at present and sometime in the future to shock to the variable itself and other endogenous variables [20]. IRF is used to see the contemporary effect of a variable. If another variable gets a shock or innovation by one standard deviation, it can be predicted when the price will return to the average price before the price shock occurs. The horizontal axis in Figure 2. shows the period where one period represents one week. In this case, a period of 36 weeks is used so that the period used in the IRF test contains 36. The vertical axis shows changes to inevitable variable shocks where these changes are expressed in standard

deviation units (SD). The results of the IRF analysis show that during the simulated period, the proportion and direction of the rubber price response in each market fluctuated.

Figure 2. is a combination of graphs or Combined Graphs showing the price response of natural rubber in Banyuasin Regency when shocks occur in the rubber market for unorganized farmers in the three sample districts. The analysis results show that when shocks occur in the three sample districts, the prices in Banyuasin Regency will return to their balance only at different periods. When price shocks occur in Banyuasin Regency itself, the price of two Banyuasin will return to normal in the 18th period. The price shock that occurred in Muba was negative at the Banyuasin price. If the price of rubber in Muba increases, it can cause a decrease in prices in Banyuasin Regency. However, prices in Banyuasin will return to normal after facing muba price shocks in period 14. [21]stated that If a variable is shocked, the variable will form a new price, which will stabilize in period X.

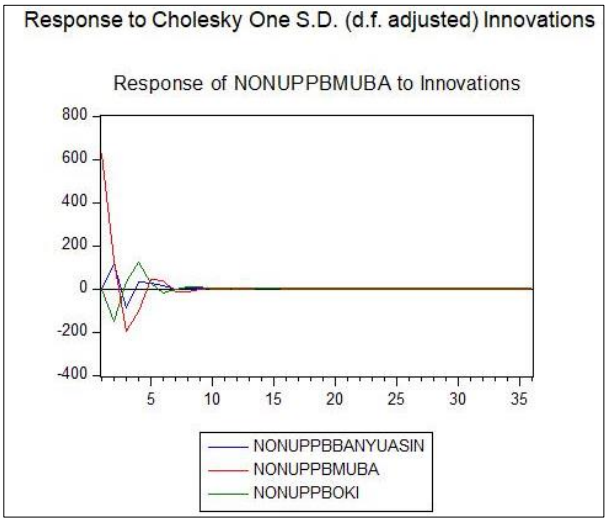

Figure 3 IRF plot of the unorganized market (non-PMU) in Musi Banyuasin District

Based on Figure 3, if a price shock occurs in the three sample districts, prices at the producer level of unorganized farmers in Musi Banyuasin Regency return to equilibrium quickly, namely in the 7th to 10th periods. The shock to the rubber market in the three districts caused Muba District to respond positively and negatively two weeks after the price shock.

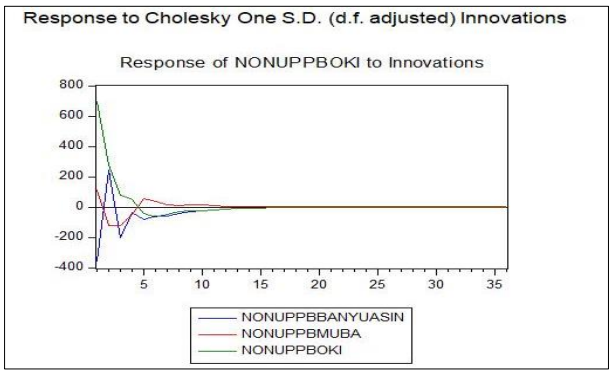

Figure 4 IRF plot of the unorganized market (non-PMU) in Musi Ogan Komering Ilir District

The response to the rubber market shocks of the three sample districts resulted in a positive response and a negative response by OKI District. However, prices at the unorganized farmer level could return to normal in the 12th to 14th period or 12 to 14 weeks after the shock.

3.4. Forecast Error Variance Decomposition (FEVD)

Forecast Error Variance Decomposition (FEVD) analysis aims to describe the relative importance of the diversity of each variable in the system which explains the causes of a shock or change. FEVD helps predict the percentage contribution of each variable due to changes in certain variables in the VAR/VECM system [22]. The decomposition

analysis of variance for this study will be used to ascertain the percentage of variation for each variable over the next 36 weeks. The pictures below show the FEVD results on natural rubber prices.

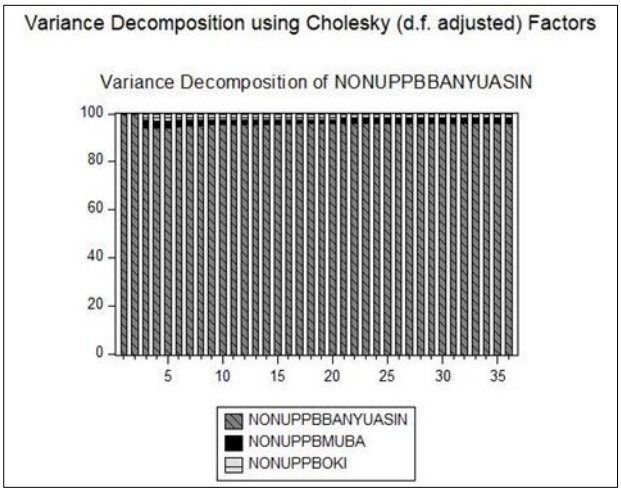

Figure 5 Forecast Error Variance Decomposition of the Banyuasin producer market

Based on Figure 5. it can be seen that the percentage of causes of changes in rubber prices in the producer's market is due to price changes in each of the various sample districts. Forecast causes of price changes in Banyuasin during 36 weeks. The future are presented in percentage form. From the first week to the 36th week, variations in natural rubber prices in Banyuasin Regency change due to the set price or the price used by rubber buyers in Banyuasin itself—several internal factors within the rubber market in Banyuasin itself cause this. Internal factors, for example, the procurement of insufficient rubber clones, tend to have high prices [23], so factories in Banyuasin Regency will buy in other districts to meet factory capacity and vice versa.

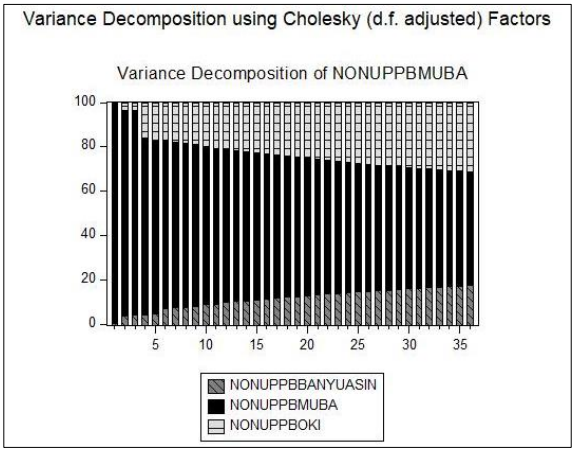

Figure 6 Forecast Error Variance Decomposition of the Musi Banyuasin producer market

The area of rubber plantations in Indonesia is extensive and has potential. However, production has been unable to meet the needs of all rubber processing factories, so many rubber factories suffer losses because the factory capacity is not met. For example, price shocks in Musi Banyuasin Regency are caused by negative price changes in OKI and Banyuasin Regencies. That is, if there is an increase in prices in Musi Banyuasin Regency, then there will be a decrease in prices in OKI and Banyuasin Regencies. This is why the market in Muba is not integrated with the other two sample districts. Many factories in South Sumatra are linked to one another. Several rubber processing companies lack raw material supply. On the one hand, this condition causes the purchase price at the local level to increase slightly, and the price of rubber located far from the factory will be lower.

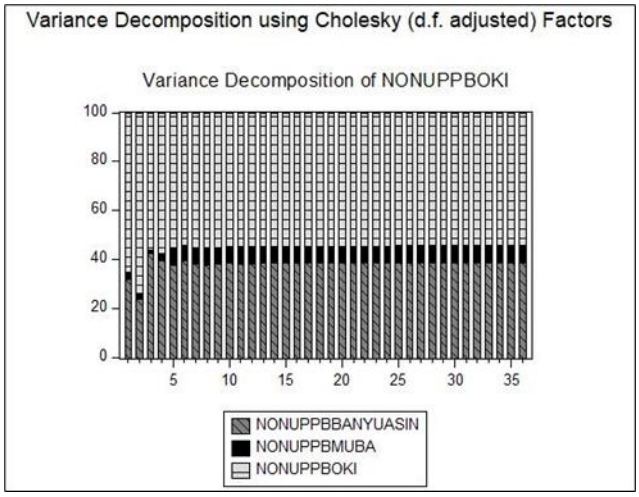

Figure 7 Forecast Error Variance Decomposition of the Ogan Komering Ilir producer market

Based on Figure 7. The price changes that apply to rubber producers in OKI Regency are caused by price shocks of 65% from the Regency itself, and the rest are caused by price changes that occur in Banyuasin Regency by the remaining 30% due to price shocks in Muba Regency, the effect is only 5%. Likewise, the next 36 weeks can be seen in Figure 7. The potential for rubber in South Sumatra Province is still very feasible to continue to be developed. However, this cannot run as it should if there is no government contribution in fixing marketing systems, facilities, and infrastructure in districts in South Sumatra, especially in improving the capital available to farmers. Because. The need for government assistance to regulate unorganized farmers so that traders cannot manipulate prices at the farmer level as producers. The involvement of farmers in the activities of PMU groups and cooperatives in farmer areas is very much needed because the participation of farmers in these activities will increase farmer productivity and eliminate farmers' dependence on collector traders with an auction system at PMU.

4. Conclusion

The rubber market is integrated into the traditional (unorganized farmer) marketing system at the long-term farmer level between the three districts and short-term integration in Banyuasin and Ogan Komering Ilir districts. However, there is no short-term integration between unorganized farmer markets in Banyuasin District, Musi Banyuasin, and Ogan Komering Ilir District. Farmers who do not have capital and need money urgently tend to sell their rubber when the drought is not optimal and only sell to middlemen without participating in auctions such as organized farmers (following PMU) so that the excess price received by farmers is lower or sells at lower prices therefore so that farmers can get fair profits for the products they produce. This research is important for farmers as a consideration in the decision to join or not to join the Rubber processing material Processing and Marketing Unit, so that farmers can improve their welfare through rubber farming income which has high economic value.

Compliance with ethical standards

Acknowledgements

We express our sincere appreciation to all the authors who contributed to the redaction of this paper.

Disclosure of conflict of interest

No conflict of interest to disclosed.

Funding Support

The authors declare that they have no funding support for this paper.

Statement of ethical approval

The authors declare that there is no conflict of interest

References

[1] Sriati S, Rismarini R, Yunita Y. Kinerja Gabungan Kelompok Tani dalam Meningkatkan Pendapatan Petani Karet di Kecamatan Banyuasin III, Kabupaten Banyuasin, Provinsi Sumatra Selatan (The Performance of the Joint Farmer Groups in Increasing the Income of Rubber Farmers in Banyuasin III District, Banyuasin Regency, South Sumatra Province). Jurnal Penyuluhan. 2021; 18:1–11.

[2] Nugraha IS, Alamsyah A, Agustina DS. Peningkatan Bagian Harga Yang Diterima Petani Melalui Pemasaran Terorganisir (Increasing the Share of Prices Received by Farmers Through Organized Marketing). Warta Perkaretan. 2019; 1:35–46.

[3] Nahar A, Luckstead J, Wailes EJ, Alam MJ. An assessment of the potential impact of climate change on rice farmers and markets in Bangladesh. Clim Change. 2018; 150:289–304.

[4] Samantha K, Tarno T, Rahmawati R. Analisis Integrasi Spasial Pasar Cabai Merah Keriting Di Jawa Tengah Dengan Metode Vector Error Correction Model (Spatial Integration Analysis of Curly Red Chili Market in Central Java Using the Vector Error Correction Model Method). Jurnal Gaussian. 2021; 10:190–9.

[5] Andelia SR, Antoni M, Adriani D. Analisis Integrasi Pasar Karet : Pada Delapan Provinsi Produsen Karet Terbesar di Indonesia (Rubber Market Integration Analysis: The Eight Largest Rubber Producing Provinces in Indonesia). Ekonomi, Keuangan, Investasi Dan Syariah (EKUITAS). 2022; 4:217–24.

[6] Yuningtyas C, Hakim D, Novianti T. Threshold Transmisi Harga Karet Alam Indonesia dengan Pasar Internasional Singapura (Threshold of Indonesian Natural Rubber Price Transmission to the Singapore International Market). Jurnal Ekonomi Pertanian Dan Agribisnis. 2020; 4:623–33.

[7] Andelia SR, Antoni M, Adriani D. Strategi Pengembangan Agribisnis Karet Dalam Prespektif Peranan Kelembagaan di Indonesia (Rubber Agribusiness Development Strategy in the Perspective of Institutional Roles in Indonesia). Jurnal Ilmiah Mahasiswa Agroinfo Galuh. 2022; 9:1221.

[8] Nurhidayati I, Hakim DB, Asmara A. Integrasi Pasar Karet Alam Sit Asap Antara Produsen Utama Dengan Pasar Berjangka Dunia (Sit Smoke Natural Rubber Market Integration Between Major Producers and World Futures Markets). Jurnal Manajemen Dan Agribisnis. 2015; 12:204–15.

[9] Audina M. Pengaruh Pandemi Covid-19 Terhadap Integrasi Pasar dan Harga Karet di Tingkat Petani di Sumatera Selatan (The Effect of the Covid-19 Pandemic on Market Integration and Rubber Prices at the Farmer Level in South Sumatra). Thesis. Universitas Sriwijaya, 2022.

[10] Andi Suryadi, Sahara RH. Integration And Asymmetry of TSR Indonesia Rubber Price At World TSR20 Price. Jurnal Aplikasi Manajemen Dan Bisnis. 2018; 4:354–64.

[11] Aryani D. Efisiensi Sistem Pasar Beras Indonesia the Efficiency of Rice Market System (The Efficiency of Indonesian Rice Market System the Efficiency of Rice Market System). Report. 2017.

[12] Vikran BP. Analisis Integrasi Pasar Spasial Dan Transmisi Harga Beras Di Provinsi Lampung (Analysis of Spatial Market Integration and Rice Price Transmission in Lampung Province). digilib.unila.ac.id; 2023.

[13] MW, Enders W. Applied Econometric Time Series. vol. 90. New York: Jhon Wiley & Sons; 1995.

[14] Fitrianti W. Analisis Integrasi Pasar Karet Alam Antara Pasar Fisik Di Indonesia (Analysis of Natural Rubber Market Integration Between Physical Markets in Indonesia). TESIS. Sekolah Pascasarjana Institut Pertanian Bogor, 2009.

[15] Juliodinata AI, Tiro MA, Ahmar AS. Metode Vector Autoregressive dalam Menganalisis Pengaruh Kurs Mata Uang, Inflasi, dan Suku Bunga Terhadap Indeks Harga Saham Gabungan (Vector Autoregressive Method in Analyzing the Effect of Currency Exchange, Inflation, and Interest Rates on the Composite Stock Price Index). VARIANSI: Journal of Statistics and Its Application on Teaching and Research. 2019; 1:13.

[16] Firdaus M. Aplikasi Ekonometrika Untuk Data Panel dan Data Time Series (Econometrics Applications for Panel Data and Time Series Data). Bogor: IPB Press; 2011.

[17] Firdaus M, Gunawan I. Integration among regional vegetable markets in Indonesia. Journal of the International Society for Southeast Asian Agricultural Sciences. 2012; 18:96–106.

[18] Abubakar I. Integration between Cocoa Bean Markets at Farm Level in Parigi Moutong District. J Agroland. 2019; 26:170–8.

[19] Rahayu E, Martha S. Analisis Tingkat Inflasi dan Bi Rate Menggunakan Vector Error Correction Model (Analysis of Inflation and Bi Rate Using the Vector Error Correction Model). Buletin Ilmiah Mat, Stat, Dan Terapannya (Bimaster). 2021; 10:51–60.

[20] Mahayana IMPM. Integrasi Pasar Kopi Indonesia Dan Amerika Serikat Serta Pengaruh Guncangan Nilai Tukar Rupiah Terhadap Harga Kopi Indonesia (Integration of the Indonesian and United States Coffee Markets and the Effect of Rupiah Exchange Rate Shocks on Indonesian Coffee Prices). IPB University, 2016.

[21] Hasyyati A. Variabel-variabel makroekonomi yang memengaruhi pertumbuhan sukuk korporasi di indonesia (Macroeconomic variables that influence the growth of corporate sukuk in Indonesia). IPB University, 2019.

[22] Saputra DD, Sukmawati A. Pendekatan Analisis Vector Error Corretion Model (VECM) Dalam Hubungan Pertumbuhan Ekonomi dan Sektor Pariwisata (The Vector Error Correction Model (VECM) Analysis Approach in the Relationship between Economic Growth and the Tourism Sector). Seminar Nasional Official Statistics. 2021; 2021:120–9.

[23] Sri Hertina, Khoirun Nisyak, Nur Aslamiah Supli. Daya Saing Karet Alam Sumatera Selatan Dalam Perdagangan Internasional (Competitiveness of South Sumatra Natural Rubber in International Trade). Indonesian Journal of International Relations. 2021; 5:241–63.