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The Effect of Domestic Consumption on Natural Rubber Farmgate Price in Indonesia

DOI: https://doi.org/10.18196/agraris.v8i2.12480

ABSTRACT

The decline in natural rubber farmgate prices in recent years directly impacted Indonesia's natural rubber market. In response to this phenomenon, the government plans to increase natural rubber domestic consumption to raise Indonesia's rubber price. This study aimed to determine the effect of increasing natural rubber domestic consumption on natural rubber farmgate prices and analyze other factors those influence it. The Error Correction Model was used to identify the variables that significantly affect Indonesia's natural rubber farmgate price. The data used in this study were monthly data from January 2012 to December 2017. Results showed that natural rubber domestic consumption did not significantly affect the Indonesia natural rubber farmgate price. However, in the long run, Indonesia's natural rubber farmgate price was influenced by the previous period of Indonesia's natural rubber prices, world natural rubber prices, world crude oil prices, and exchange rates. While in the short run, Indonesia's natural rubber farmgate price was influenced by the previous period of Indonesia's natural rubber prices, world natural rubber prices, and exchange rate.

Keywords: Domestic consumption; Error correction model; Natural rubber farmgate price

INTRODUCTION

Natural rubber is one of the major commodities in agricultural sector in Indonesia. Almost 85 percent of the producers are small-scale farmers who depend their livelihoods on the commodity (Ministry of Agriculture, 2017). Indonesian natural rubber is also the prime commodity of Indonesian exports. The export of natural rubber varies in type, but the most common export is technically specified natural rubber (TSNR) 20. In 2019, Indonesia's largest natural rubber exports were technically specified natural rubber (TSNR) 20 (HS40012220), which amounts to 91.3 percent of Indonesia's total natural rubber exports (BPS-Statistics Indonesia, 2018). In 2017, Indonesia also succeeded in exporting natural rubber with a total export value of 5.1 billion US dollars (UN Comtrade, 2019).

Recently the farmgate price of natural rubber has decreased considerably, which is mainly caused by the declining world price (Figure 1). Indonesia depends immensely on the

international market since almost 81 percent of its natural rubber production is exported (Ministry of Agriculture, 2017). The decrease in natural rubber farmgate prices has caused economic and social problems among small-scale rubber farmers (Nugraha, Alamsyah, & Sahuri, 2018). Erlina, Koestiono, Hanani, & Syafrial (2019) also indicated that the decrease in farmgate rubber price significantly affects the activity and production decisions of both farmer and farmer's group. In addition, Tongkaemkaew & Chambon (2018) revealed that the decrease in natural rubber prices would cause labor migration to the industrial or service sector. Meanwhile, Jin, Min, Huang, & Waibel (2021) revealed that when natural rubber prices decline, farmers in the Mekong region of China diversify their income to non-agricultural activities. Farmers also stop tapping the rubber in some cases and eventually shift to other plants (Ali & Manoj, 2020). However, Mahdi & Yonariza (2017) indicated that the minimum farmgate price of IDR 8,000 per kilogram of natural rubber is still profitable for farmers.
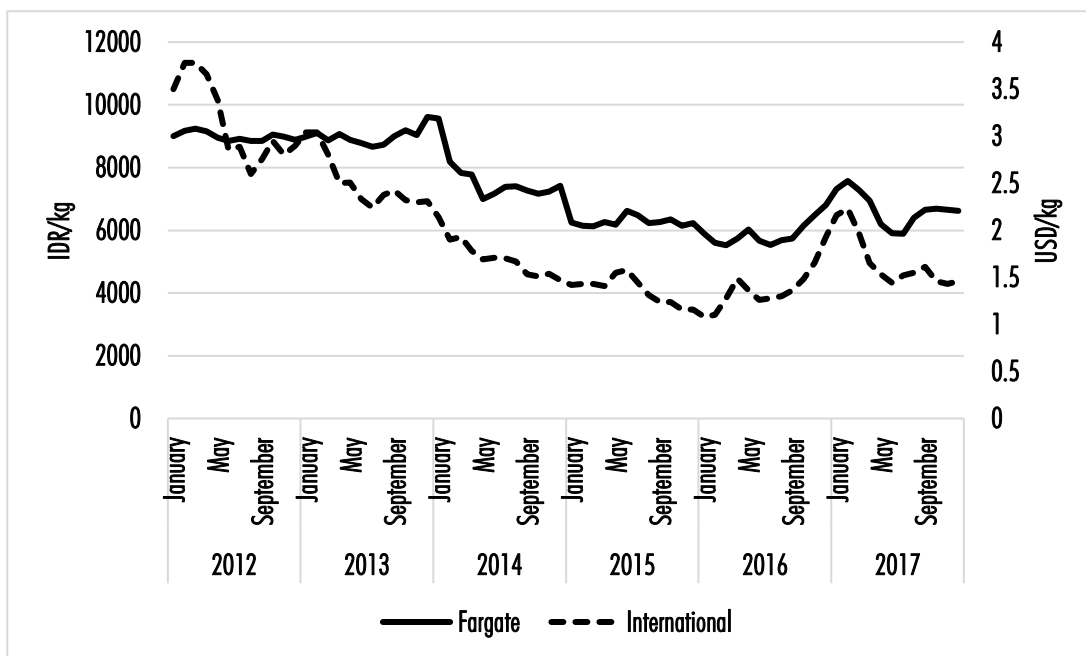

FIGURE 1. NATURAL RUBBER FARMGATE AND INTERNATIONAL PRICE, JANUARY 2012-DECEMBER 2017
SOURCE: BPS-STATISTICS INDONESIA (2018)

Some research indicated that the Indonesian domestic rubber price is integrated with the international price. Therefore, the government of Indonesia implements two policies to increase the natural rubber farmgate price. The first is to limit natural rubber exports, which cooperate with the two other producing countries, Thailand and Malaysia. The policy is called the Agreed Export Tonnage Scheme (AETS), in which the three countries agreed to limit their natural rubber export in some agreed periods. The second policy is increasing the domestic consumption of natural rubber. The government boosts the domestic consumption of natural rubber by using the materials in infrastructure projects such as asphalt mixture, ports, and other activities.

Some research indicated that the Indonesian domestic rubber price is integrated with the international price. Indonesian domestic natural rubber price has a long-run market

integration with national rubber prices in China, Japan, and South Korea (Purnomowati, Darwanto, Widodo, & Hartono, 2015). Meanwhile, in Singapore, the market integration occurred in the short and long-run, which is similar to Suryadi, Sahara, & Hasbullah (2018) research. It indicates that the Singapore natural rubber price determines Indonesian domestic natural rubber price.

In order to increase the natural rubber farmgate price, the government of Indonesia has implemented several programs to increase the domestic consumption of natural rubber. The policy's objective is to increase the demand for natural rubber and eventually increase the natural rubber farmgate price. The government bought natural rubber directly from farmers at a set price and utilized the natural rubber for several infrastructure projects.

Limited literature has analyzed the determinants of natural rubber farmgate price, and most literature deals with market integration between domestic and international natural rubber prices (Kaewsompong, Sriboonchitta, Maneejuk, & Yamaka, 2016; Purnomowati et al., 2015; Suryadi et al., 2018). Fong, Khin, & Lim (2020) analyzed the determinants of the domestic price of natural in Thailand, Indonesia, Malaysia, and Vietnam using annual data and panel cointegration method. The authors found that consumption affects domestic prices besides other variables such as production, Shanghai natural rubber price, crude oil price, and synthetic rubber price. Kopp, Dalheimer, Alamsyah, Yanita, & Brümme (2019) found that the price of natural rubber, synthetic rubber, and crude oil was cointegrated or had a long-run relationship. In India, Melba & Shivakumar (2016) revealed that natural rubber price is affected by future price, international price, and synthetic rubber price.

In Indonesia, the natural rubber export price is affected by international rubber price, export tariff, exchange rate, domestic consumption, export volume, and global crisis affected (Al Kautsar, 2014; Daulika, Peng, & Hanani, 2020). At the farmer's level Arifin (2005), Masliani (2020); and Usman, Wardhana, & Istiqamah (2022) and indicated that changes in the international price of natural rubber at the processing level are not perfectly transmitted to farmgate price, especially when the price increase. The traders and rubber factories keep the profit from the price increase. Kopp & Sexton (2021) added that natural rubber buyer has strong market power and the farmers were double marginalized causing the natural rubber farmgate price tend to fluctuate in favor of the buyer.

In Malaysia, Khin, Bin, Keong, Yie, & Liang (2019) revealed that production, domestic consumption, crude oil price, and Shanghai natural rubber prices affected the Malaysian natural price. However, the exchange rate did not significantly affect the Malaysian natural rubber price. Meanwhile, Ramli, Noor, Sarmidi, Said, & Azam (2019) and Ramli (2019) indicated that natural rubber in the main producer countries, such as Thailand, Indonesia, and Malaysia, were interelated. It implies that the change in natural rubber prices in one country will impact other countries.

This article differs from the previous article, which analyzes the natural rubber farmgate price, while other articles mostly focus on export price and price integration. In addition, the analysis focusess on the effect of domestic consumption of natural rubber using monthly data.

In terms of model, this article utilized a similar approach to other articles which used time series analysis.

RESEARCH METHOD

The data used in this research were secondary data from several sources. The time series monthly data from January 2012 to December 2017 was used. The data included the Indonesian natural rubber prices, domestic production and consumption of natural rubber data, the exchange rate of IDR to USD, world oil prices, and world natural rubber prices. Data were obtained from Statistics Indonesia, Bank Indonesia, World Bank, Indonesian Rubber Companies Association (GAPKINDO), International Rubber Study Group (IRSG), and other institutions related to previous studies. Various literature studies were also sourced from books, journals, and articles from the IPB University Library and the internet.

The quantitative methods were applied to determine whether the Indonesian natural rubber domestic consumption level and other factors affected the Indonesian natural rubber farmgate prices. The model utilized was the Error Correction Model (ECM), which consists of three steps. The first step was testing stationarity then followed by testing cointegration model with Engel Granger Cointegration test. It constructs residuals (errors) to identify whether unit roots were present, using Augmented Dickey-Fuller test or another, similar test. If the residuals was stationary than it can be concluded that the variables are cointegrated.

This research model used the natural logarithmic equation (Ln) to equalize the units on each variable, so the slope coefficient a_1 shows the elasticity of the dependent variable to the independent variable. The model was calculated using the Ordinary Least Square (OLS) method, and the long-term equation was formulated as Equation 1:

$$LFP_t=a_0+a_1LNFP_{t-1}+a_2LNINT_t+a_3LNPROD_t+a_4LNCONS_t+a_5LNEXPORT_t+ \\ a_6LNEXCH_t+a_7LNOIL_t+u_t \qquad (1)$$

The short-term equation model was formulated as Equation 2:

$$\Delta LNFP_t=b_0+b_1\Delta LNFP_{t-1}+b_2\Delta LNCONS_t+b_3\Delta LNPROD_t+b_4\Delta LNINT_t+ \\ b_5\Delta LNEXPORT_t+b_6\Delta LNEXCH_t+b_7\Delta LNOIL_t+\gamma u_{t-1}+e_t \qquad (2)$$

While, Δ was first difference; $LNFP_t$ was Natural rubber farmgate price month t (IDR/kg); $LNFP_{t-1}$ was Natural rubber farmgate price in previous month t (IDR/kg); $LNCONS_t$ was Natural rubber consumption in month t (Ton); $LNPROD_t$ was Natural rubber production in month t (Ton); $LNINT_t$ was World natural rubber prices in month t (USD/kg); $LNEXPORT_t$ was Indonesia natural rubber exports volume in month t (Ton); $LNEXCH_t$ was Exchange rate rupiah to US dollar in month t (IDR/USD); $LNOIL_t$ was World crude oil prices in month t (USD/bbl); e_t was error term; γ was error term coefficient; and u_{t-1} was Error Correction term.

The considerably variable of this research was domestic natural rubber consumption ($LNCONSt$). Since the domestic consumption increase, it will raise the natural rubber farmgate price. Meanwhile, the international natural rubber price, international oil price, and the exchange rate will positively affect the natural rubber farmgate price. On the other hand, domestic natural rubber production and natural rubber export will negatively affect the

natural rubber farmgate price. In addition, the lag of natural rubber farmgate prices can positively or negatively affect the natural rubber farmgate price. The sign of the error correction coefficient (γ) should be negative.

RESULTS AND DISCUSSION

Indonesian Natural Rubber Condition

Indonesia is the second-largest producer of natural rubber in the world after Thailand. Indonesia's total natural rubber production reached 3.4 million tons in 2019 (Figure 2) and has increased since 1990-2019, with average production growth of around 3.7 percent (Food and Agriculture Organization [FAO], 2019). The average increase is contributed by the average growth of a harvested area of 2.6 percent and the increase in productivity of 1.6 percent in 1999-2019 (FAO, 2019).
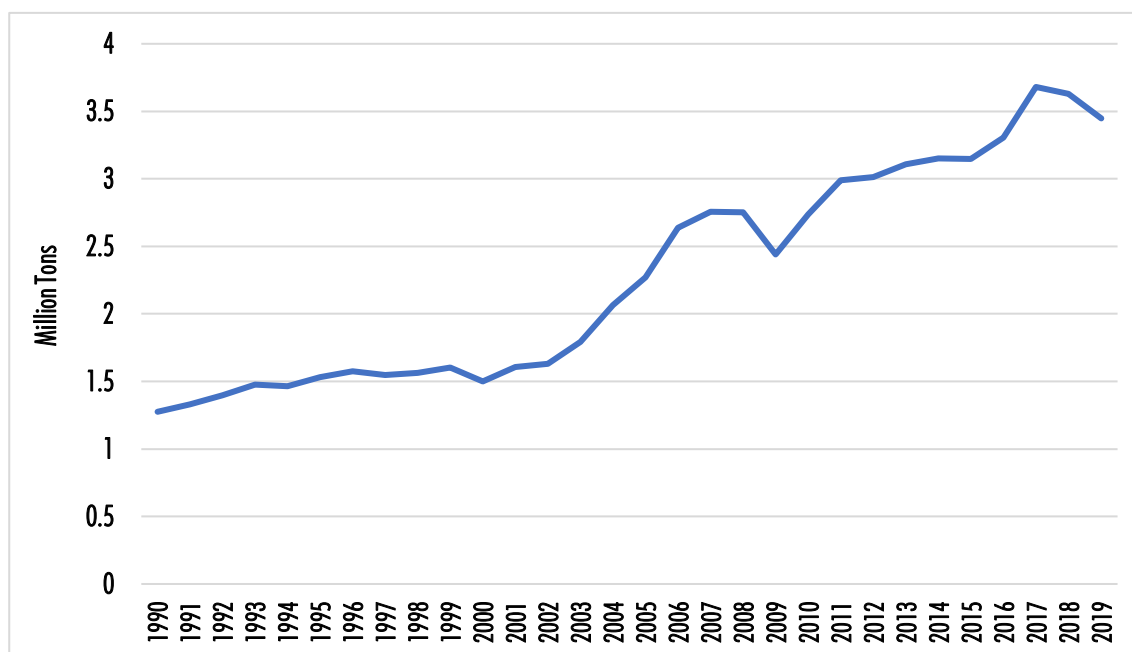

FIGURE 2. INDONESIA'S NATURAL RUBBER PRODUCTION, 1990-2019
SOURCE: BPS–STATISTICS INDONESIA (2020)

The center of natural rubber production in Indonesia consist of 5 provinces. South Sumatra has the highest contribution to the total natural rubber production, with around 28 percent, followed by North Sumatra at 12 percent, Riau at 10 percent, Jambi at 9 percent, and West Kalimantan at 8 percent in 2019 (BPS–Statistics Indonesia, 2020). Based on ownership status, the production and harvested area of natural rubber plantations in Indonesia was dominated by smallholder plantations. In 2019, 88.7 percent of the natural produced and 88.9 percent of the harvested area were dominated by smallholders (BPS–Statistics Indonesia, 2020).

The consumption of natural rubber in Indonesia is still low Indonesia only consumes approximately 20 percent of the total production, while the remaining 80 percent was exported. Rubber is a commodity that cannot directly be consumed. Commonly, the demand

for large amounts of natural rubber is for industrial needs. Natural rubber will be processed through several processes to become more valuable goods.

The growth of natural rubber consumption in Indonesia during 2002-2016 has a positive trend, with an average increase of 10 percent annually (Figure 3). Compared to 2002, domestic consumption increased four times in 2019. In 2002, only 8.9 percent of natural rubber produced was consumed domestically, and the number increased to 18.6 percent in 2019. Most of the natural rubber consumption was used for the tire industry, shoes, and gloves, and product diversification is still relatively limited (Perdana, 2019).
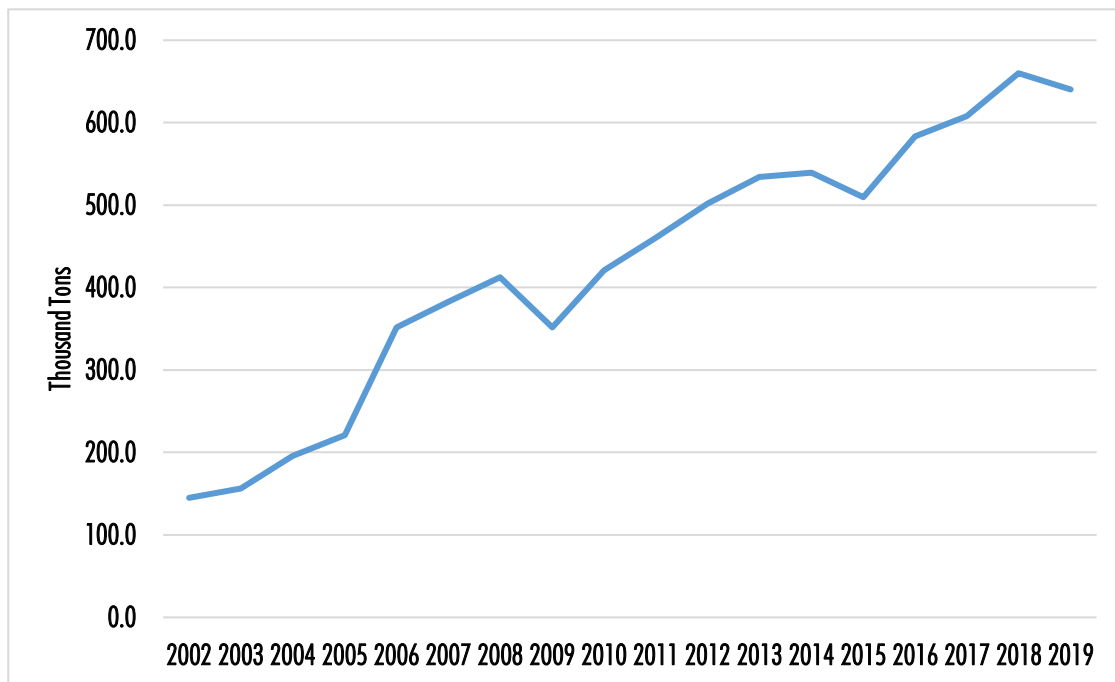

FIGURE 3. INDONESIA'S DOMESTIC CONSUMPTION OF NATURAL RUBBER, 2002-2019
SOURCE: INTERNATIONAL RUBBER STUDY GROUP (2021)

Indonesia typically exports three main products of natural rubber, such as technically specified natural rubber (TSNR) 20 (HS 40012220), technically specified natural rubber (TSNR) 10 (HS 40012210), and ribbed smoked sheet (RSS) rubber Grade 1 (40012110). These products which 99 percent of Indonesia's natural rubber export value in 2019 (BPS–Statistics Indonesia, 2020). Meanwhile, technically specified natural rubber (TSNR) 20 (HS 40012220) was the largest natural rubber exported product. This product contributed 91.3 percent of Indonesia's total value export of natural rubber products in 2019 (BPS–Statistics Indonesia, 2020). Indonesia is the leading exporter of technically specified rubber (HS 400122). In 2019, Indonesia contributed 38.8 percent of the world's total TSNR export, followed by Thailand at 23.4 percent and Malaysia at 9.6 percent (UN Comtrade, 2019).

The average of technically specified natural rubber (TSNR) 20 export value from 2010 until 2019 decreased by 3.1 percent annually (Figure 4). Meanwhile, the average export quantity during the same period increased by 1 percent annually (Figure 4). This indicated that the exporting price of technically specified natural rubber (TSNR) fluctuates over the years and moves in the same pattern as the international price of natural rubber.
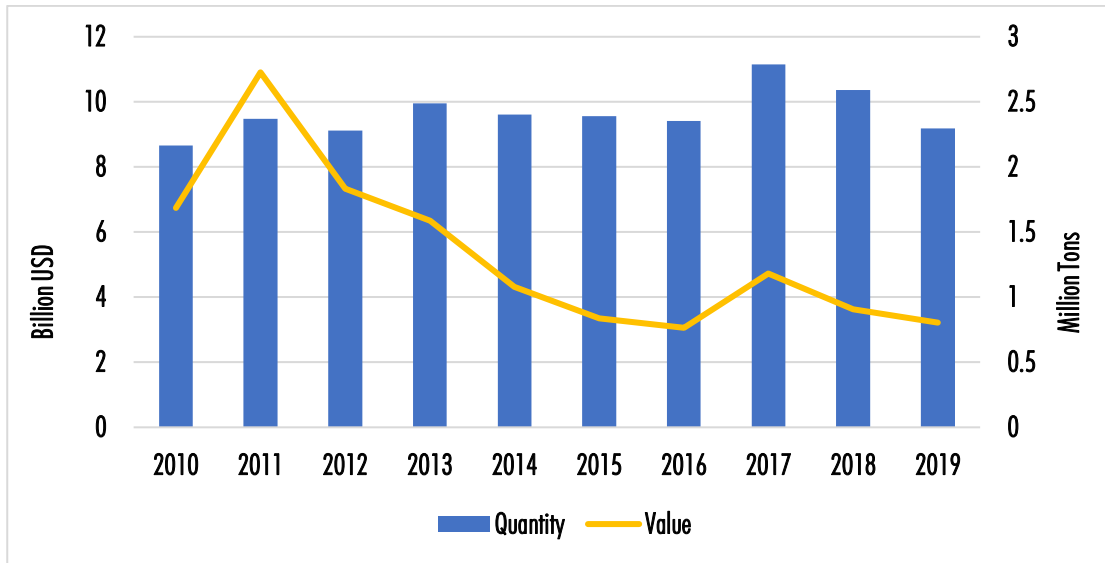
FIGURE 4. INDONESIA'S TSNR 20 EXPORT VALUE AND QUANTITY, 2010-2019
SOURCE: INTERNATIONAL TRADE CENTER (2021)

The major export destination of Indonesia's technically specified natural rubber (TSNR) 20 in 2019 was the USA with 22 percent, followed by Japan at 21 percent and China at 9 percent (Figure 5). These three countries already contributed 50 percent of Indonesia's technically specified natural rubber (TSNR) 20 total exports. Oktora & Firdani (2019) revealed that Indonesia highly depends on importing countries for export, especially China. A slowdown economy of China will affect Indonesia's TSNR export to China. Technically specified natural rubber (TSNR) 20 is mainly used for raw tire materials, and many tire companies are located in the three countries.
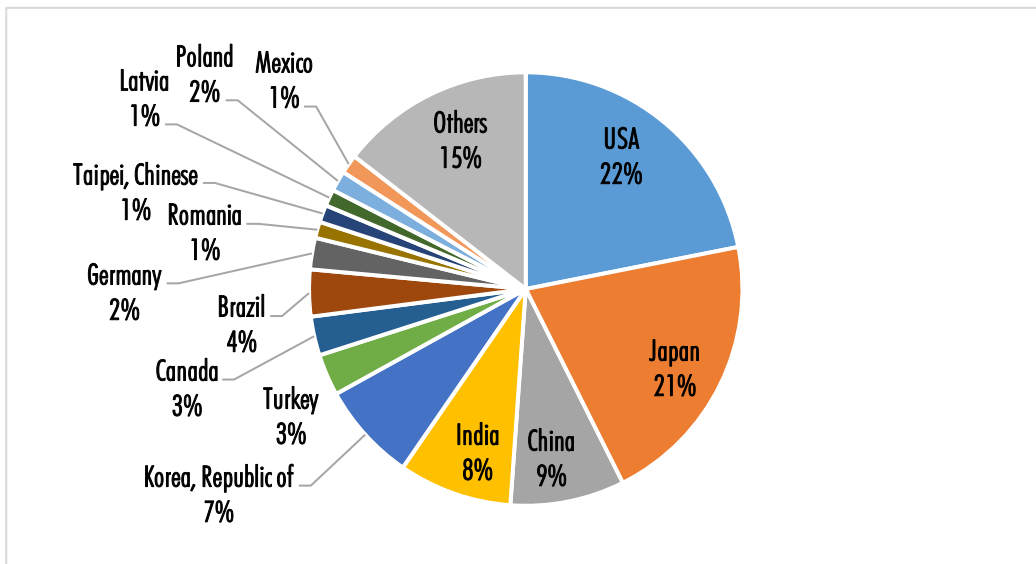

FIGURE 5. INDONESIA'S TSNR 20 MAIN EXPORT DESTINATION, 2019
SOURCE: INTERNATIONAL TRADE CENTER (2021)

The Effect of Domestic Consumption on Natural Rubber Farmgate Price

The unit root test indicated that all the variables were stationary in the first level or I(1) at a 10 percent significant level. It was indicated by the p-value of all the variables in the first

difference was less than 0.1 or 10% (Table 1). Then the cointegration test showed that the residual was stationary at the level form, indicating a long-run relationship between the variables (Table 1).

TABLE 1. UNIT ROOT AND COINTEGRATION TEST

Variables	Level		First Difference	
	ADF	p-value	ADF	p-value
Farmgate price (LNFP)	-0.820	0.358	-6.751***	0.000
Domestic consumption (LNCONS)	0.110	0.714	-11.009***	0.000
Production (LNPROD)	2.323	0.995	-1.677*	0.088
International price (LNINT)	-2.103**	0.035	-5.580***	0.000
Export (LNEXP)	0.417	0.801	-14.991***	0.000
Exchange rate (LNEXCH)	1.968	0.988	-5.991***	0.000
Oil price (LNOIL)	-0.767	0.381	-5.916***	0.000
Residual	-6.760***	0.000		

Note: ***, **, * significant at the 1% , 5% and 10% level, respectively

Two equations were calculated, i.e., the long-run and the short-run equation. In the long-run and short-run equation, the domestic consumption variable did not significantly affect the natural rubber farmgate price (Table 2). The result indicated that the government policy towards increasing domestic consumption of natural rubber would not effectively increase the natural rubber farmgate price. This was caused since the current domestic consumption was relatively smaller than export. Furthermore, despite being the world's second-largest natural rubber producer, Indonesia is a price taker rather than a price maker. This result proves that the significant variable which affected natural rubber farmgate price was external variables, such as international price, rather than domestic or internal variables. Therefore, increasing domestic consumption of natural rubber will not raise the farmgate prices since the low percentage of domestic consumption. The increase in domestic consumption will only affect natural rubber export prices (Al Kautsar, 2014; Daulika et al., 2020) but not farmgate prices.

TABLE 2. LONG-RUN AND SHORT-RUN ESTIMATION RESULTS

Variables[a]	Long-run Coefficient	Short-run Coefficient
Farmgate price previous month ($LNFP_{t-1}$)	0.610***	0.637***
Domestic consumption (LNCONS)	-0.042	0.003
Domestic production (LNPROD)	0.015	-0.001
International price (LNINT)	0.191***	0.258***
Export (LNEXPORT)	0.004	0.024
Exchange rate (LNEXCH)	0.191**	0.571**
Oil price (LNOIL)	0.081***	0.082
Error correction		-0.891***
Constant	1.136	0.001
R^2	0.963	0.515
F-stat	231.428***	8.088***

Note: ***, **, * significant at the 1% , 5% and 10% level, respectively
[a] the variables in the short-run are in the first difference form

Several variables were significant in the long-run and short-run, namely the lag of natural rubber farmgate price, the international price of natural rubber, and the exchange rate. Meanwhile, the oil price was only significant in the long-run. The international price of natural rubber significantly affected the Indonesian natural rubber farmgate price in the long-run, with coefficients of 0.191 and 0.258 in the short-run. This result indicated that the international price of rubber would be more sensitive to changes in the natural rubber farmgate price in short-run than the long-run. The international price affected the Indonesian natural rubber farmgate price since most of them were exported. Therefore, Indonesia depends on the international market. The recent low farmgate price was caused by the low natural rubber international price (Suryadi et al., 2018). The same case also occurred in other commodities, such as cocoa beans. The cocoa bean farmgate price was influenced by its international price (Rifin, 2015) and, in the case of palm oil, between domestic and international CPO prices (Nakajima, 2012).

The natural rubber farmgate price was sensitive to the exchange rate changes both in the long-run and short-run. A depreciation of IDR to USD will increase the competitiveness of Indonesian natural rubber in the export market, which finally increase the natural rubber farmgate price (Al Kautsar, 2014; Daulika et al., 2020; Khin, Chau, & Yean, 2016). Butt, Ramakrishnan, Loganathan, & Chohan (2020) even found a bi-directional relationship between the price of natural rubber and the nominal exchange rate in Malaysia. A different result was found by Khin et al. (2019) that the exchange rate did not significantly affect the Malaysian natural rubber price (SMR20).

International oil price was significant in the long-run affecting the natural rubber farmgate price. Oil was used as a raw material for synthetic rubber which was considered to be the substitute for natural rubber. High oil prices will increase the production cost of synthetic rubber, causing producers to shift to natural rubber (Fong et al., 2020). This shift increases the demand for natural rubber and farmgate price. Fong et al. (2020); Mdludin, Applanaidu, & Abdullah (2016); and Zhang & Qu (2015) for the case of natural rubber and other agricultural commodities. Kumar, Pinto, Hawaldar, Spulbar, & Birau (2021) also found that futures oil prices were affected in the short run by natural rubber prices in India, and a similar case occurred in the case of China (Zhang & Qu, 2015). Meanwhile, in the case of Thailand, there is a strong positive relationship between natural rubber and crude oil price (Tanielian, 2018).

The government policy to increase natural rubber domestic consumption in Indonesia did not significantly affect Indonesian natural rubber farmgate prices in the short and long term. Even increasing domestic consumption with the current market prices did not impact natural rubber farmers due to the price level is still low, even though the objective of government policy is to protect the farmers who were facing the decline in natural rubber prices. The low price of natural rubber had declined the farmer's monthly income, investment capacity, and purchasing power. Furthermore, it caused farmers to shift their income sources from natural rubber farming to other prospective plants (Syarifa, Agustina, Nancy, & Supriadi, 2016).

Meanwhile, the International Tripartite Rubber Council (ITRC), which consists of Thailand, Indonesia, and Malaysia, declare export restrictions as of April 1, 2019. These countries agreed to reduce the export of natural rubber by as much as 240,000 tons for the three countries. Indonesia reduces rubber exports by 98,160 tons, Malaysia by 15,600 tons, and Thailand, the largest producer, reduces the export volume by 126,240 tons. The newly implemented policy was expected to raise the price of world natural rubber to 2 USD per kg from the current price of around 1.4 USD per kg. The results showed that the volume of Indonesia's natural rubber exports did not significantly affect the price of Indonesian natural rubber. However, restricting the export of natural rubber carried out by Indonesia, Thailand and Malaysia will certainly reduce the world's natural rubber supply. According to the economic principle, the international price level will increase when supply decreases. The international price of natural rubber is one of the significant variables affecting the natural rubber farmgate price, indicating that the farmgate price was integrated with the international price. Therefore, restricting export will hopefully increase the natural rubber farmgate price (Khin, Chong, Shamsudin, & Mohamed, 2008). This research stated that the world's natural rubber stock has a negative relationship with the price of natural rubber, therefore when the world's natural rubber stock decreases, it will increase the price of world natural rubber.

This research showed that increasing domestic consumption had not proven to increase the farmgate price of natural rubber. Two aspects can affect this condition. Firstly, domestic consumption did not affect the farmgate price of natural rubber despite the volume. Secondly, domestic consumption was insufficient to affect the natural rubber farmgate price. Therefore, in the future, increasing domestic consumption might affect the farmgate price of natural rubber when domestic consumption is high enough. This also indicated that the farmgate price of natural rubber was basically caused by external factors rather than internal factors in Indonesia. Indonesia and whole natural rubber-producing countries must implement policies to increase the farmgate price of natural rubber.

CONCLUSION

Indonesian natural rubber domestic consumption was not proven to affect Indonesia's natural rubber farmgate price in the short and long term. In order to increase farmgate prices through domestic consumption, the downstream industry must be more developed by diversifying the product, not only depending on tires, shoes, and gloves. Industries such as health products, automotive spare parts, and others can be developed to increase the domestic consumption of natural rubber and eventually increase farmgate price.

In addition, factors that influenced Indonesia's natural rubber farmgate price in the long-run and short-run were the lag of natural rubber farmgate price, international natural rubber price, and exchange rate. Meanwhile, international oil prices affected natural rubber farmgate prices in the short-run. The policy of restricting natural rubber export for Indonesia, Malaysia, and Thailand will likely increase natural rubber internationally price. Then the increase in international price will increase Indonesia's natural rubber farmgate price.

Authors' contributions: PPP contributed to the original draft, data acquisition and data analysis. AR contributed to the research idea and revising the manuscript. DN contributed to the revising the literature review and references

Conflict of interest: The authors declare no conflict of interest

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