Determinant factors of Indonesian rubber export to Japan

D K Sari, T Supriana* and Rahmanta
Department of Agribusiness, Faculty of Agriculture, Universitas Sumatera Utara, Medan, Indonesia.

E-mail: *tavi@usu.ac.id

Abstract. Export reflects trade activities between countries that can provide a boost in economic dynamics. Japan is the second largest export destination for Indonesian Rubber after United States and the third largest car manufacturer in the world, so that exporting rubber to Japan is considered quite potential. The purpose of this study is to analyse the effect of production, exchange rate, and GDP on Indonesian rubber export volume to Japan. The analytical method used in this study was the forecasting method and multiple linear analyses based on time series data from 1989 to 2018. The results indicated a positive trend in Indonesian rubber export prospect to Japan. Rubber production and world rubber prices significantly effect and have positive effect, while Japan GDP has non-significant and negative effect on Indonesian rubber export volume to Japan.

1. Introduction
The agricultural sector has a important role in Indonesian economic activities. One of the agricultural subsectors of agriculture that is quite potential is rubber plantation. Rubber plants can produce all year-round and almost all areas in Indonesia are suitable for rubber plantation. Domestic natural rubber consumption is only around 15% while the production is higher, it makes Indonesia prefer to export to other countries.

The increase in export volume is also closely related to price. As the law of supply, when the price of a commodity rises then the supply will increase. Therefore, when the international rubber price increases, Indonesian rubber exporters will raise the production to increase export value.

One of the biggest export destinations for Indonesian rubber is Japan. Japan is a producer of high-tech industries, especially motor vehicle and also very well known for its efficiency and competitiveness. In 2018, Japan was the third-fastest economically growing country after the United States and China in terms of GDP Therefore, Japan is expected to be one of Indonesian rubber trading partners that continuously make a positive contribution to the Indonesian economy [1].

This objective of this study is to analyse Indonesian rubber exports to Japan and determinant factors that affect it, such as rubber production, rubber prices, and Japan’s GDP.

2. Data and methods
The selection of export destination countries is based on list of Indonesian largest export countries. Japan is the third largest destination country for non-oil and gas in 2018 and is the second largest export destination for Indonesian rubber products. Japan industrial sector is the third largest in the world. In terms of modern and robotic technology, Japan is also more advanced than America and China
Data used in this research is time series over 30 years from 1989 to 2018. The data collected from the World Bank, Central Bureau of Statistics (BPS), Rubber Association of Indonesia (GAPKINDO), the Ministry of Trade of the Republic of Indonesia, journals, and several other sources.

The data and information obtained for this study will be analysed through quantitative methods, the forecasting methods to find out Indonesian rubber export to Japan with moving averages and linear trends. Meanwhile, the multiple linear analysis methods were used to analyse the factors that affect Indonesian rubber exports to Japan, such as domestic rubber production, international rubber prices, and Japan’s GDP. The relationships of each variable in this study were:

\[ Y = f(PK, HK, GDP) \]  
(1)

Furthermore, the equation transformed into multiple regression so we obtain the following equation:

\[ Y = \beta_0 + \beta_1 PK + \beta_2 HK + \beta_3 GDP + e_i \]  
(2)

Where,

- \( Y \): Indonesian rubber export volume to Japan
- \( PK \): Indonesian rubber production
- \( HK \): World rubber prices
- \( GDP \): Japan’s GDP
- \( E_i \): Error

3. Results and discussions

The development of Indonesian rubber exports to Japan during the research period generally showed positive developments. Rubber exports are also expected to be one of the sectors that can boost economic growth as the industrialization strategy changes from imported industry to export industry. The development of Indonesian rubber export volume and domestic natural rubber production from 1989 to 2018 are as follows:

![Figure 1. Indonesian rubber export volume to Japan and Indonesian rubber production trend.](image)

The chart in Figure 1 illustrates the volume of Indonesian rubber exports has the same pattern as rubber production, in other words the increase in rubber production in line with the export volume. This is in line with the concept [2] that increasing rubber production which is one of the export
commodities will also increase export volume. Increasing the domestic product in a country will also increase export. In other words, the difference in a country's gross domestic product will give an illustration of the high and low from the volume of exports [3]. Export volume can be considered to be one of the important macro-economic valuations of a country's development, especially for developing countries like Indonesia. The increase in export value will contribute to the people's economy [4].

3.1. Forecasting analysis of moving average method
Moving average forecasting analysis proposed in this study is carried out by forecasting based on the average value in the predetermined forecast period. To obtain a better forecast, three moving average forecasting models are used, they were the 2 years, 3 years, and 4 years moving averages. The graph of the volume of Indonesian rubber exports to Japan is summarized in Figure 2.

![Figure 2. Actual and forecasting of Indonesian rubber export volume to Japan.](image)

Figure 2 provides information that in general there has been an increase in export volume from year to year. Although in some circumstances the export volume decreased, in general there was a positive indication of an increase in export volume. In addition, the graph in Figure 2 shows that the predictive ability of moving averages per 2 years is better than 3 years or 4 years. The volume of Indonesian rubber exports to Japan is relatively stable and experiencing an increase from year to year. This gives note that the outlook for rubber exports from Indonesian to Japan is in a good prospective.

3.2. Linear trend forecasting analysis
Forecasting analysis using moving average method also indicates that there is a positive trend of Indonesian rubber export volume to Japan from year to year. Figure 3 provides a summary of the linear trend evaluation of the rubber export volume.

Figure 3 shows a positive trend from Indonesian rubber exports to Japan indicating that the volume of rubber exports from Indonesian to Japan will increase from year to year. The role of export value from year to year moves with reference to equations:

\[
\text{Export Volume} = -24,605,196.94 + 18,292,635.45 \text{ Period}
\]  

(3)
This indicates that every year the volume of rubber exports from Indonesian to Japan will increase by 18,292,635.45 kg. This shows that the prospect of rubber exports from Indonesian to Japan is very promising.

![Graph showing linear trend analysis of Indonesian rubber exports to Japan.](image)

**Figure 3.** Linear trend analysis of Indonesian rubber exports to Japan.

### 3.3. Multiple linear analysis methods

Statistical analysis of the determinant factors using multiple linear analysis methods showed in Table 1.

| Model          | Unstandardized Coefficients | Standardized Coefficients | T    | Sig.  |
|----------------|----------------------------|----------------------------|------|-------|
| (Constant)     | 1.554                      | 2.211                      | .703 | .491  |
| Production     | 1.682                      | .312                       | .644 | .000  |
| Rubber_Price   | .009                       | .041                       | .015 | .220  |
| GDP            | -.109                      | .475                       | -.221| .822  |

a. Dependent Variable: Export_Volume

Based on Table 1, the regression equation model for predicting rubber export volume is formulated as:

\[ Y = 1.554 + 1.682 \text{PK} + 0.009 \text{HK} - 0.109 \text{GDP} + e1 \]  

(4)

The regression model's constant value is 1.554 indicates that when all variables in the research model are equal to zero (have no value), then the export volume level (log) is 1.554 which is an external effect from this regression model. This indicates that the average level of Indonesian rubber exports to Japan reached 1.554 Kg.

Rubber production and world rubber prices significantly effect and have positive effect, while Japan GDP has non-significant and negative effect on Indonesian rubber export volume.
The trend of number of Indonesian rubber exports increased every year, even though it was fluctuating but the average growth in the volume of exports continued to grow positively. Over the past 21 years the export value of Indonesian rubber has grown by 9.95% [5]. These results also indicated the potential for export volume to increase year to year. Indonesian rubber products have a fairly competitiveness compared to the rubber products of other ACFTA members, and it also can be seen that Indonesia is able to make good use of the benefits of being an ACFTA member in increasing its trade for rubber commodities [6].

Table 1 shows every increase of 10 Kg (Log 10 = 1) in rubber production, the export volume level will increase by 1.682 Kg. The higher the production of rubber was produced, the greater the export volume that occurred. This significance because the change in Indonesian rubber production cannot be separated from the share of the world rubber market. Indonesian is the second largest country after Thailand with the largest production level and market share in the world. This shows that rubber has remained a superior commodity for Indonesian plantations over time. With developments both in terms of world rubber consumption and production, in the coming year is certainly still going to continue to increase. The availability of land provides an opportunity to produce even greater natural rubber by increasing the plantations area [7].

An increase of IDR 100/kg in the price of rubber (log100 = 2) in the price of rubber, export volume will increase by 0.018 kg. Trade between one country and another can create a solid and integrated market. Price changes that occur in a market can affect price changes in other markets if there is good integration between two markets. Weakening demand from major consumer countries and coupled with oversupply or increase in stock has made rubber prices down. The improvement in the global economy also did not appear to have had sufficient effect on rubber prices [8].

With a decrease in Japan’s GDP of IDR 100 Billion, (Log 100 = 2), the export volume will decrease by 0.018 Kg. This result is in line with statement [8] that partially only Indonesian rubber production can affect Indonesia’s rubber exports. Only a part of Indonesian rubber production can affect exports. Meanwhile, the exchange rate and GDP do not significantly affect Indonesian rubber exports [9-11].

Other Research Results [1] reveal that the increase in GDP of importing countries cause an increase in Indonesian exports to the export destination countries. The export increased due to an increase in domestic investment of importers, which led to the increase in demand for imported goods and raw materials as inputs in the production process originating from Indonesian.

This difference exists because the calculation of Japan’s GDP is actually the accumulation of income from all components of the citizens, both individual groups and corporate groups. The group of companies is very diverse, not only companies that required raw materials from rubber. So that the change in GDP variable didn’t not automatically increase the rubber export volume.

4. Conclusions
The forecast results show that the volume of Indonesian rubber exports to Japan will increase year on year. This positive trend shows the outlook for Indonesian rubber exports to Japan is still quite promising. Rubber production and world rubber prices significantly effect and have positive effect, while Japan GDP has non-significant and negative effect on Indonesian rubber export volume.

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