

ISTANBUL SABAHATTIN ZAIM UNIVERSITY
GRADUATE EDUCATION INSTITUTE
DEPARTMENT OF BUSINESS ADMINISTRATION

**ANALYSIS OF THE DETERMINANTS OF RUBBER
EXPORT VOLUME FROM INDONESIA**



MA THESIS

Balya Ibnu MULKAN

Istanbul

July-2021

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Istanbul
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DECLARATION OF SCIENTIFIC ETHICS AND ORIGINALITY

This is to certify that this MA thesis titled “Analysis of the Determinants of Rubber Export Volume From Indonesia” is my own work and I have acted according to scientific ethics and academic rules while producing it. I have collected and used all information and data according to scientific ethics and guidelines on thesis writing of Sabahattin Zaim University. I have fully referenced, in both the text and bibliography, all direct and indirect quotations and all sources I have used in this work



Balya Ibnu Mulkan

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4. All my Indonesian classmate, Syawal, Adhifa and Fadhila as my best friend during our study as MBA student at IZU
5. All to my fellow Indonesian brothers and sisters in Istanbul

Balya Ibnu MULKAN

Istanbul-2021

ABSTRACT
ANALYSIS OF THE DETERMINANTS OF RUBBER EXPORT
VOLUME FROM INDONESIA

Balya Ibnu MULKAN

Master, Business Administration

Thesis Advisor: Asst. Prof. Nicoleta Isac

July-2021, 70 Pages

This study aims to investigate the determinants factors towards rubber volume export in Indonesia. The data used in this research is annual data starting from 1980 to 2018. Where volume export (VE) is the dependent variable, and the independent variables include rubber price, exchange rate, rubber volume production, and Indonesia's inflation rate. This research employed Autoregressive Distributed Lag (ARDL) and bounds cointegration techniques. The bound test output explained the existence of a long-run equilibrium relationship between rubber volume export (VE), rubber price, exchange rate, rubber volume production, and Indonesia's inflation rate. The final outcome of this study is that the most significant determinant towards the export volume in the short-term and long-term calculations simultaneously is the variable volume production. Other determinants that were slightly affecting the volume of rubber exports are the domestic price and the exchange rate, but both of them only have a significant effect in the long-run estimate, while in the short-run, the variable has no significant effect. On the contrary, the inflation rate only has a significant effect on the short-run estimate.

Keywords: ARDL, Indonesia, volume rubber export, rubber price, exchange rate, rubber volume production and Indonesia's inflation rate

ÖZET
ENDONEZYA'DAN KAUÇUK İHRACAT HACMINİN
BELİRLEYİCİLERİNİN ANALIZI

Balya Ibnu MULKAN

Yüksek Lisans, İşletme

Tez Danışmanı: Dr. Öğretim Üyesi Nicoleta Isac

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Bu çalışma, Endonezya'da kauçuk ihracatına yönelik belirleyici faktörleri incelemeyi amaçlamaktadır. Bu araştırmada kullanılan veriler, 1980'den 2018'e kadar olan yıllık verilerdir. Burada, hacim ihracatı (VE) bağımlı değişkendir ve bağımsız değişkenler kauçuk fiyatı, döviz kuru, kauçuk hacim üretimi ve Endonezya'nın enflasyon oranını içerir. Bu araştırma, Otoregresif Dağıtılmış Gecikme (ARDL) ve sınır eşbütünleşme tekniklerini kullandı. Bağlı test çıktısı, kauçuk hacim ihracatı (VE), kauçuk fiyatı, döviz kuru, kauçuk hacim üretimi ve Endonezya'nın enflasyon oranı arasında uzun vadeli bir denge ilişkisinin varlığını açıkladı. Bu çalışmanın nihai sonucu, kısa vadeli ve uzun vadeli hesaplamalarda eş zamanlı olarak ihracat hacmine yönelik en önemli belirleyicinin değişken hacimli üretim olmasıdır. Kauçuk ihracatının hacmini bir miktar etkileyen diğer belirleyiciler yurt içi fiyat ve döviz kurudur, ancak her ikisinin de uzun vadeli tahminlerde önemli bir etkisi olurken, kısa vadede değişkenin önemli bir etkisi yoktur. Aksine, faiz oranının sadece kısa vadeli tahminde önemli bir etkisi vardır.

Anahtar Sözcükler : ARDL, Endonezya, hacimsel kauçuk ihracatı, kauçuk fiyatı, döviz kuru, kauçuk hacim üretimi ve Endonezya'nın enflasyon oranı

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LIST OF ABBREVIATIONS

ADF	: Augmented Dickey Fuller
ARDL	: Autoregressive Distributed Lag-Error Correction Model
DP	: Domestic Price
ECM	: Error Correction Model
ER	: Exchange Rate Rupiah against USD
IR	: Inflation Rate of Indonesia
KPSS	: Kwiatkowski Phillip Schmidt Shin
PP	: Phillips-Peron
VE	: Volume Rubber Export of Indonesia
VP	: Volume Rubber Production of Indones

CHAPTER I

INTRODUCTION

1.1 Background

International trade such as export and import plays an important role in a country's economy. In Indonesia, international trade has been carried out for a long time, especially by exporting commodity products. Also, Indonesia is a country that is supported by the availability of excellent and diverse natural resource potentials that make this country called a commodity economy (Hegerty, 2016: 35). Indonesia has considerable potential in agriculture, which is the second-largest sector after the manufacturing industry (Mulyani, Kusnandar, & Antriandarti, 2021: 93). One of the subsectors of agriculture that has a very important role for Indonesia is plantation. According to (Susila & Bambang, 2001: 2), the plantation has a significant contribution to macroeconomic stability, and this brings to job creation and a source of raw materials for the downstream agricultural products industry.

Indonesia possesses the advantage in producing and exporting commodity products due to the abundance of its natural resources. (Dumairy, 1996: 214) stated that plantation crops that have become common to export as commodity products are rubber, palm oil, cocoa, tea, coffee, pepper, and tobacco. Since Indonesia is a tropical country and it has good potential for rubber plants. This plant is widely spread in all regions of Indonesia except Nusa Tenggara and Sulawesi Island. It is caused among those commodity products, rubber is the most exported commodity product in Indonesia, and every year its export capacity experiences an increasing trend (Directorate General Estate of Crops, 2019: 3). Thus, it leads a positive contribution

to the Indonesia economy as a rubber exporter country (Peng, Daulika, & Nuhfil Hanani, 2020: 39)

The following is a graph of top commodity production of plantation products in Indonesia in the last eight years, since 2010-2018:

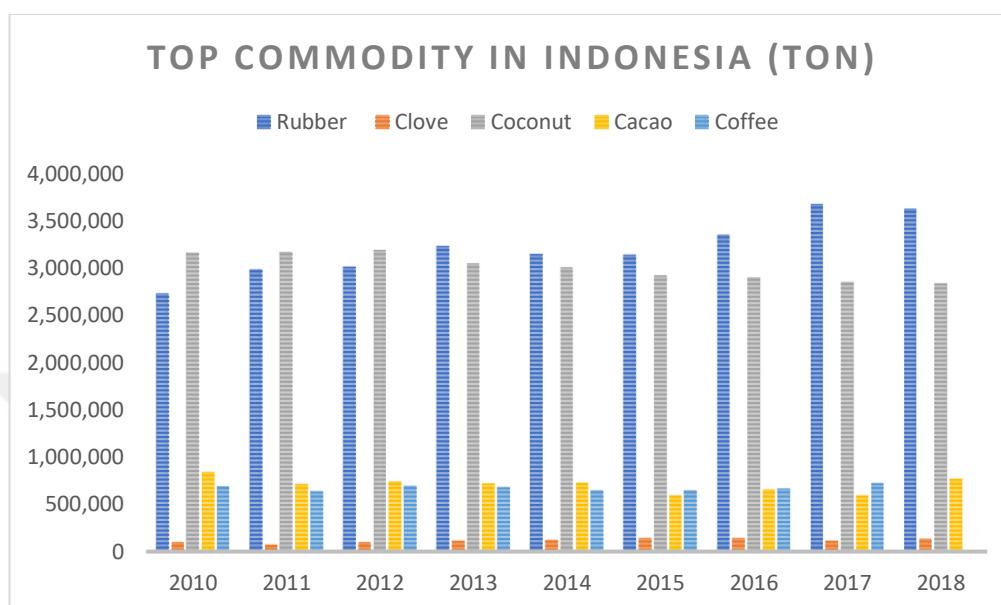


Figure 1.1: Top Commodity

Source : Direktorat Jendral of Estate Crops (processed)

Based on Figure 1.1 Top Commodity above, rubber and coconut production shows a very dominant amount compared to clove, cacao, and coffee commodities. The rubber production trend also shows a trend that is relatively rising each year when compared to coconut production.

The area of rubber in Indonesia reached 3,671,387 hectares, of which the vast majority were cultivated by the local farmers (Directorate General Estate of Crops, 2019: 7). The number of farmers and workers who work in the rubber industry is more than 1 million households and with a rubber area of around 3.5 million hectares (Yanita, Yazid, Zulkifli, & Mulyana, 2016: 478). In 2017, Indonesia's rubber exports reached 2.99 million tons with a value of US \$ 5.10 billion (Chafid, 2019: 2). Thus, for the locals, rubber is one of the important commodities as a source of income and job opportunities, and for the country, it can enhance foreign exchange and driving economic growth.

The figure 1.2 present the historic data on rubber export from 1980-2018 and show us the growth rate of Indonesia's rubber volume in the last 39 years.



Figure 1.2: Volume Indonesia Export 1980-2018

Source : Direktorat Jendral of Estate Crops (processed)

The diagram above illustrates how the trend of the volume of Indonesia's rubber export between 1980 and 2018. Overall, the trend shows a steady increase over the years, and according to (Mabrouki, 2017: 67), the increase in export is to lead the economic growth, access to gain more other countries' currencies and can be huge additional national income and even lead to a surplus of the countries financially. This upward trend also is caused by Indonesia rubber plants could produce the raw material of rubber throughout the year (Kamaludin, 2018: 86).

To analyze the volume of Indonesian natural rubber exports, the following table presents the data based on destination countries in 2012-2018:

Table 1.1: Indonesia Rubber Export

Country	2012	2013	2014	2015	2016	2017	2018	Total
USA	564,2	601,5	591,2	615,8	568,4	577,2	595,4	4113,7
Japan	384,5	419,3	401,9	420,6	413	453,1	472,8	2965,2
RRC	425,9	500,9	357,9	282,2	293,4	433,7	243,9	2537,9
India	96,8	134,3	179,8	183,6	210	247,4	287,8	1339,7
South Korea	141,9	146,7	158,4	182,8	179,3	192,4	189,5	1191
Brazil	68,5	86,6	102,8	94,4	95,5	97,9	93,9	639,6
Canada	76,5	71,3	73,6	76,2	72,8	90,1	89,4	549,9
Turkey	49,6	65,5	71,2	67,6	64,6	87,3	92,5	498,3
Germany	57,9	70,2	72,9	68,4	68	72,4	69,2	479
Belgium	38	55,4	56,8	62,5	68	50,1	46,1	376,9
Other	466,3	475,1	483,3	489,4	461,3	621,2	561,5	3558,1
Total	2370,1	2626,8	2549,8	2543,5	2494,3	2922,8	2742	

Source : Direktorat Jendral of Estate Crops (processed)

In table 1.1 above, for the last seven years, There are ten largest Indonesian rubber importing countries in the world. It can be seen that countries with the largest rubber importers are in tonnes are the United States, Japan, and China, and the least importer country is Belgium among those ten countries.

These days increasing rubber consumption in the world is greater than the increase in rubber production itself. It caused the higher demand in the international market. This increasing rubber demand in the international market can be an opportunity for Indonesia since Indonesia is one of the highest rubber exporters country in the world, along with Malaysia and Thailand in South Asia. Therefore, this study aims to figure out the determinants that influence the volume of rubber export to all countries in the world. This study also is expected to provide insight for all Indonesian and the government regarding what is the factors that most influence the volume of rubber

export in Indonesia. Thus, I believe this study will be really helpful to encourage rubber sales to over the world by knowing better what determinants could lead rubber volume export from Indonesia.

1.2 Problem Formulation

The purpose of the research is to examine whether the volume of rubber exports are influenced by several factors, including:

1. How does the price of Indonesian domestic rubber affect the volume of Indonesia's rubber exports?
2. How does the rupiah exchange rate against the currencies of the USD affect the volume of Indonesia's rubber exports?
3. How does the production volume affect the volume of Indonesia's rubber exports?
4. How does Indonesia's inflation rate affect the volume of Indonesia's rubber exports?

1.3 Research Objective

Based on the description above, the aim of this research is:

1. To analyze how Indonesia domestic rubber price affect Indonesia volume rubber export
2. To analyze how the Indonesia currency against USD affect Indonesia volume rubber export
3. To analyze how Indonesia's rubber production volume toward Indonesia volume rubber export
4. To analyze how Indonesia's inflation rate toward Indonesia volume rubber export.

1.4 Research Scope

The timeframe of this research will only focus on analyzing the data Indonesian rubber export period of 1980-2018.

1.5 Research Benefit

The benefit of this research is as follows:

1. This study can identify the most to the least factors affecting the Indonesian rubber export.

2. This study illustrates how the Indonesian rubber export market in the last 39 years so that can be used to evaluate shortages and encourage export sales.
3. The results of this study can be a reference material for further studies related to rubber exports



CHAPTER II

LITERATURE REVIEW

The literature review will be conducted in two parts, inductive study, and deductive study. The inductive study tried to review all the related studies which have previously conducted and analyzed export commodities in Indonesia, especially rubber export. While deductive study provides the existing theory that related to this research.

2.1 Inductive Study

The growth of rubber production in Indonesia is around 6.3% per year. This number is influenced by many factors. Rubber production is one of the most significant determinants of rubber export. There are some related studies about how rubber production affects the volume export. For instance, the study conducted by (Herlina, 2018: 64). her research aims to analyze the effect of rubber production, the rupiah exchange rate, and rubber prices on the volume of Indonesian rubber exports to the United States in 1980-2015. The result of this study indicated that only rubber production in the long term and in the short term has a positive and significant relationship to the volume of Indonesian rubber exports. Similarly, the research conducted by (Atika & Afifuddin S, 2015: 29) examined how Indonesia rubber export prospect to Japan. The variables used in this study were Indonesia rubber production, International rubber price, exchange rate, and Japan GDP in the period of 1990-2013. The study result was found out that rubber production and exchange rate also have a positive relationship and significant towards Indonesian rubber export to Japan.

In terms of exchange rate impact towards volume export, some studies conducted by (Klaassen, 2004: 817), the study showed that the exchange rate has a significant effect on export. Similar result the study also conducted by (Chi & Cheng, 2016: 20). The empirical result of their study is the volatility of the exchange rate has a significant impact positively on volume export. In international trade, the factor that must be considered for exporting and importing countries is the product price. But the research about the determinant Indonesian rubber export conducted by (Siburian, 2012: 1), which applied the Error Correction Model method, showed that Indonesian rubber

price has a negative relationship whether in the short term and long term. On the other hand, in India, a study examined using Ordinary Least Squares (OLS) by (Kannan, 2013: 44) showed that rubber price has a significant effect on rubber production.

A study that was discussing factors that influence the export performance conducted by (Uysal & Mohamoud, 2018: 168) was analyzing the variables that have an impact on export performance and gives the solution to improve the export performance. The empirical result of their research is labor force, industrialization, exchange rate, and foreign direct investment had a positive impact on export activity. While inflation has a negative impact on export value and GDP growth shows no impact on the export value. Also, a study conducted by (Sugiharti, Setyorani, & Esquivias, 2020: 13) explained how the impact of the exchange volatility rate has on Indonesia's primary export commodities such as rubber, pulp paper, chemicals, and ores. In their study, GARCH and ARDL model has been used to figure out if the long-run and short-run relationship exists. The result varies to different countries' destinations. Some commodities have a relationship in the long run, and some of them only have it in the short run, but overall, the result of the study showed that the exchange rate fluctuation in Indonesia is negatively affected toward the commodity volume export. .

The study about other commodities export and beef such as coffee and variety of peppers and beef export also exists. The study conducted by (Atmadji, Astuti S. A, & Suhardiman , 2018: 93) was discussing a comparison between Indonesian and Vietnam coffee export to Malaysia. The model used in their study was Error Correction Model (ECM). The result showed that the coffee export from Vietnam to Malaysia doesn't seem a serious competitor to Indonesian coffee in the Malaysian market. Another study was conducted about the Prospect of Indonesia Black and White Peppers Export (Supriana & Yanti, 2013: 4). In their research, they discussed how to analyze the black pepper and white pepper export to various destination countries. The method used in their research is Ordinary Least Square, Fixed effect Model & Random Effect Model, cross-sectional data from 2001-2012 in 8 countries. The result indicated that the best destination country for Black pepper is the USA while for White pepper is Netherland. Also (Rudatin, 2016: 65) explained the effect of imported beef price, per capita income (GDP) of Indonesian, and domestic beef price toward the volume of Indonesia's beef import. The result showed that the variable used in this research has a significant effect in the short term except for the GDP per capita of Indonesia. While in the long term,

all the variables are giving a significant effect on beef import. On the contrary, the research conducted by (Mulyani, Kusnandar, & Antriyandarti, 2021: 98) stated that Gross Domestic Product (GDP) affected the volume of Indonesian rubber export to the USA, China, and Japan.

2.2 Deductive Study

2.2.1 International Trade

The definition of international trade is the exchange of capital, goods, and services between countries which includes exports and imports. International trade occurs because each country does not meet all the production needs of its own country, so trade transactions are required. Trade between countries takes place on the basis of mutual trust and mutual benefits such as bartering and buying and selling transactions between countries. This happens because each country has advantages and disadvantages of goods and services, such as differences in natural resources, human resources, technology, economic structures, etc. Therefore, international trade is important and has benefits between countries so that it can meet the needs of a country. There are several theories explaining the emergence of international trade between countries:

2.2.1.1 Absolute Advantage

According to (Smith, 1776), trade between two countries is based on absolute advantage. If a country is more efficient than another country in producing a commodity but less efficient than another country in producing another commodity or product, both countries can exchange or trade their commodities. Thus it could cover the commodity needed (Salvatore, 1997). Each country could have broad trade benefits on product specialization by exporting goods when that country has an absolute advantage, as well as importing goods if the country does not have an absolute advantage.

2.2.1.2 Comparative Advantage

This theory is introduced by English political economists (Ricardo, 1817). This theory explains how a country could produce a particular product or service at a lower cost compared with other countries or their trading partners. Thus, a country could easily export its product at a lower price but still can make a good margin. On the other hand, the importing country get benefit what they buy with good price as well.

2.2.1.3 Heckser-Ohlin (H-O)

This theory was developed by Eli Heckscher and Bertil Ohlin. This theory states that a country will trade (export and import) with other countries because these countries have comparative advantages, advantages in technology, and superiority in production factors. This model basically states that a country will conduct export products that which is abundance and import products that are scarce.

2.2.2 Export

Exports are goods and services that are produced in a country but sold to buyers in other countries. Exporting the products is really important in the modern economy. According to G.M Meier and Baldwin, export is one of the economic sectors that plays an important role through expansion in the industrial sector. It affects the development of the modern industry. There are several factors that influence exports (Chand, 2020):

2.2.2.1 The country inflation rate

If a country has a relatively high rate of inflation, households and company will likely buy the products from other countries. The country will suffer and difficult to export their products as well due to the inflation occurs. On the contrary, inflation that can be reduced will lead to an increase in export and reduce the import.

2.2.2.2 Exchange Rate

A fall in the exchange rate will lead to a lower price and raise the import price. This causes an increase in the value of its export and lowers the amount spent on imports.

2.2.2.3 Productivity

The productivity in-country is incredibly important. A country that has lower labor costs, productive workers, and cheaper products will likely lead to the number of products being exported..

2.2.2.4 Quality

Quality has a significantly positive relationship with the export. Thus, A fall in the quality of a country's products will lead to an adverse effect on the country's balance of trade in goods and services.

2.2.2.5 Marketing

Marketing and promoting the product or service is one of the keys to having our products penetrate well to the market. Similarly, the product that a country ever imported is influenced by the foreign company's marketing strategy.

2.2.2.6 Domestic Gross Domestic Product (GDP)

GDP is the amount of added value produced by all business units in a particular country or is the total value of the final goods and services produced in a country. If income at home increase, the needs of the society may increase as well, and the impact is the household will buy more items that some of these will be imported. The increase in domestic demand might lead to an increase in imports.

2.2.2.7 Foreign Gross Domestic Product (GDP)

On the contrary with point 6, if the other country's GDP is increasing, the foreigner also will purchase more products from foreign countries. Thus, it potentially increases the export of that countries.

2.2.2.8 Trade restriction

Trade restriction is an artificial restriction on the trade of goods and/or services between two or more countries. the relaxation in trade restrictions between countries will lead to export products more efficient since the domestic firms could easily sell their product to other countries.

2.2.3 Relationship between the determinant and volume export

2.2.3.1 Price toward volume export

International price is the price of a product that applies in the world market. If the international price is higher than the domestic price, in result a country will tend to become an exporter. Countries with a high level of production are attracted to take advantage of higher prices in the world market and start selling their products to buyers in other countries. On the contrary, when the international price is lower than the domestic price, The country tends to be an importer because consumers in that country will be interested in taking advantage of lower prices offered by other countries (Mankiw, 2008).

2.2.3.2 Exchange rate toward volume export

Theoretically, the exchange rate could lead to many impacts on the economy, such as leading the market into uncertainty, profits, increase in risk, transaction cost (Juhro &

Phan, 2018: 252), and it might lead cause unstable export and import between countries. In the previous study, the exchange conducted by (Chi & Cheng, 2016: 13) stated that the exchange rate has a positive effect on the volatility of exports but on the other study (Nishimura & Hirayama, 2013: 100), it does not prove that exchange rate could lead into the volatility of the export.

2.2.3.3 Volume production toward volume export

The previous study conducted by (Wirawan & Indrajaya, 2012: 93) discussing how production volume, price, and investment affected the volume export from 1996 to 2010. The variable that give a significant impact is production volume. This study also found that the increase in production is caused by the expansion of rubber plantations. The higher the production volume of product in a country, the higher potential to do the export. Low domestic demand has made Indonesia prefer to export to other countries.

2.2.3.4 Inflation rate toward volume export

Definition of inflation since the early 1970s, economists define inflation as a continuous increase in price. The definition of inflation theory, according to (Samuelson & Nordhaus, 1995) that inflation is a condition in which an increase in price level occurs. This definition indicates a state of weakening public purchasing power followed by a decline in the intrinsic value of a country's currency. Meanwhile, according to (Brealey, Stewart C, & Marcus, 2001), Inflation is a value in which the price of goods and services is increasing. Inflation is one of the monetary events that shows a tendency to increase in prices of goods in general, which means a decline in the value of the currency.

2.2.4 Demand Theory

Demand theory indicates the relationship between consumer demand for products and services in the market (Hayes, 2020). The law of demand has an inverse or negative relationship between the price and demand for products and services. It indicates that if the price of a commodity happens to increase, then the demand of that commodity tends to decrease, considering there are no other factors influenced. It can be illustrated in the following figure 2.1 below (McKenzie, 2020) :

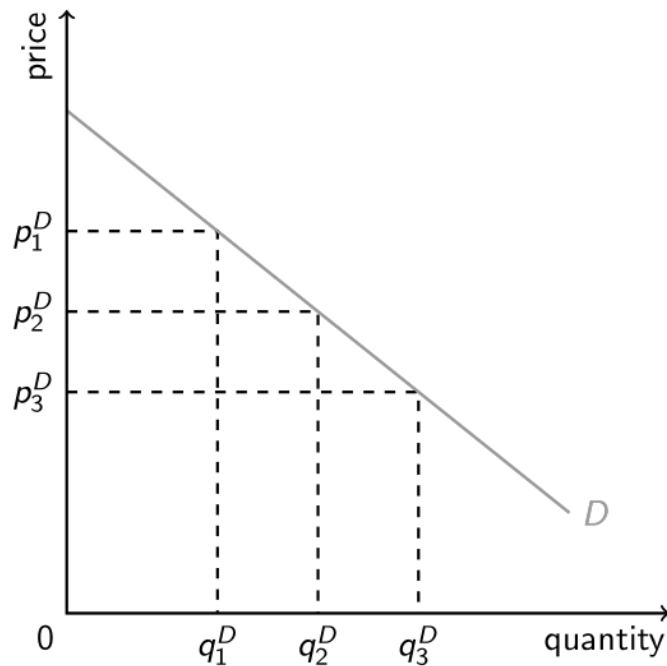


Figure 2.1: Demand Curve

Source: Inomics.com

As the product's price falls from p_1^D to p_2^D to p_3^D , the demand will increase from q_1^D to q_2^D to q_3^D . According to (Daniel, 2004) the demand in the market is influenced by five factors, which include: Price of the product, price **of substitutes and complementary goods**, **number of consumers**, **Consumers' taste and preferences**, and income.

The demand, which is expressed in a mathematical relationship with the factors that influence it, is called a demand function. The demand function connects the independent variables with the dependent variables. The equation function of demand can be seen as follows:

:

$$D_x = f(P_x, P_y, Y, T, N)$$

Whereas:

D_x : Product demand

P_x : Product price

P_y : Price of of substitutes and complementary goods

Y : Income

T : Consumers' taste and preferences

N : Number of consumer

2.2.5 Supply Theory

Supply theory is a theory that explains the number of goods that a company could produce, product, and service offered to consumers in the market. The theory of supply applies the law of supply. It explains when the price of a good or service increases, the supply quantity will also increase as well, considering there are no external factors influenced or other factors remain the same. The relationship between the price and the number of goods is shown in graph 2.2. known as the supply curve. Here is the following supply curve as follows:

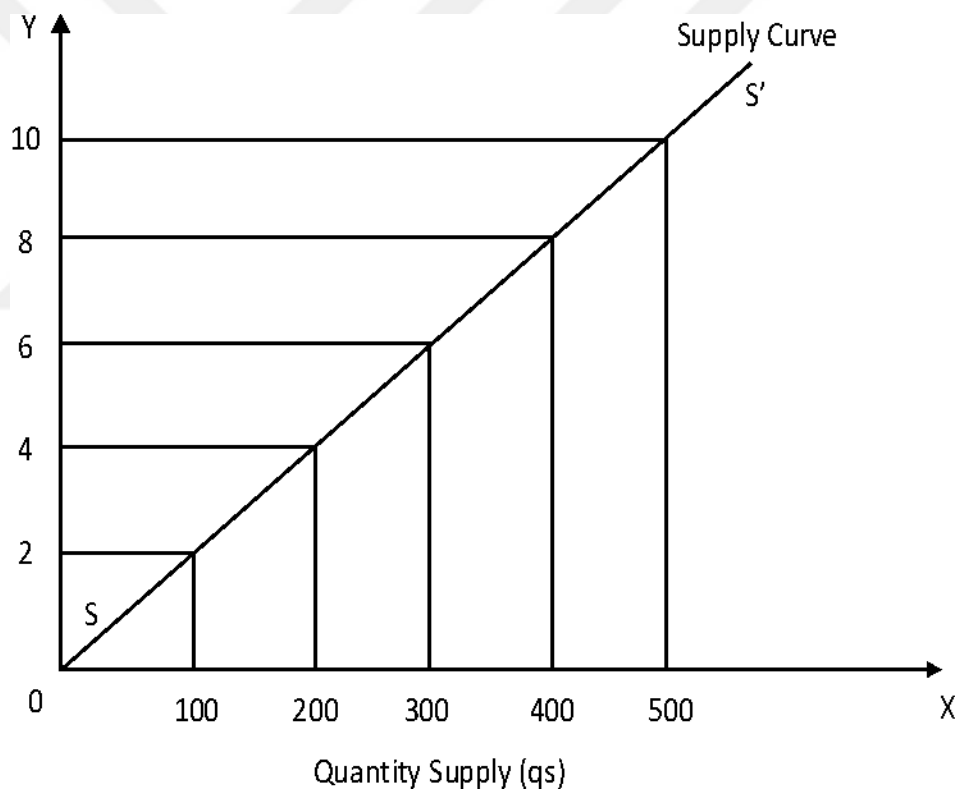


Figure 2.2: Supply Curve

Source: kullabs.com

In the supply curve above, it can be seen that if the price of goods (Y) increases, it will cause an increase in the number of goods offered (X). According to (Mankiw, 2008), one of the factors that cause a decrease or increase in supply is the rise and fall of the price of goods..

2.2.6 Production Theory

In economics, Production theory attempts to explain the principles by which business decides how much of each commodity it sells as an output or product to produce, and how much of each type of labor, raw material, fixed capital goods and etc., which it is used as inputs or factors that influence the production that it will be used (Dorfman, 2016).

According to (Dodd, 1957) The production process is a method or technique of adding the value of a good and service by utilizing these factors below:

1. Land or natural resources
2. Labor includes physical and mental effort affect production activities
3. The entrepreneur or enterprise that manages production activities and makes decisions about risks

(Nicholson, 1995) The production function is an equation that shows the optimum amount of output produced with the combination of inputs used in the production process. No matter how many commodities a business company produces, the company tries to produce them as cheaply as possible. Take into account the quality of the product and the price of the productive factors as given. The company's task is to determine the cheapest combination of production factors that can produce the desired output. This task is best understood in terms of the so-called production function, which is the equation that states the relationship between the number of factors used and the quantity of product obtained.

This relationship can be written mathematically as:

$$y = f(x_1, x_2, \dots, x_n; k_1, k_2, \dots, k_m)$$

Whereas y denotes the quantity of output. The company is presumed to use the n as the determinants factors of production, such as the paid production labor, materials needed and ect that knows as the variable that can be adjusted.

The company is also presumed to use m as the fixed factors such as electricity bills, fixed monthly salary of the labor, fixed machinery and etc., and those variables are fixed. Thus, the quantity cannot be adjusted, and it is indicated by K and so on

.

CHAPTER III

RESEARCH METHODOLOGY

This chapter is discussing the research object and the data required to complete the research. A Further explanation regarding the method of data collection, tools of data analysis, and framework will be explained.

3.1 Research Approach

This study uses secondary data types in the form of data series from the period 1980-2018. Time-series data analysis is an analysis that explains and measures various changes or developments in data during a certain period of time. This data was obtained through literature studies from various sources such as the World Bank, Bank Indonesia, and Directorate General Estate of Crops.

3.2 Operational Variable

3.2.1 Dependent Variable

The dependent variable used in this study is the volume of Indonesian rubber exports in tonnage as VE (Volume Export). The data was obtained from the annual report published by the Directorate General Estate of Crops (2019)).

3.2.2 Independent Variable

The independent variables to be tested in this study are Domestic rubber Price in Tonnage as DP (Domestic Price), Indonesia currency rate against USD ER (Exchange Rate), Production rubber volume as VP (Volume Production), and Indonesia's inflation rate as IR (Inflation Rate). The source of those data variables was obtained from various sources, such as the Directorate General Estate of Crops (2019) for the variable of Domestic Price and Volume Production. While the Exchange rate and Inflation rate were obtained from the Bank of Indonesia (www.bi.go.id) and the world bank (www.databank.worldbank.org)

3.2.2.1 Exchange Rate (ER)

The exchange rate is a comparative measure used in transactions as payment. The exchange rates used are the Rupiah exchange rate against the USD based on the exchange rates based on the selling and buying rates set by Bank Indonesia.

3.2.2.2 Domestic Price (DP)

The domestic price of rubber production is very fluctuating. Moreover, this is influenced by the volume of the USD against the local currency (Indonesia). This domestic rubber data is obtained from annual sales divided by the export volume in that period.

3.2.2.3 Volume Production (VP)

The production volume used in this study is the volume of rubber production in an annual span of time. Data is obtained from the annual report issued by the 2019 edition of the Directorate General Estate of Crops.

3.2.2.4 Inflation Rate (IR)

Inflation is the increase in the prices of goods and services in a country in the long term or continuously caused by an imbalance between the availability of goods and money. The inflation value used is the annual inflation value of Indonesia obtained from world bank data for the years 1980-2018.

3.3 Research Method

3.3.1 Stationarity Test

Stationarity tests take the null hypothesis that y_t is trend stationary. Here is the following equation of y_t :

$$y_t = TD_t + z_t$$

$$TD_t = \kappa + \delta t$$

$$z_t = \phi z_{t-1} + \varepsilon_t, \varepsilon_t \sim WN(0, \sigma^2)$$

where y_t is trend stationary, TD_t is a deterministic linear trend and z_t is an AR(1) process. If $|\phi| < 1$ then y_t is $I(0)$ about the deterministic trend TD_t . If $\phi = 1$, then $z_t =$

$z_{t-1} + \varepsilon_t = z_0 + \sum_{j=1}^p \varepsilon_j$, a stochastic trend and y_t is $I(1)$ with drift. But If y_t becomes first difference, the equation will be:

$$\Delta y_t = \delta + \Delta z_t$$

$$\Delta z_t = \phi \Delta z_{t-1} + \varepsilon_t - \varepsilon_{t-1}$$

Notice that first differencing y_t , when it is trend stationary, it generates a unit moving average root in the ARMA representation of Δz_t . That is, the ARMA representation for Δz_t is the non-invertible ARMA(1,1) model $\Delta z_t = \phi \Delta z_{t-1} + \varepsilon_t + \theta \varepsilon_{t-1}$ with $\theta = -1$. This outcome is known as over differencing. According to (Zivot & Wang, 2006: 112), this test is based on testing for a unit moving average root in Δz_t .

The stationary test aims to determine whether the data is stationary or not because it contains trend elements. In time-series data, stationarity is an important requirement that must be met. A set of data is said to be stationary if the mean and variant values of the data are constant or do not change systematically over time. Time series data often produces spurious estimates, so to avoid it, it must be transformed from non-stationary data to stationary data (Baumöhl & Lyócsa, 2009: 4). In a time-series data, stationarity test also means that the statistical properties don't change over time and it's more stable and also it's vital because it is useful analytical software, statistical test and statistical model rely on it.

Stationary testing in this research is using Augmented Dickey-Fuller (ADF), Phillips-Peron (PP), and Kwiatkowski Phillip Schmidt Shin (KPSS) test. Before running the model, non-stationarity data is commonly found in the time series data. Thus, to figure out the properties of the series, the Augmented Dickey-Fuller (ADF) and Phillips-Peron are conducted first. At the same time, the KPSS is intended to complete the unit root test of ADF and PP in terms of the stationarity of the data.

If a time series data is not stationary at level $I(0)$, then the data should be tested at the first difference $I(1)$ or second difference $I(2)$. Because this study uses the ARDL method, all variables must be stationary at the level $I(0)$ or first difference $I(1)$. If

these conditions are not met, or there are variables that are stationary in second-order (I (2)), it will cause the ARDL method to be invalidated.

3.3.1.1 The Dickey-Fuller test

The Dickey-Fuller test was developed by two statisticians, David Dickey and Wayne Fuller, in 1979 (Kwiatkowski, Phillips, Shin, & Schmidt, 1992: 160). The Dickey-Fuller test tests the null hypothesis, which states that the unit root is in the autoregressive model. The unit root test is a stationarity test of time series data. Time series data have stationarity if time changes do not cause a change in distribution form. The existence of a root unit is one of the causes of instability in the data.

The hypotheses for the ADF test is:

The null hypothesis = has a unit root.

The alternate hypothesis = trend stationary

The model of Augmented Dickey-Fuller (ADF) as follows:

$$y_t = \beta_0 D_t + \phi y_{t-1} + \sum_{j=1}^p \psi_j \Delta y_{t-j} + \varepsilon_t$$

Where D_t is a vector of deterministic terms (constant, trend), the p lagged difference terms, Δy_{t-j} , are used to estimate the error in ARMA, and the p -value is set so that the error ε_t is uncorrelated serially. The error term is also presumed to be homoscedastic. The specification of the deterministic terms is dependent on the assumed behavior of y_t under the H_1 of trend stationarity as described in the previous part. Under the H_0 , y_t is $I(1)$, which is implying that $\phi = 1$ (Zivot & Wang, 2006).

An alternative equation of the ADF test regression is:

$$\Delta y_t = \beta_0 D_t + \pi y_{t-1} + \sum_{j=1}^p \psi_j \Delta y_{t-j} + \varepsilon_t$$

where $\pi = \phi - 1$. Under the H_0 or null hypothesis, Δy_t is $I(0)$ that implies that $\pi = 0$

3.3.1.2 Philip-Perron (PP)

One of the popular unit root testing in time series data was developed by Phillips & Perron (1988: 338). This test has some differences from the ADF test, especially in

how they work with serial correlation and heteroskedasticity in the errors of data. Therefore, the regression formula of Phillip-Peron (PP) as follows:

$$\Delta y_t = \beta_0 D_t + \pi y_{t-1} + u_t$$

where Δ is the first difference, while u_t is $I(0)$ and may be heteroskedastic in the data.

The hypotheses for the PP test is:

The null hypothesis = has a unit root

The alternate hypothesis = trend stationary

3.3.1.3 Kwiatkowski Phillips Schmidt Shin (KPSS)

The Kwiatkowski Phillips Schmidt Shin (KPSS) aims to figure out if a time series is stationary around a mean or linear trend or is non-stationary due to a unit root. The H_0 hypothesis assumes stationarity around a mean or a linear trend, while the H_1 is the existence of a unit root on the data. The equation model is as follows:

$$y_t = \beta_0 D_t + \mu_t + u_t$$

$$\mu_t = \mu_{t-1} + \varepsilon_t, \varepsilon_t \sim WN(0, \sigma^2 \varepsilon)$$

Whereas D_t is deterministic components (constant or constant time trend), u_t is order $I(1)$ or $I(0)$ and might be heteroskedastic. A pure random walk is signed by μ_t with innovation variance $\sigma^2 \varepsilon$. The H_0 or null hypothesis that y_t is $I(0)$ is formulated as $H_0 : \sigma^2 \varepsilon = 0$, which is implying that μ_t is a constant. **Different from the ADF and PP test, the hypotheses for the PP test is:**

The null hypothesis = data is stationary

The alternate hypothesis = data is not stationary

After all variables in this study are tested using those 3 unit root tests and got the stationarity data at levels or at the first difference, the further step is conducting the cointegration bounds test and ARDL-ECM method.

3.3.2 ARDL-ECM Method

The model used in this study is the Autoregressive Distributed Lag Error Correction Model (ARDL-ECM) approach. The variable used in this research is time-series data. The research model is shown in equation (3.1)

In this equation, the variables used are volume of Indonesian rubber exports as VE (Volume Export), Domestic rubber Price in Tonnage as DP (Domestic Price), Indonesia currency rate against USD ER (Exchange Rate), Production rubber volume as VP (Volume Production) and Indonesia's inflation rate as IR (Inflation Rate).

$$VE = f(DP, ER, VP, IR) \dots (3.1)$$

Furthermore, the linear equation is converted into a natural logarithm model. This is because natural logarithm equations provide more precise and more efficient results when compared to simple linear models (Shahbaz, 2010). The benefit of transforming data times series into a natural algorithm is also to control the skewness of the data and solve the problem in heteroskedasticity, the value will be smaller and easier to interpret in many analytical tools, and by using the natural algorithm, the data form is more effective relationship non-linear while it preserves the correct model (linear model) (Benoit, 2011). The equation is as follows:

$$LVE = b_0 + b_1 LDP_t + b_2 LER_t + b_3 LVP_t + b_4 LIR_t + \varepsilon_t \dots (3.2)$$

While b_1 , b_2 , b_3 , b_4 are long-run elasticity volume export towards domestic price, Exchange Rate, volume production, and annual inflation rate respectively. ε_t is the error term, and b_0 is the intercept.

Autoregressive Distributed Lag (ARDL) approach was introduced by (Pasaran, Shin, & Smith, 2001: 291) to test for the presence of cointegration between variables and also to estimate the long-term and short-term coefficients of these variables. The parameters in the estimation of the short-term relationship will be consistent, and the

coefficient on the estimation of the long-term relationship will be very consistent over the small sample size. In addition, ARDL can correct residual and endogenous variable problems simultaneously. In the test results obtained from the bounds cointegration test, if there is cointegration, then the equation will be estimated as follows:

$$\Delta LVE = a_{02} + \sum_{i=1}^P a_1 \Delta LVE_{t-i} + \sum_{i=1}^{P1} a_2 \Delta LDP_{t-i} + \sum_{i=1}^{P2} a_3 \Delta LER_{t-i} + \sum_{i=1}^{P3} a_4 \Delta LVP_{t-i} + \sum_{i=1}^{P4} a_5 \Delta LIR_{t-i} + \phi ect + \varepsilon_t \dots 3.4$$

Whereas :

VE : Volume Export

DP : Domestic Price in Tonnage (USD)

ER : Exchange of rate

VP : Indonesia Rubber Production Volume

IR : Indonesia Inflation Rate (annual)

ϕ : Error term coefficient (ect-1)

ε_t : disturbance term

The method of analysis is the approach used to analyze the effect of each independent variable towards the dependent variable. Referring to the time series model in Equation (3.2), in this study, there are several steps of analysis that must be conducted, those are stationarity test, cointegration bound testing, and ARDL-ECM (Autoregressive Distributed Lag-Error Correction Model) method.

The flow of selecting the ARDL method as a method of data analysis can be seen in Figure 3.1 (Arshed, 2014)

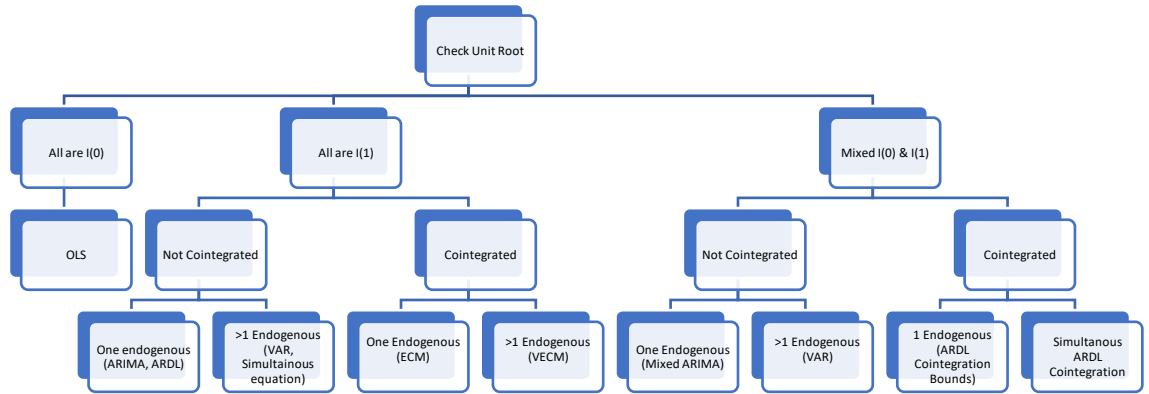


Figure 3.1: Research Flowchart

Source: Tentative Time Series Model Selection Plan (Arshed, 2014)

3.3.3 Bounds Cointegration Test

Cointegration bound-testing is a test to find cointegration between variables in the model. A cointegration test is the first step before conducting the ARDL procedure. The ARDL technique can be applied if the underlying regressors are all at the level $I(0)$ or at the first difference $I(1)$ or mutually cointegrated (Pesaran, & Pesaran, 1997). However, according to (Ouattara, 2004) the result of the bound cointegration test cannot be applicable to the ARDL if the regressors are all at the order $I(2)$ or higher. The equation bound testing for this study is:

$$\Delta LVE = a_{01} + \sum_{i=1}^P a_{1i} \Delta LVE_{t-i} + \sum_{i=1}^{P1} a_{2i} \Delta LDP_{t-i} + \sum_{i=1}^{P2} a_{3i} \Delta LER_{t-i} + \sum_{i=1}^{P3} a_{4i} \Delta LVP_{t-i} + \sum_{i=1}^{P4} a_{5i} \Delta LIR_{t-i} + b_1 LVE_{t-1} + b_2 LDP_{t-1} + b_3 LER_{t-1} + b_4 LVP_{t-1} + b_5 LIR_{t-1} + \varepsilon_t \dots (3.3)$$

In the equation (3.3) above α_0 is the intercept term, b_1, b_2, b_3, b_4 and b_5 are for long-run coefficient while $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ and α_5 are for the short-run coefficient, and Δ is the difference operator.

The next step is to compare the F-statistic value with the lower critical bound and upper critical bound values. (Narayan, 2005: 1981) If the value of the F-statistic is greater than the critical upper bound $I(1)$, then there is cointegration between the variables, which means H_0 is rejected, and it has a long-run relationship. However, if F-statistic is less than the $I(0)$ bound critical value, then H_0 cannot be rejected and identifies that there is no long-run relationship. However, the decision is inconclusive if the value of F-statistic falls in between at level $I(0)$ and $I(1)$ bounds value.



CHAPTER IV

RESEARCH FINDINGS

4.1 Descriptive Statistics

The data carried out in this paper uses the secondary data time series from 1980-2018. This study aims to figure out how volume rubber export is influenced by some determinants such as rubber price, exchange rate, production rubber volume, and Indonesia's inflation rate. The data collection method used in the study were sourced from very reliable and accurate websites, such as Direktorat Jendral of Estate Crops, Word Bank, and Bank of Indonesia.

Descriptive statistics provide an overview of data, and it shows the mean, standard deviation, variance, maximum, minimum, sum, range, kurtosis, and skewness (slope distribution) of each variable. The descriptive statistics are shown in table 4.1 below:

Table 4.1: Data Descriptive

Variable	LVE	LDP	LER	LVP	LIR
Mean	14,2626879	6,81099399	8,45499975	14,3897756	2,21822911
Median	14,1894038	6,70553475	8,99031695	14,2882349	2,17099912
Standard Deviation	0,39281998	0,76722257	0,87455065	0,43297756	0,6777444
Kurtosis	-1,2880532	-0,2810351	-1,7844085	-1,2943112	1,45621235
Skewness	0,09212727	-0,0387187	-0,2167922	0,21731464	0,43215343
Minimum	13,5893725	5,2454004	7,02553831	13,7092763	0,81260481
Maximum	14,9114222	8,4342363	9,57038962	15,1185396	4,32109719

Source: Personal Collection

On the other side, in the concept of Kurtosis, Kurtosis is a measure that shows how narrow a data is in its distribution or used to describe the flatness or peakedness of a

distribution. The value of kurtosis = 3, meaning that the data has a normal distribution, The value of kurtosis > 3, meaning that the data has a leptokurtic distribution (more pointed), The value of Kurtosis < 3 means that the data has a platykurtic distribution (distributed well). It can be concluded that all the data are platykurtic since all the data are less than 3.

The data is also displayed in the graph for each variable in order to depict the trend of the data used. Below is the following graph of Volume Export (VE) Domestic Price (DP), Exchange Rate (ER), Volume Production (VP), and Inflation Rate (IR).

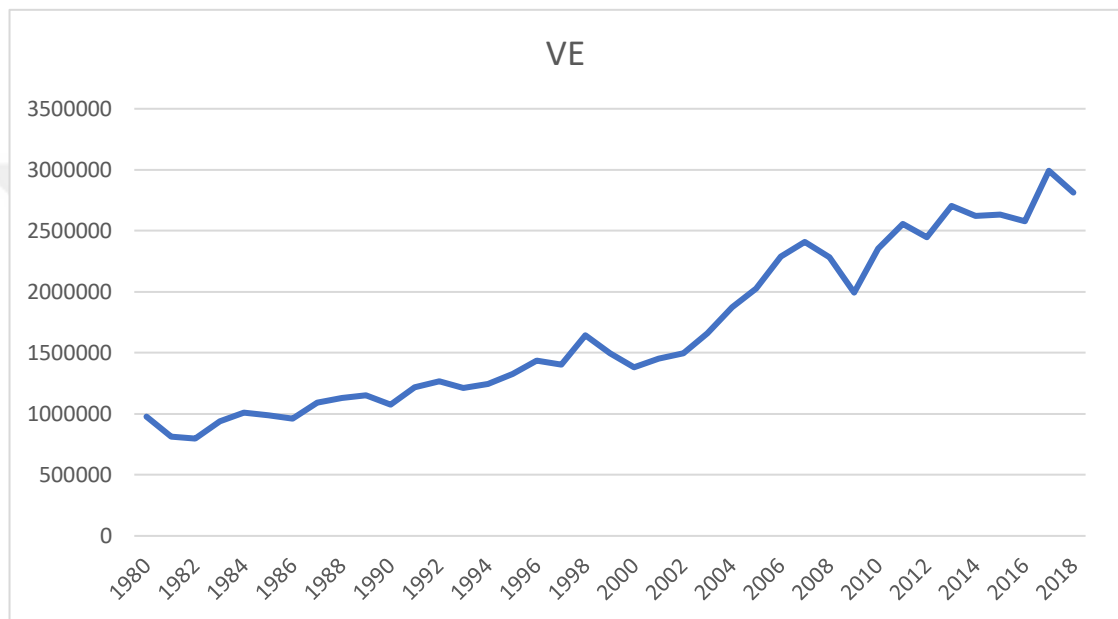


Figure 4.1: Volume Export

Source : Direktorat Jendral of Estate Crops (processed)

The figure above illustrates how volume rubber export as the dependent variable change over a period of 39 years from 1980 to 2018. Overall, the Volume export figure depicts an uptrend even though there are some fluctuations through those years. The total volume export touched an all-time high in 2017, while in 2017- 2008, the volume of volume export plummeted drastically; that decrease in volume export was due to the global financial crisis in 2008.

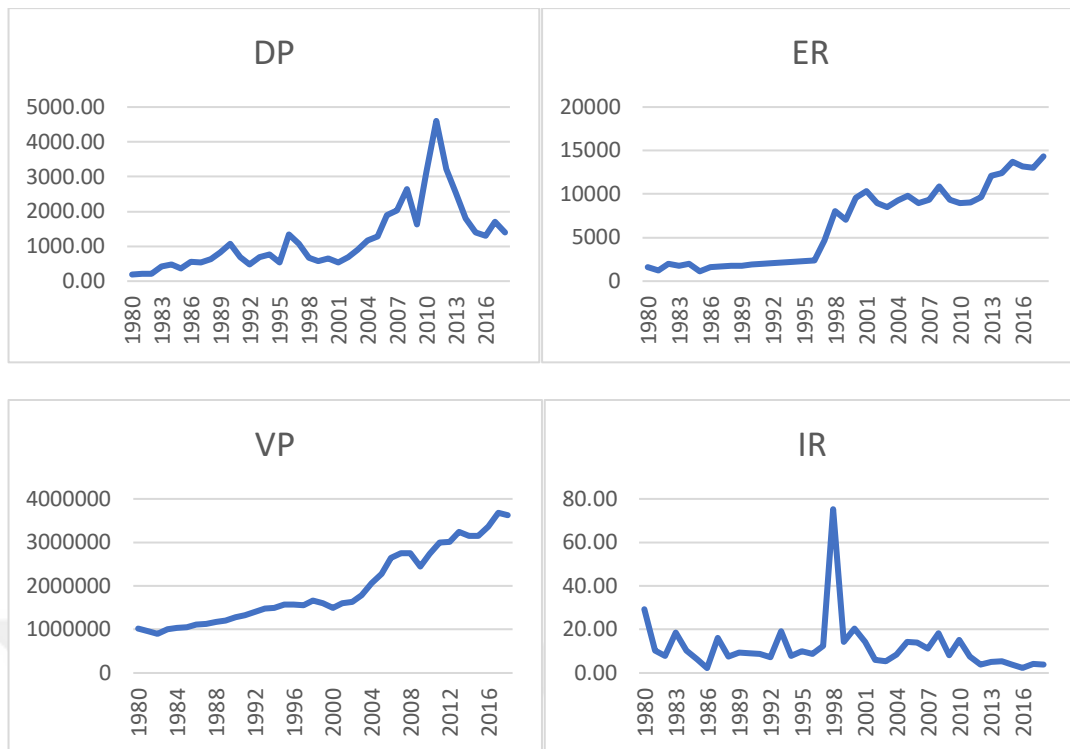


Figure 4.2: Independent Variables

Source: Processed from Direktorat Jendral of Estate Crops, World bank and Bank of Indonesia

The other variables are independent variables. Those are domestic price as DP, exchange rate as ER, volume production as VP, and inflation rate as IR.

The domestic price (DP) shows the upper trend since the beginning. However, whenever a global crisis occurs, the price is unstable (the global crisis happened twice, in 1998 and 2008). Since both crises are affecting globally, it is also affected the exchange rate of the Indonesian currency. It is also massively affected to the graph of Inflation rate (IR), the inflation of Indonesia throughout 39 period of time is relatively stable, due to global monetary crisis the graph in 1998 was exceptionally surging.

As for two other variables, volume production (VP) and exchange rate (ER), both are showing increase steadily over time and relative stability over the global crisis. As for volume production, it almost has no effect on rubber production, which means it grows well. But, for the exchange rate, this steady increase means that Indonesia's currency is getting weaker towards the US dollar.

4.2 Correlation properties of time series

The correlation coefficient is to measure the degree of relationship or association between two variables. The value of the correlation coefficient is always in the range of -1 to 1. The higher or, the lower of the value indicates how strong the relationship between both variables.

Table 4.2: Correlation Properties

Times Series	LVE	LDP	LER	LVP	LIR
LVE	1,0000				
LDP	0,8695	1,0000			
LER	0,9033	0,7120	1,0000		
LVP	0,9924	0,8653	0,8852	1,0000	
LIR	-0,2787	-0,2570	-0,1514	-0,3335	1,0000

Source: Personal collection

From table 4.2 above, it can be seen that almost all the correlation coefficients among the variable relatively strong and positively correlated. The dependent variable (LVE) is positively correlated with all the independent variables except LIR, and the highest positive correlation is with LVP, 0,99. On the other hand, the dependent variable, which is highly correlated with another independent variable, is LER and LVP. While the lowest among them is LVP and LIR, it means both variables show an inverse correlation between them.

4.3 Research Result

4.2.1 The Tests for Stationarity

These tests aim to determine whether the data is stationary or not. If the data being tested is not stationary, it is followed by a test of the degree of integration until the data is stationary. The unit root test was conducted using:

1. Augmented Dickey-Fuller (ADF)
2. Phillips-Peron
3. Kwiatkowski Phillip Schmidt Shin (KPSS)

Those tests aim to determine the stationarity of Domestic data Price, Indonesia Exchange Rate, Volume Production, and Indonesia's inflation rate from 1980 to 2018, 39 years.

In time-series data, the non-stationary data commonly happens. Thus, before jumping to the next stage, which is the bound cointegration test, the data must be tested by using a traditional unit test to figure out the data stationarity, Augmented Dickey-Fuller (ADF) and Phillip Perron (PP), and The Kwiatkowski Phillip Schmidt Shin (KPSS) will be used in this study.

The following table 4.4 below are the result of stationary test ADF, PP and KPSS:

Table 4.3: Unit Root Test

Time Series	ADF at Levels			First Difference			Conclusion
	Constant	Linear Trend	None	Constant	Linear Trend	None	
LVE	-0,3706	- 4,4008***	1,9686	-7,0721***		-6,1139***	I(1)
LDP	-2,1697	-2,5726	0,7023	-6,6426***	- 6,7312***	-6,5644***	I(1)
LER	-0,7148	-2,1215	1,5971	-7,1270***	- 7,0394***	-6,5151***	I(1)
LVP	0,2584	-2,8145	3,4875	-5,5114***	- 5,4021***	-4,2610***	I(1)
LIR	- 4,1457***	- 4,3357***	-0,9882			-9,5649***	I(0)
	PP at levels			PP at first difference			
LVE	0,2205	- 4,4769***	4,6126	- 12,0586***		-6,1145***	I(1)

LDP	-2,1525	-2,5072	0,7023	-6,6426***	-	6,7457***	-6,5682***	I(1)
LER	-0,6587	-2,0966	1,8043	-7,1270***	-	7,0394***	-6,4939***	I(1)
LVP	0,2112	-2,9679	3,3364	-5,5016***	-	5,3873***	-4,3330***	I(1)
LIR	-	-	-1,3748				-	I(0)
	KPSS at levels			KPSS at first difference				
LVE	0,7485	0,0961*		0,2685*	0,2386			I(1)
LDP	0,6393***	0,0668*		0,1146*	0,0517*			I(0)
LER	0,6963***	0,1063*		0,0931*	0,0937*			I(0)
LVP	0,7437	0,1122*		0,1071*	0,0543*			I(1)
LIR	0,2946*	0,1508**		0,1708*	0,1664**			I(0)

Note: ‘*’, ‘**’ and ‘***’ indicate the rejection of null hypothesis of unit root at 10%, 5% and 1% significance level, respectively

Source: Personal collection

In table 4.3 above, it illustrates the outcome of the ADF, PP, and KPSS test, indicating whether the data are stationary or non-stationary at levels or at first difference. It can be seen that some variables are integrated of order I(0), and some variables are at the order I(1). Thus, based on the outcome from the stationarity test, the data series is an amalgamation of I(0) and I(1). This indicates the approach that will carry out in this study is ARDL-ECM analysis.

4.2.2 Bounds Cointegration Test

After the unit root test is properly conducted and got the outcome, the next step is to conduct the bounds cointegration test. This test aims to figure out whether or not there

is a long-run relationship in the unrestricted error correction model. The outcome of the test can be seen in the following table 4.4 below:

Table 4.4: Bound Cointegration Test

Dependent Variable : LVE	F-Statistics	Bound critical value		Outcome
		I(0)	I(1)	
LVE = f(LDP, LER, LVP,				
LIR)	6.29	2.86**	3.52**	Cointegration
	6.29	2.45***	4.01***	Cointegration

Note: I(0) and I(1) are F bounds critical values at a 5%** & 10%*** significance level computed by Pesaran et al. (2001) for Case III-unrestricted constant and no trend. K = 4

Source: Personal collection

Where:

K = The total number of independent variable in the model

I(0) = lower bound value

I(1) = upper bound value

As seen in Table 4.4, the value of F-statistics is far above the upper bound critical value at 5% and 10% significance level. That can be concluded that the null hypothesis (H0) is rejected. Therefore, volume export (VE) is related strongly to dependent variables of LDP, LER, LVP, and LIR in the long-run relationship. The outcome generated by the bound test with equation (3.3) proceeds the long-run coefficient. Thus, it concludes that the ARDL long-run estimates can be conducted.

4.2.3 ARDL Long-run Estimates; Dependent variable: LVE

The result for the ARDL long-run tests is shown in Table 4.5 below. Based the table 4.5, overall, all the variables have a significant impact on the volume export (LVE) as the dependent variable except inflation rate (LIR).

Table 4.5: ARDL Long-run Estimates

Variable	Coefficient	Standard Error	t-stat	P values
LDP	0.055777	0.024131	2.311379	0.0284
LER	0.069209	0.022041	3.139933	0.0040
LVP	0.687765	0.070559	9.747437	0.0000
LIR	0.006405	0.016200	0.395338	0.6956

Source: Personal collection

$$EC = LVE - (0.0558*LDP + 0.0692*LER + 0.6878*LVP + 0.0064*LIR)$$

a. The influence of domestic price

Based on the statistical testing on the table above, the domestic price has a positive influence at a 5% significant level in the long-run estimates with the coefficient value is 0.055. It concludes that if the change in the domestic price is increasing by a percentage, it will lead to an increase in the volume export by 0.055%.

b. The influence of exchange rate

Based on the statistical testing on the table above, the exchange rate has a positive influence at a 1% significant level in the long-run estimates, with the coefficient value is 0.069. It indicates that if the change in the exchange rate is increasing by a percentage, it will lead to an increase in the volume export by 0.069%.

c. The influence of volume production

Based on the statistical testing on the table above, volume production has a positive influence at a 1% significance level in the long-run estimates with the highest coefficient value among other determinants, and the magnitude is 0.687. It indicates that if the change in the volume production is increasing by a percentage, it will lead to an increase in the volume export by 0.687%.

d. The influence of inflation rate

B Based on the statistical testing on the table above, the inflation rate has a positive influence, but it turns out that the inflation rate is an insignificant impact on the long-

run estimates. It is shown by the value of Prob value is 0.69, or it indicates that H_0 is not rejected.

It can be summarized that in the long-run estimates, the most important variable that affecting the volume export is volume production (LVP). The other two variables that have a significant and positive influence are exchange rate (LER) and domestic price (LDP). Meanwhile, the inflation rate (LIR) is the only variable that has an insignificant impact on volume export in the long run.

4.2.4 The Unrestricted Error Correction Model

In the subchapter 4.4.2 Bound Cointegration Test, the result shown that volume export (LVE) and all the determinants in this study are cointegration exists, the unrestricted error correction specification is being estimated, short-run and error correction term (ECT) are shown in table 4.6.

Table 4.6: Unrestricted Error Correction Model

Unrestricted error correction form for ARDL (1,1,1,1,1) model				
Dependent variable ΔLVE				
Variable	Coefficient	Standard Error	t-stat	P values
C	3.089754	0.515711	5.991251	0.0000
Δ (LDP)	0.012898	0.019396	0.664990	0.5115
Δ (LER)	0.022627	0.030724	0.736452	0.4676
Δ (LVP)	0.942930	0.120087	7.852032	0.0000
Δ (LIR)	0.019907	0.009588	2.076260	0.0472
Ect-1	-0.913683	0.152283	-5.999903	0.0000
R-squared	0.844628	Mean dependent var	0.027843	
Adjusted R-squared	0.820351	S.D. dependent var	0.086663	

S.E. of regression	0.036732	Akaike info criterion	-3.626402
Sum squared resid	0.043175	Schwarz criterion	-3.367836
Log likelihood	74.90164	Hannan-Quinn crit.	-3.534406
F-statistic	34.79145	Durbin-Watson stat	2.099947
Prob(F-statistic)	0.000000		

Source: Personal collection

The details of each determinant will be explained more detail in the following paragraph:

a. The influence in the domestic price

Based on the result of error correction model testing, the value of the coefficient is 0.0128, but the magnitude of the prob value is 0.5515. Thus, it is concluded that domestic price in the short run estimates does not have a significant effect on volume export.

b. The influence in the exchange rate

Based on the result of error correction model testing, the value of the coefficient is 0.0226, but the magnitude of the prob value is 0.4676. Thus, it is concluded that the exchange rate in the short-run estimates does not have a significant effect on volume export.

c. The influence in the volume production

Based on the result of error correction model testing, the value of coefficient shows 0.9429, and the magnitude of prob value is 0.0000 or significance at 1% level. Thus, it indicates a percentage increase in volume production results in a 0.94% increase in Indonesian volume rubber export.

d. The influence in the inflation rate

Based on the result of error correction model testing, the value of coefficient shows 0.0199, and the magnitude of prob value is 0.0472 or significance at 5% level. Thus, it indicates that the inflation rate in the short-run estimates has a significant effect on volume export.

According to the explanation above, it can be summarized that all the determinants show positive coefficients but only volume production and an inflation rate that statistically significant at 1% and 5% level respectively. Thus, in the short run, only volume production and an inflation rate that affect the volume export.

Based on the finding, the value of ect is -0.913 or 91%, and the prob value is statistically significant at level 1%. It could be interpreted that this error correction model in this study is valid for the short-term estimate.

The value of R^2 shows the magnitude of the independent variables affecting the dependent variable. The short-term estimation results in this study state that the value of R^2 is 0.844 means that 84.4% of the independent variables, domestic price, exchange rate, volume production, and inflation rate in the model are able to explain the dependent variable. While the remaining 15.6% is explained by variables outside the model.

CHAPTER V

CONCLUSION AND RECOMMENDATION

In this section, the conclusion and the recommendation based on the findings from the previous chapter are given.

5.1 Conclusion

Overall, it can be concluded that among those dependent variables in this study, there are some variables that have the most significant and the least significant influence on the volume of rubber export.

In this study, volume production is the most significant influence on volume rubber export in both short term and long term estimates. The study conducted by Wirawan & Indrajaya (2012) also stated that the increase in Indonesian rubber export was caused by expanding the area for the rubber plantation that could lead an increase in volume production. Therefore, in order to increase the volume export, the rubber production capacity must be increased as well. We expected this outcome theoretically, an increase in volume production should lead to an increase in the volume export of a product.

The other determinants those positively influencing the volume export also in the long term are the exchange rate and domestic price. The other study conducted by (Chi & Cheng, 2016: 13) also stated that the exchange rate has a positive effect on the volatility of exports. While domestic price, theoretically according to (Mankiw, 2008) has a negative relationship toward the volume export but in another study conducted by (Mulyani, Kusnandar, & Antriyandarti, 2021) which specifically discussed volume rubber export to China, stated that domestic price is also positively correlated towards volume export. In term of the proportion, both determinants are only slightly affecting the volume export. Thus, this small portion could be caused by external factors such as inflation, high demand rubber international in the market, international price and etc. We believe this might need further research.

Lastly, the least determinant that positively affecting the volume of rubber export is the inflation rate. In this study, the volatility of the inflation rate only affects the volume of export in the short term. In general, high inflation will likely lead a country to import the product, and it was also supported by the study conducted (Uysal & Mohamoud, 2018), that inflation has a negative impact on export value. Although in this study, the inflation rate has a positive relationship, the portion is very small and only in the short term estimates. Indonesia's inflation uptrend is due to the Asian financial crisis in 1997-1998, which made inflation in Indonesia and other Asian countries increase very significantly, and this made Indonesia's average inflation is still quite high and seems showing an uptrend for the last 39 years.

5.2 Recommendation

Thus, based on the conclusion generated above, since volume production is positively affecting and the most contribution determinant on the increase in Indonesian volume rubber export, the suggestion that can be given by the researcher to optimize the volume of rubber export is by increasing the production capacity. The solution could be expanding the land area or establish more rubber industry, but this case must be investigated thoroughly to avoid the negative causes to the environment. We believe this effort needs to be cooperated and integrated with both farmers and the government. As for the other 3 determinants (exchange rate, inflation rate and domestic price), since those are only slightly positively affecting the volume export, the research concludes to exclude them from the considered factors in this research.

Therefore, I believe this research is far from perfect and might still need some modifications and improvements. Such as since the data used in this study is annual data, quarterly data might generate a different outcome, this research also used all countries destination data of rubber volume export for the last 39 years. The study conducted by (Mulyani, Kusnandar, & Antriandarti, 2021) which the data they used only focus to certain destination rubber export countries such as USA, China, Japan as the highest rubber importing countries showed slightly different outcome with this research. Thus, the next researcher might consider those data to be used in the further research with the similar study.

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ATTACHMENT

Data of Volume Export (VE), Domestic Price USD in Tonnage (DP), Exchange Rate (ER), Volume Production (VP) & Inflation Rate (IR)

Year	VE	DP	ER	VP	IR
1980	976131	189,69	1580	1020000	29,15%
1981	812800	204,82	1250	963238	10,15%
1982	797608	202,61	1980	899214	7,95%
1983	938032	417,23	1790	1006980	18,61%
1984	1009558	471,57	1987	1032598	10,42%
1985	987771	362,68	1125	1054966	6,19%
1986	958692	558,77	1641	1113133	2,25%
1987	1092525	526,81	1650	1130351	16,00%
1988	1132132	634,24	1731	1173298	7,63%
1989	1151409	816,91	1797	1209037	9,49%
1990	1077331	1081,67	1901	1275295	9,09%
1991	1220020	685,11	1992	1328172	8,77%
1992	1267605	475,03	2062	1398448	7,29%
1993	1214568	694,46	2110	1475438	19,15%
1994	1244950	761,79	2200	1499424	7,78%
1995	1324295	535,00	2308	1573303	9,88%
1996	1434285	1337,18	2383	1574026	8,68%
1997	1404010	1063,68	4650	1552585	12,57%
1998	1641186	671,13	8025	1661898	75,27%
1999	1494543	568,20	7085	1604359	14,16%
2000	1379612	644,11	9595	1501428	20,45%
2001	1453382	540,94	10348	1607461	14,30%

Year	VE	DP	ER	VP	IR
2002	1495987	693,56	8985	1630359	5,90%
2003	1662210	899,29	8507	1792348	5,49%
2004	1874261	1163,14	9244	2065817	8,55%
2005	2024593	1275,75	9781	2270891	14,33%
2006	2286897	1889,69	8975	2637231	14,09%
2007	2407972	2021,91	9373	2755172	11,26%
2008	2283158	2638,15	10895	2754356	18,15%
2009	1991533	1627,66	9353	2440347	8,27%
2010	2351915	3115,17	8946	2734854	15,26%
2011	2556233	4601,95	9023	2990184	7,47%
2012	2444503	3216,17	9622	3012254	3,75%
2013	2701445	2556,76	12128	3237433	4,97%
2014	2623471	1807,37	12378	3153186	5,44%
2015	2630313	1406,32	13726	3145398	3,98%
2016	2578791	1306,95	13160	3357951	2,44%
2017	2991909	1704,90	13041	3680428	4,29%
2018	2811954	1404,44	14334	3630268	3,82%

Whereas:

VE : Volume Indonesian Rubber Export

DP : Domestic Price in Tonnage (USD)

ER : Indonesia Currency Rate to USD

VP : Indonesia Rubber Production Volume

IR : Indonesia Inflation Rate (annual)

Logarithm Natural

Year	VE	DP	ER	VP	IR
1980	13,7913521	5,2454004	7,36518013	13,8353132	3,37230053
1981	13,6082404	5,32212136	7,13089883	13,7780558	2,31754365
1982	13,5893725	5,31126836	7,59085212	13,7092763	2,07323532
1983	13,7515393	6,03362973	7,4899709	13,8224663	2,92384414
1984	13,8250232	6,15606489	7,59438124	13,8475885	2,34390264
1985	13,8032062	5,89350754	7,02553831	13,8690191	1,82315542
1986	13,7733251	6,32574666	7,40306109	13,9226891	0,81260481
1987	13,9040021	6,26684326	7,40853057	13,9380388	2,77282744
1988	13,9396131	6,45242966	7,45645456	13,9753291	2,03197106
1989	13,956497	6,70553475	7,49387389	14,0053347	2,24971477
1990	13,8899972	6,98626518	7,55013534	14,0586881	2,20760936
1991	14,0143778	6,52958072	7,59689444	14,0993141	2,17099912
1992	14,0526399	6,16337397	7,63143166	14,1508736	1,98634661
1993	14,009899	6,54312995	7,65444323	14,2044655	2,95243743
1994	14,0346059	6,6356715	7,69621264	14,2205916	2,05111575
1995	14,0963908	6,28226699	7,74413663	14,2686878	2,29071947
1996	14,176177	7,19832069	7,77611548	14,2691472	2,16061937
1997	14,154843	6,96948896	8,4446225	14,2554318	2,5314228
1998	14,3109297	6,50896635	8,99031695	14,3234709	4,32109719
1999	14,217331	6,34247426	8,86573515	14,2882349	2,65050583
2000	14,1373129	6,46787077	9,16899741	14,2219272	3,01785867
2001	14,1894038	6,29331414	9,24454854	14,2901665	2,65996019
2002	14,2182967	6,54184282	9,1033118	14,3043108	1,77428297
2003	14,3236586	6,80160701	9,04864463	14,3990371	1,70245984
2004	14,443725	7,05887901	9,13172997	14,5410363	2,14601631

2005	14,5208793	7,15128971	9,18819701	14,6356828	2,66248015
2006	14,6427064	7,54416775	9,10219821	14,7852401	2,6452822
2007	14,6942955	7,61179734	9,14558849	14,8289904	2,4211305
2008	14,6410701	7,87783481	9,29605925	14,8286942	2,89865679
2009	14,5044153	7,39489726	9,14345243	14,7076508	2,11320895
2010	14,6707404	8,04403763	9,09896178	14,8215886	2,72551611
2011	14,7540452	8,4342363	9,10753215	14,9108455	2,01035175
2012	14,7093524	8,07594773	9,17180742	14,9181992	1,32278971
2013	14,8092974	7,8464969	9,40327211	14,9902913	1,60261267
2014	14,7800088	7,49962618	9,42367598	14,9639239	1,69436253
2015	14,7826134	7,24872981	9,52704712	14,961451	1,38134287
2016	14,7628312	7,17544852	9,4849372	15,0268415	0,89155696
2017	14,9114222	7,44126455	9,47585352	15,1185396	1,45691078
2018	14,8493902	7,24739224	9,57038962	15,104817	1,34018262

ADF Unit Root Test at Level (Log Natural)

Null Hypothesis: Unit root (individual unit root process)
 Series: LVE, LDP, LER, LVP, LIR
 Date: 02/19/21 Time: 15:35
 Sample: 1980 2018
 Exogenous variables: Individual effects
 Automatic selection of maximum lags
 Automatic lag length selection based on SIC: 0
 Total (balanced) observations: 190
 Cross-sections included: 5

Method	Statistic	Prob. **
ADF - Fisher Chi-square	15.6826	0.1091
ADF - Choi Z-stat	0.26898	0.6060

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
LVE	0.9042	0	9	38
LDP	0.2201	0	9	38
LER	0.8309	0	9	38
LVP	0.9728	0	9	38
LIR	0.0024	0	9	38

ADF Unit Root Test at 1st Difference (Log Natural)

Null Hypothesis: Unit root (individual unit root process)
 Series: LVE, LDP, LER, LVP, LIR
 Date: 02/19/21 Time: 15:39
 Sample: 1980 2018
 Exogenous variables: Individual effects
 Automatic selection of maximum lags
 Automatic lag length selection based on SIC: 0
 Total (balanced) observations: 185
 Cross-sections included: 5

Method	Statistic	Prob. **
ADF - Fisher Chi-square	142.025	0.0000
ADF - Choi Z-stat	-10.7260	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results D(UNTITLED)

Series	Prob.	Lag	Max Lag	Obs
D(LVE)	0.0000	0	9	37
D(LDP)	0.0000	0	9	37
D(LER)	0.0000	0	9	37
D(LVP)	0.0001	0	9	37
D(LIR)	0.0000	0	9	37

Phillips-Peron Unit Root Test at Level (Log Natural)

Null Hypothesis: Unit root (individual unit root process)
Series: LVE, LDP, LER, LVP, LIR
Date: 02/19/21 Time: 15:43
Sample: 1980 2018
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett ke
Total (balanced) observations: 190
Cross-sections included: 5

Method	Statistic	Prob.**
PP - Fisher Chi-square	15.6298	0.1107
PP - Choi Z-stat	0.53120	0.7024

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate Phillips-Perron test results UNTITLED

Series	Prob.	Bandwidth	Obs
LVE	0.9704	17.0	38
LDP	0.2263	1.0	38
LER	0.8450	2.0	38
LVP	0.9698	1.0	38
LIR	0.0022	2.0	38

Phillips-Peron Unit Root Test at 1st Difference (Log Natural)

Null Hypothesis: Unit root (individual unit root process)
Series: LVE, LDP, LER, LVP, LIR
Date: 02/19/21 Time: 15:43
Sample: 1980 2018
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett ke
Total (balanced) observations: 185
Cross-sections included: 5

Method	Statistic	Prob.**
PP - Fisher Chi-square	151.610	0.0000
PP - Choi Z-stat	-11.1140	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate Phillips-Perron test results D(UNTITLED)

Series	Prob.	Bandwidth	Obs
D(LVE)	0.0000	14.0	37
D(LDP)	0.0000	0.0	37
D(LER)	0.0000	0.0	37
D(LVP)	0.0001	1.0	37
D(LIR)	0.0000	11.0	37

KPSS Unit Root Test at Level (Log Natural)

Null Hypothesis: Unit root (individual unit root process)

Series: LVE, LDP, LER, LVP, LIR

Date: 02/19/21 Time: 15:47

Sample: 1980 2018

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0

Total (balanced) observations: 190

Cross-sections included: 5

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	0.24156	0.5954
Im, Pesaran and Shin t-bar	-1.42857	
T-bar critical values ***:		
1% level	-2.43200	
5% level	-2.16000	
10% level	-2.02000	

** Probabilities are computed assuming asymptotic normality

*** Critical values from original paper

Intermediate ADF test results

Series	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
LVE	-0.3707	0.9042	-1.524	0.774	0	9	38
LDP	-2.1697	0.2201	-1.524	0.774	0	9	38
LER	-0.7148	0.8309	-1.524	0.774	0	9	38
LVP	0.2584	0.9728	-1.524	0.774	0	9	38
LIR	-4.1460	0.0024	-1.524	0.774	0	9	38
Average	-1.4286		-1.524	0.774			

KPSS Unit Root Test at 1st Difference (Log Natural)

Null Hypothesis: Unit root (individual unit root process)

Series: LVE, LDP, LER, LVP, LIR

Date: 02/19/21 Time: 15:47

Sample: 1980 2018

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0

Total (balanced) observations: 185

Cross-sections included: 5

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-14.3182	0.0000
Im, Pesaran and Shin t-bar	-7.16353	
T-bar critical values ***:		
1% level	-2.43300	
5% level	-2.16000	
10% level	-2.02000	

** Probabilities are computed assuming asymptotic normality

*** Critical values from original paper

Intermediate ADF test results

Series	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
D(LVE)	-7.0721	0.0000	-1.524	0.776	0	9	37
D(LDP)	-6.6426	0.0000	-1.524	0.776	0	9	37
D(LER)	-7.1271	0.0000	-1.524	0.776	0	9	37
D(LVP)	-5.5115	0.0001	-1.524	0.776	0	9	37
D(LIR)	-9.4644	0.0000	-1.524	0.776	0	9	37
Average	-7.1635		-1.524	0.776			

ARDL Fixed 1 Unrest No Trend

Dependent Variable: LVE

Method: ARDL

Date: 03/11/21 Time: 10:34

Sample (adjusted): 1981 2018

Included observations: 38 after adjustments

Dependent lags: 1 (Fixed)

Dynamic regressors (1 lag, fixed): LDP LER LVP LIR

Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LVE(-1)	0.086317	0.167216	0.516198	0.6098
LDP	0.012898	0.024334	0.530059	0.6002
LDP(-1)	0.038064	0.023645	1.609834	0.1187
LER	0.022627	0.033784	0.669752	0.5085
LER(-1)	0.040608	0.036689	1.106831	0.2778
LVP	0.942930	0.147244	6.403868	0.0000
LVP(-1)	-0.314530	0.182843	-1.720223	0.0964
LIR	0.019907	0.012191	1.632940	0.1137
LIR(-1)	-0.014055	0.013532	-1.038714	0.3078
C	3.089754	0.789926	3.911445	0.0005
R-squared	0.992339	Mean dependent var	14.27509	
Adjusted R-squared	0.989876	S.D. dependent var	0.390277	
S.E. of regression	0.039268	Akaike info criterion	-3.415876	
Sum squared resid	0.043175	Schwarz criterion	-2.984932	
Log likelihood	74.90164	Hannan-Quinn criter.	-3.262549	
F-statistic	402.9812	Durbin-Watson stat	2.099947	
Prob(F-statistic)	0.000000			

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Long Run Form and Bounds Test

Dependent Variable: D(LVE)

Selected Model: ARDL(1, 1, 1, 1, 1)

Case 3: Unrestricted Constant and No Trend

Date: 03/11/21 Time: 10:35

Sample: 1980 2018

Included observations: 38

Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.089754	0.789926	3.911445	0.0005
LVE(-1)*	-0.913683	0.167216	-5.464080	0.0000
LDP(-1)	0.050963	0.022438	2.271240	0.0310
LER(-1)	0.063235	0.021457	2.947087	0.0064
LVP(-1)	0.628399	0.143700	4.372995	0.0002
LIR(-1)	0.005852	0.014943	0.391602	0.6983
D(LDP)	0.012898	0.024334	0.530059	0.6002
D(LER)	0.022627	0.033784	0.669752	0.5085
D(LVP)	0.942930	0.147244	6.403868	0.0000
D(LIR)	0.019907	0.012191	1.632940	0.1137

* p-value incompatible with t-Bounds distribution.

Levels Equation				
Case 3: Unrestricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDP	0.055777	0.024131	2.311379	0.0284
LER	0.069209	0.022041	3.139933	0.0040
LVP	0.687765	0.070559	9.747437	0.0000

LIR	0.006405	0.016200	0.395338	0.6956
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$$EC = LVE - (0.0558*LDP + 0.0692*LER + 0.6878*LVP + 0.0064*LIR)$$

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	6.299797	10%	2.45	3.52
k	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06
Finite Sample: n=40				
Actual Sample Size	38	10%	2.66	3.838
		5%	3.202	4.544
		1%	4.428	6.25
Finite Sample: n=35				
		10%	2.696	3.898
		5%	3.276	4.63
		1%	4.59	6.368

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-5.464080	10%	-2.57	-3.66
		5%	-2.86	-3.99
		2.5%	-3.13	-4.26

1% -3.43 -4.6

ARDL Error Correction Regression

Dependent Variable: D(LVE)

Selected Model: ARDL(1, 1, 1, 1, 1)

Case 3: Unrestricted Constant and No Trend

Date: 03/11/21 Time: 10:36

Sample: 1980 2018

Included observations: 38

ECM Regression				
Case 3: Unrestricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.089754	0.515711	5.991251	0.0000
D(LDP)	0.012898	0.019396	0.664990	0.5115
D(LER)	0.022627	0.030724	0.736452	0.4676
D(LVP)	0.942930	0.120087	7.852032	0.0000
D(LIR)	0.019907	0.009588	2.076260	0.0472
CointEq(-1)*	-0.913683	0.152283	-5.999903	0.0000
R-squared	0.844628	Mean dependent var		0.027843
Adjusted R-squared	0.820351	S.D. dependent var		0.086663
S.E. of regression	0.036732	Akaike info criterion		-3.626402
Sum squared resid	0.043175	Schwarz criterion		-3.367836
Log likelihood	74.90164	Hannan-Quinn criter.		-3.534406
F-statistic	34.79145	Durbin-Watson stat		2.099947
Prob(F-statistic)	0.000000			

* p-value incompatible with t-Bounds distribution.

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.299797	10%	2.45	3.52
k	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-5.999903	10%	-2.57	-3.66
		5%	-2.86	-3.99
		2.5%	-3.13	-4.26
		1%	-3.43	-4.6

Unit Root Test ADF at Level

Volume Export

Null Hypothesis: LVE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.370688	0.9042
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LVE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.400894	0.0063
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LVE has a unit root
 Exogenous: None
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	1.968659	0.9868
Test critical values: 1% level	-2.627238	
5% level	-1.949856	
10% level	-1.611469	

*MacKinnon (1996) one-sided p-values.

Domestic Price

Null Hypothesis: LDP has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.169712	0.2202
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LDP has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.572667	0.2941
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LDP has a unit root
 Exogenous: None
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	0.702304	0.8629
Test critical values: 1% level	-2.627238	
5% level	-1.949856	
10% level	-1.611469	

*MacKinnon (1996) one-sided p-values.

Exchange Rate

Null Hypothesis: LER has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.714831	0.8309
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LER has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.121583	0.5177
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*Mackinnon (1996) one-sided p-values.

Null Hypothesis: LER has a unit root
 Exogenous: None
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	1.597173	0.9709
Test critical values: 1% level	-2.627238	
5% level	-1.949856	
10% level	-1.611469	

*Mackinnon (1996) one-sided p-values.



Volume Production

Null Hypothesis: LVP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	0.258431	0.9728
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LVP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.814515	0.2011
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LVP has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	3.487529	0.9997
Test critical values: 1% level	-2.627238	
5% level	-1.949856	
10% level	-1.611469	

*MacKinnon (1996) one-sided p-values.

Inflation Rate

Null Hypothesis: LIR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.145782	0.0024
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LIR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.335757	0.0074
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LIR has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.988210	0.2836
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

ADF at First Difference

Volume Export

Null Hypothesis: D(LVE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.072100	0.0000
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LVE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.898828	0.0000
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LVE) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.113987	0.0000
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Domestic Price

Null Hypothesis: D(LDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.642621	0.0000
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LDP) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.731281	0.0000
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LDP) has a unit root
 Exogenous: None
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.564427	0.0000
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Exchange Rate

Null Hypothesis: D(LER) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.127092	0.0000
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LER) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.039405	0.0000
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LER) has a unit root
 Exogenous: None
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.515195	0.0000
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Volume Production

Null Hypothesis: D(LVP) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.511483	0.0001
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LVP) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.402135	0.0004
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LVP) has a unit root
 Exogenous: None
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.261061	0.0001
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Inflation Rate

Null Hypothesis: D(LIR) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.463103	0.0000
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LIR) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.327372	0.0000
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LIR) has a unit root
 Exogenous: None
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.564959	0.0000
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

PP Unit root test level

Volume Export

Null Hypothesis: LVE has a unit root
Exogenous: Constant
Bandwidth: 17 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	0.220508	0.9704
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LVE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-4.476943	0.0052
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LVE has a unit root
Exogenous: None
Bandwidth: 22 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	4.612694	1.0000
Test critical values: 1% level	-2.627238	
5% level	-1.949856	
10% level	-1.611469	

*MacKinnon (1996) one-sided p-values.

Domestic Price

Null Hypothesis: LDP has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.152594	0.2263
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LDP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.507274	0.3231
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LDP has a unit root
Exogenous: None
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	0.702304	0.8629
Test critical values: 1% level	-2.627238	
5% level	-1.949856	
10% level	-1.611469	

*MacKinnon (1996) one-sided p-values.

Exchange Rate

Null Hypothesis: LER has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-0.658779	0.8450
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LER has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.096652	0.5311
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LER has a unit root
Exogenous: None
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	1.804334	0.9810
Test critical values: 1% level	-2.627238	
5% level	-1.949856	
10% level	-1.611469	

*MacKinnon (1996) one-sided p-values.

Volume Production

Null Hypothesis: LVP has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	0.211202	0.9698
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LVP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.967909	0.1542
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LVP has a unit root
Exogenous: None
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	3.336487	0.9996
Test critical values: 1% level	-2.627238	
5% level	-1.949856	
10% level	-1.611469	

*MacKinnon (1996) one-sided p-values.

Inflation Rate

Null Hypothesis: LIR has a unit root
 Exogenous: Constant
 Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-4.176784	0.0022
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LIR has a unit root
 Exogenous: Constant, Linear Trend
 Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-4.386836	0.0065
Test critical values: 1% level	-4.219126	
5% level	-3.533083	
10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LIR has a unit root
 Exogenous: None
 Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-1.374803	0.1543
Test critical values: 1% level	-2.627238	
5% level	-1.949856	
10% level	-1.611469	

*MacKinnon (1996) one-sided p-values.

PP at First Difference

Volume Export

Null Hypothesis: D(LVE) has a unit root
Exogenous: Constant
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-12.05865	0.0000
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LVE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-11.39772	0.0000
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LVE) has a unit root
Exogenous: None
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-6.114506	0.0000
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Domestic Price

Null Hypothesis: D(LDP) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-6.642621	0.0000
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LDP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-6.745738	0.0000
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LDP) has a unit root
 Exogenous: None
 Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-6.568297	0.0000
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Exchange Rate

Null Hypothesis: D(LER) has a unit root
 Exogenous: Constant
 Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-7.127092	0.0000
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LER) has a unit root
 Exogenous: Constant, Linear Trend
 Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-7.039405	0.0000
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LER) has a unit root
 Exogenous: None
 Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-6.493939	0.0000
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Volume Production

Null Hypothesis: D(LVP) has a unit root
 Exogenous: Constant
 Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-5.501670	0.0001
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LVP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-5.387351	0.0005
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LVP) has a unit root
Exogenous: None
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-4.333016	0.0001
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

Inflation Rate

Null Hypothesis: D(LIR) has a unit root
Exogenous: Constant
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-14.08575	0.0000
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LIR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-15.03874	0.0000
Test critical values: 1% level	-4.226815	
5% level	-3.536601	
10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LIR) has a unit root
Exogenous: None
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-13.91585	0.0000
Test critical values: 1% level	-2.628961	
5% level	-1.950117	
10% level	-1.611339	

*MacKinnon (1996) one-sided p-values.

KPSS at Level

Volume Export

Null Hypothesis: LVE is stationary
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.748596
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: LVE is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.096161
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Domestic Price

Null Hypothesis: LDP is stationary
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.639326
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: LDP is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.066875
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Exchange Rate

Null Hypothesis: LER is stationary
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.696391
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: LER is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.106374
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Volume Production

Null Hypothesis: LVP is stationary
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.743701
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: LVP is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.112284
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Inflation Rate

Null Hypothesis: LIR is stationary
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.294677
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: LIR is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.150856
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

KPSS at first difference

Volume Export

Null Hypothesis: D(LVE) is stationary
Exogenous: Constant
Bandwidth: 22 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.268500
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(LVE) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 21 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.238642
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Domestic Price

Null Hypothesis: D(LDP) is stationary
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.114699
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(LDP) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.051773
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Exchange Rate

Null Hypothesis: D(LER) is stationary
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.093199
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(LER) is stationary
 Exogenous: Constant, Linear Trend
 Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.093705
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Volume Production

Null Hypothesis: D(LVP) is stationary
 Exogenous: Constant
 Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.107117
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(LVP) is stationary
 Exogenous: Constant, Linear Trend
 Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.054313
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Inflation Rate

Null Hypothesis: D(LIR) is stationary
 Exogenous: Constant
 Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.170831
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(LIR) is stationary
 Exogenous: Constant, Linear Trend
 Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.166485
Asymptotic critical values*:	
1% level	0.216000
5% level	0.146000
10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

CV

Balya Ibnu MULKAN

Master Business Administration

EDUCATION

Universitas Islam Indonesia [2014-2018]

Industrial Engineering International Program

Istanbul Sabahattin Zaim Univeristy

Master Business Administration

WORK EXPERIENCE

CV. Pelita Mas [A Researcher] [2018]

The output of my research is the improvement layout and having proper product placement into shelves using combination of Algorithm Apriori and Profited Sequential Pattern.

PT. Indocement Tunggal Prakarsa Tbk [Supply Division] [2018]

I did an improvement on how to deal with the supply chain of Coal as the main fuel in order to discover the best time to make purchasing order from the suppliers.

Marketing and Communication [Staff of Logistic] [2015-2016]

I was charged to provide do the purchasing to restock the item needed

International Program Buddy [HRD Division] [2016-2018]

I was assigned to handle the foreign student for having short period of study at our campus and accompany them when the trips are scheduled.