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# THE INFLUENCE OF MACROECONOMIC VARIABLES ON INDONESIAN NATURAL RUBBER EXPORTS TO SOUTH KOREA PEROD 1990-2022

**Diah Manik Leontina ***
Economics, Udayana University
diahmanikleontina@gmail.com

**Sudarsana Arka**
Economics, Udayana University

**ABSTRACT**

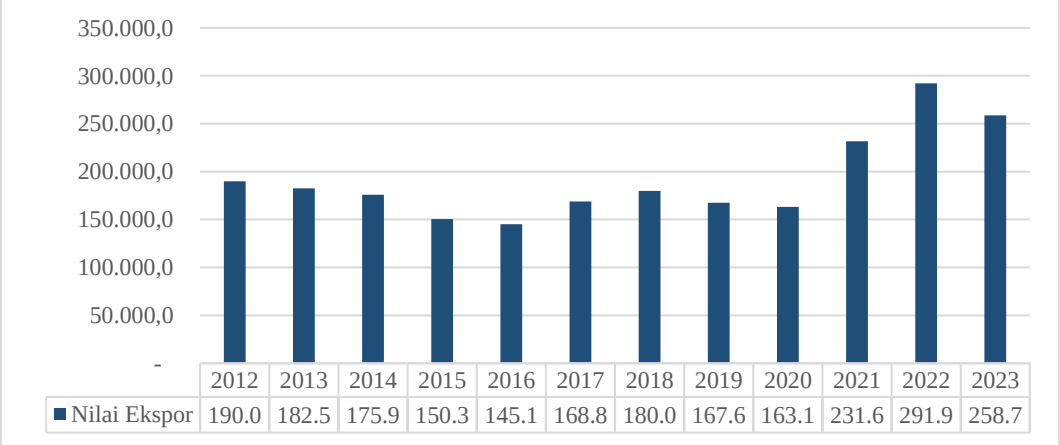
Indonesia is a country that has abundant natural resources, especially in the agricultural sector. Natural rubber is one of Indonesia's leading export commodities which certainly has considerable potential for the country's economy. Indonesian natural rubber is exported to various countries in the world, especially to South Korea. However, the situation of Indonesia's export volume to South Korea has fluctuated over the last thirty-two years, and is likely to decline in 2017-2022. The objectives of this research are: 1) Analyze the influence of macroeconomic variables, namely prices, exchange rates, GDP per capita and inflation rates simultaneously on Indonesian exports to South Korea for the period 1990-2022. 2) Partially analyze the influence of price, exchange rate, GDP per capita and inflation rate variables on Indonesian rubber exports to South Korea for the period 1990-2022. The analysis technique used is the Error Correction Model (ECM) for time series data with 32 observations obtained through secondary data. The selected models are stationarity testing, cointegration testing, classical assumption testing consisting of normality tests, multicollinearity tests, and heteroscedasticity tests. The results of this research are: 1) International prices, exchange rates, GDP per capita and inflation simultaneously have a significant influence on Indonesia's natural rubber exports to South Korea for the period 1990-2022. 2) International prices in the long and short term have a negative but not significant effect on Indonesian natural rubber exports to South Korea. 3) In the long term, the exchange rate has a negative but not significant effect on Indonesian natural rubber exports to South Korea. Meanwhile, in the short term, the exchange rate has a positive but not significant effect on Indonesia's natural rubber exports to South Korea. 4) GDP per capita in the long and short term has a positive and significant effect on Indonesian natural rubber exports to South Korea. 5) Long-term inflation has a positive and significant effect on Indonesian natural rubber exports to South Korea. Meanwhile, in the short term, inflation has a negative and significant effect on Indonesian natural rubber exports to South Korea.

**Keywords:**Exports, International Prices, Exchange Rates, GDP per Capita, Inflation

## INTRODUCTION

Exports in international trade can provide benefits for countries because each country can earn income in the form of foreign exchange. The more export activities, the more foreign exchange a country receives. According to (Mankiw, 2015) Exports are trade activities that involve buying and selling goods and services produced domestically and sold abroad. Exports are also an important measure of a country's economic growth and function as a driving force for the economies of developing countries, for example by increasing the use of certain production factors and increasing efficiency.

Indonesia is one of the countries that relies on international trade activities as a driver of economic growth. Apart from playing a role in bringing foreign exchange into the country, export activities enable Indonesia to build global business networks and track product and industrial developments in international markets.(Dewi and Indrajaya, 2020). The value of Indonesia's exports is currently growing rapidly due to high demand from other countries so that the stability of the Indonesian economy can be maintained. Export performance is an important factor that must be considered in making economic policies, especially in the current situation where turmoil in financial markets has had a negative impact on the real sector of the economy. In the last few years, Indonesia has faced a prolonged weakening in commodity prices, even though it is known that up to now Indonesia is still an exporter of commodities originating from natural products.(Kurniawaty et al., 2022).




| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nilai Ekspor | 190.0 | 182.5 | 175.9 | 150.3 | 145.1 | 168.8 | 180.0 | 167.6 | 163.1 | 231.6 | 291.9 | 258.7 |

*Source: Central Statistics Agency, 2024*

**Figure 1. Indonesian Export Value 2012-2023 (Million US$)**

Figure 1 shows that Indonesian exports experienced fluctuating development from 2012 to 2023. In 2012 the value of Indonesian exports reached 190.0 million US$, this figure continued to decline until 2016 reached 145.1 million US$. Then it increased from 2017 to 2018, reaching 180.0 million US$. In 2019 and 2020, the value of Indonesia's exports decreased by 163.1 million US$. After that, it increased until 2022,

reaching 291.9 million US$. And in 2023 the value of Indonesian exports will decline again to 258.7 million US$. Even though in nominal terms Indonesia's exports have decreased, in terms of volume, Indonesia's exports in 2023 will still grow by 8.55 percent (yoy). The slowdown in export value is in line with changes in prices of Indonesian export commodities (Rahman Tsani et al., 2022).

Indonesia's exports consist of commodities from the oil and gas sector and the non-oil and gas sector. Non-oil and gas exports are divided into three main groups, namely agriculture, mining and industry (Humaira & Rochdiani, 2021). Currently, non-oil and gas exports are able to absorb more human resources than oil and gas exports, so that employment opportunities will increase significantly and support Indonesia's economic development in the future. Indonesia is an agricultural country where part of the population's livelihood is through farming or gardening, so the agricultural sub-sector is a very vital sector for Indonesia. The contribution of the agricultural sector to non-oil and gas sector exports is around 1.82 percent (Ministry of Trade, 2023).

**Table 1. Export Value of Indonesia's Non-Oil and Gas Sector 2018-2022**

| Year | Agriculture | Mining | Processing industry |
|---|---|---|---|
| 2018 | 3,431.0 | 29,286.0 | 130,118.1 |
| 2019 | 3,612.4 | 24,897.0 | 127,377.7 |
| 2020 | 4,119.0 | 19,729.8 | 131,087.0 |
| 2021 | 4,242.0 | 37,908.2 | 177,204.4 |
| 2022 | 4,895.2 | 64,935.9 | 206,068.5 |

*Source: Ministry of Trade, 2023*

Based on Table 1, the non-oil and gas export value with the largest contribution from 2018 to 2022 is the industrial sector compared to the agricultural sector and the mining sector. In Table 1 it is known that although the agricultural sector is the third sector that contributes to the number of non-oil and gas exports, in its development from 2018 the export value of this sector continues to increase until 2022. According to the Ministry of Trade, the value of agricultural exports in 2022 will reach 4,895.2 million US$ and will continue to increase over the next few years. So this sector is a sector that has quite potential in supporting the economy and national income because of several comparative advantages that Indonesia has(Asta & Saputra, 2020). There are several comparative advantages that Indonesia has, such as the agricultural land in Indonesia which is still very large (outside the island of Java), the majority of the Indonesian population still relies on agriculture as their livelihood, agriculture is a renewable business so this sector can survive indefinitely.

The performance of the Indonesian agricultural sector is very good, especially seen from the performance of the plantation subsector commodities. Plantation products that have become conventional export commodities consist of rubber, cocoa, coconut and coffee (Dumairy, 1999:214). Becoming the main rubber producing country in the world after Thailand which is currently the main rubber producing country in the world. Indonesia is the second largest exporter of natural rubber after Thailand with natural rubber production reaching 3.6 million tons in 2022 and a contribution to world rubber production reaching 29.8 percent.

**Table 2. The Largest Natural Rubber Producing Countries in the World in 2022**

| Country | Volume Exports (Tons) | Mark Exports (US$) |
|---|---|---|
| Thailand | 4,744,250 | 4.1 Billion |
| Indonesia | 3,630,368 | 3.9 Billion |
| Vietnamese | 1,137,725 | 998.1 Million |

*Source: ITC, 2023*

Based on the data in Table 2, it can be seen that there are three largest natural rubber producing countries which are also natural rubber exporting countries in the world, namely Thailand, Indonesia and Vietnam which are currently competing in world international trade. From the data in Table 2, it shows that for exports in the field of rubber and rubber goods, rubber is still Indonesia's main export product, especially natural rubber exports and continues to run, but continues to experience a decline in demand.

**Table 3. Export Value of Indonesia's Leading Agricultural Commodities 2017-2022 (Million US$)**

| Year | Palm oil | Rubber | Coconut | Coffee | Cocoa |
|---|---|---|---|---|---|
| 2017 | 18,513,462,522 | 5,104,009,063 | 84,330,233 | 220,048 | 53,519,853 |
| 2018 | 16,527,848,105 | 3,951,451,411 | 64,817,040 | 786,016 | 72,442,930 |
| 2019 | 14,716,274,696 | 3,527,202,235 | 75,764,226 | 1,138,105 | 80,621,455 |
| 2020 | 17,363,920,824 | 3,011,685,500 | 160,343,358 | 2,074,871 | 75,807,280 |
| 2021 | 26,665,127,850 | 4,016,964,218 | 108,446,187 | 1,729,688 | 56,290,212 |
| 2022 | 27,765,830,185 | 3,544,961,241 | 95,998,660 | 2,752,069 | 63,851,691 |

*Source: United Nations Comtrade, 2023*

Based on Table 3, the value of Indonesian rubber exports ranks second as the largest commodity export after palm oil. Compared to palm oil commodities, Indonesia's natural rubber export market is more diverse where natural rubber is used in various manufacturing industries such as car tires, electronic equipment,

construction and medical equipment which will have a higher selling value.(Syarifa et al., 2023). Indonesian natural rubber latex also has considerable potential both in meeting domestic needs and competing in international markets. Apart from that, according to the International Rubber Study Group (IRSG), in 2022 global demand for Indonesian natural rubber recorded growth of 4.8 percent. Meanwhile, global demand for palm oil commodities according to the Indonesian Palm Oil Entrepreneurs Association (GAPKI) will only grow around 3.5 percent in 2022.

It can be seen in Table 3 that the volume of Indonesian natural rubber exports has experienced fluctuating development and is not always positive, where the export value tends to decline from 2017 to 2022. This means that the development of Indonesian natural rubber exports is slower compared to world natural rubber consumption. This estimate is based on the global population of end users of natural rubber products which is increasingly diverse and continues to grow every year. Indonesia must exploit this golden opportunity, especially with the aim of increasing the productivity of Indonesian natural rubber to meet the needs of an increasingly open international market. Natural rubber raw materials can be used to support the national economy.

The role of Indonesian natural rubber is not only felt by Indonesia but also countries that import Indonesian natural rubber. Importing countries have a strong interest in the continued supply of natural rubber as a raw material for strategic industries such as the tire industry, automotive military equipment, medical equipment industry, and many more. According to the Central Statistics Agency, the main destination countries for Indonesian natural rubber exports until 2022 include 4 main countries dominated by countries in the Asian region, namely Japan, China, India and South Korea after the United States in first place.

**Table1. Indonesian Natural Rubber Export Volume to 5 Main Destination Countries 2017-2022 (Thousand Tons)**

| Year | USA | China | Japan | India | South Korea |
|---|---|---|---|---|---|
| 2017 | 589,172 | 445,399 | 463,850 | 259,802 | 192,704 |
| 2018 | 605,960 | 252,037 | 483,807 | 303,652 | 189,537 |
| 2019 | 554,263 | 220,361 | 505,220 | 200,158 | 169,245 |
| 2020 | 449,683 | 329,985 | 388,420 | 188,617 | 149,637 |
| 2021 | 547,816 | 174,721 | 487,887 | 224,478 | 141,914 |
| 2022 | 594,000 | 185,251 | 488,158 | 242,942 | 101,894 |

*Source: Central Statistics Agency, 2023*

In Table 4 data over the last few years the top five countries importing Indonesian natural rubber are the United States, Japan, China, India and South Korea. We can see in Table 4 that the United States, China, Japan and India continue to

increase their imports of Indonesian natural rubber, however if we look at Indonesia's natural rubber exports to South Korea from 2017 to 2022 they continue to decline. The decline in natural rubber exports was due to the global economic slowdown which made natural rubber exports less competitive in the South Korean market. Apart from that, the reason Indonesia is a natural rubber export partner to South Korea is also because domestic consumption of Indonesian natural rubber is still very small so of course natural rubber production will be more focused on the export sector.

Indonesia and South Korea are two countries that are interconnected in terms of trade, investment in various giant projects and sophisticated industry. With a value of 20.58 billion US$ in bilateral trade, South Korea will become Indonesia's tenth largest trading partner in 2022. South Korea is one of the main destination countries for Indonesian rubber, whose manufacturing and automotive industries are currently developing very rapidly, which creates opportunities for Indonesia. as a major natural rubber exporter to South Korea.

One factor in the performance of Indonesian natural rubber exports is influenced by the price of rubber itself. If the global rubber price decreases, of course it will increase the volume of natural rubber exports to destination countries. Prices on the international market are a form of balance between international supply and international demand. Where price has a negative relationship with demand, if the price of a commodity increases then the commodity demanded will decrease (Maulana & Kartiasih, 2017). Vice versa, if a commodity's price decreases, the demand for the commodity will increase. Therefore, export prices are important because the price factor is crucial in trade. The global price of natural rubber in 2022 is 1,810 thousand US$ per ton, where this price has decreased from the previous year, namely reaching 2,071 thousand US$ per ton. This decline will affect the volume of Indonesian natural rubber exports on the international market, especially in South Korea.

Export activities certainly cannot be separated from developments in exchange rates. The exchange rate is one of the macro factors that influences export activities. This research uses the United States dollar exchange rate, because the international standard currency exchange rate is relatively stable and can be accepted by all countries as a legal means of payment. A stronger exchange rate will result in a country's exports decreasing. This happens because domestic goods are more expensive than foreign goods. If a country's currency weakens, this can have positive and negative sides for the country's economy and the national business world. For exports, this situation could be beneficial and could encourage more exports.

Exports are also influenced by a country's Gross Domestic Product in macroeconomic theory, which is an identity equation because exports are part of a country's GDP. The higher a country's GDP per capita, the higher its people's

purchasing power. This means that people in that country have more money to buy imported products, including products from Indonesia. South Korea's GDP per capita in 2022 will reach 35,254,624 million US$.

Inflation is an economic condition where prices generally increase over a long period of time. Temporary price increases such as price increases during the Eid period are not considered inflation, because after the Eid period prices can fall again.(Fihri et al., 2021). Inflation in general can occur because there is more money in circulation than needed. Inflation is an economic phenomenon that can never be completely eliminated. The efforts made are usually limited to reducing and controlling. If inflation in a country continues to increase, it will cause domestic prices of goods to rise so that the price of domestic goods is much more expensive than the price of goods from abroad so that people are more inclined to import goods.

Indonesia's natural rubber export activities to South Korea, which have experienced fluctuating movements for thirty years, have tended to decline in the last six years. This is very important to research further to find out macroeconomic variable factors such as international prices, the rupiah exchange rate against the US dollar, GDP per capita. , and the inflation rate which causes increases and decreases in the volume of Indonesian natural rubber exports to South Korea. Seeing the important role of Indonesian natural rubber commodities in the development of the national and international economy, this research tries to look at the macroeconomic variables that influence Indonesian natural rubber exports to South Korea in 1990 - 2022 with independent variables which are included in the macroeconomic variables, including the price of rubber. , South Korea's GDP per capita, the rupiah exchange rate against the United States dollar, and the inflation rate.

Based on the description of the background above, the author tries to find out more about what macroeconomic variables can influence natural rubber exports to South Korea because this country is one of the largest importers of Indonesian natural rubber. Therefore, the author took the research title "The Influence of Macroeconomic Variables on Indonesian Rubber Exports to South Korea for the Period 1990-2022".

## RESEARCH METHODS

The type of research used is a quantitative approach. According toYuliarmi and Marhaeni (2019), Quantitative data is data that can be expressed in the form of numbers. The nature of this research is associative, which aims to determine the relationship between two or more variables, and is characterized by influence or causal relationships, namely looking for relationships between the independent variable and the dependent variable. This research was conducted to determine and analyze the development of the performance of Indonesian natural rubber exports

to South Korea as seen from prices, the rupiah exchange rate against the US dollar, GDP per capita of the destination country, and the inflation rate.

The analysis technique used is the Error Correction Model (ECM) for time series data with 32 observations obtained through secondary data. The selected models are stationarity testing, cointegration testing, classical assumption testing consisting of normality tests, multicollinearity tests, and heteroscedasticity tests.

## RESULTS AND DISCUSSION

### Results of Analysis of Research Data

In this section, before carrying out the analysis using ECM (Error Correction Model) testing to analyze the magnitude of the influence of prices, exchange rates, GDP per capita and inflation on Indonesian natural rubber exports to South Korea, there are several tests that must be carried out to meet the testing requirements. There are several important tests that must be carried out in the ECM approach, including data stationarity test, degree of integration test, and cointegration test.

#### Data Stationarity Test Results

The results of the data stationarity test using the Augmented Dickey Fuller (ADF-Test) method carried out at the level unit root test can be seen in Table 5. It can be seen that in the ADF test the export, price, exchange rate, GDP per capita and inflation variables show that the probability value is still higher. of α = 5 percent (0.05) at level or I (0) so it can be concluded that all these variables are not stationary at level level, so it is necessary to have a degree of integration test or unit root test at first difference and second difference levels to determine the degree how much data will be stationary.

**Table 5. Stationarity Test Results for All Variables**

| ADF test | t-Statistics | | | Probability | | |
|---|---|---|---|---|---|---|
| | Levels | 1st Difference | 2nd Difference | Levels | 1st Difference | 2nd Difference |
| Y | -2.391195 | -2.929241 | -6.339944 | 0.1528 | 0.05334 | 0.0000 |
| X1 | -1.892578 | -5.115776 | -7.996862 | 0.3314 | 0.0002 | 0.0000 |
| X2 | -1.091373 | -6.732452 | -7.994902 | 0.7065 | 0.0000 | 0.0000 |
| X3 | -0.717951 | -5.520479 | -8.06488 | 0.8281 | 0.0001 | 0.0000 |
| X4 | -1.230914 | -3.276755 | -5.932481 | 0.6452 | 0.0267 | 0.0001 |

Based on Table 5 of the stationary test using the Augmented Dicky-Fuller test, the results show that all variables, namely exports (Y), prices (X1), exchange rate (X2), GDP (X3), and inflation (X4) are not stationary at level level. Stationary or not at a

level can be known from the ADF t-Statistics probability value. Because all variables are not stationary in the ADF level Intercept model test. So, based on Kuncoro's (2013) explanation, it is known that the solution is to differentiate the data at the first difference level.

After carrying out a data differentiation test at the first difference level, it is known that the price (X1), exchange rate (X2), GDP (X3) and inflation (X4) variables are stationary at the first difference level because the probability value is <0.05. However, the export variable (Y) is not yet stationary at the first difference level so testing needs to be continued at the second difference level. If you look at Table 5, in testing the second difference level, it is known that all variables are stationary because the probability value is <0.05 so it can be continued to the next test, namely the Johansen method cointegration test.

**Johansen Cointegration Test Results**

The next step is a cointegration test which aims to determine whether or not there is a long-term relationship between the dependent variable and the independent variable. The Johansen test also provides an alternative LR statistical test known as maximum eigenvalue statistics.

If the trace statistic value is > the critical value (at α= 1 percent, 5 percent, 10 percent) then there is cointegration or a long-term relationship between variables. But if the trace statistic < the critical value (at α= 1 percent, 5 percent, 10 percent) then there is no cointegration or there is no long-term relationship between variables (Widarjono, 2013). As a requirement for carrying out a cointegration test to see long-term relationships, previously a regression residual test was carried out to see the behavior of the residuals from the regression equation used where the residuals must be stationary at the level so that they can be continued to the Johansen cointegration test.

**Table 6. Residual Regression Test Results**

| | | t-Statistics | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistics | | -4.215083 | 0.0024 |
| Test critical values: | 1% level | -3.653730 | |
| | 5% level | -2.957110 | |
| | 10% levels | -2.617434 | |

Based on Table 6, the results of the regression residual stationarity test show that the residual variable is stationary at level level, namely by looking at the probability of 0.0024 which is smaller than 0.05. Next, Johansen cointegration testing was carried out.

**Table 7. Johansen Cointegration Test Results**

Series: LOGY X1 X2 LOGX3 X4

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

| Hypothesized No. of CE(s) | Eigenvalues | Trace Statistics | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.638596 | 72.84882 | 69.81889 | 0.0281 |
| At most 1 | 0.407910 | 41.29833 | 47.85613 | 0.1794 |
| At most 2 | 0.285353 | 25.05132 | 29.79707 | 0.1596 |
| At most 3 | 0.224720 | 14.63635 | 15.49471 | 0.0671 |
| At most 4* | 0.195560 | 6.745871 | 3.841465 | 0.0094 |

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

Based on Table 7, the results of the Johansen cointegration test show that in probability there is one rank that has a cointegration relationship. This can be seen from the Trace Statistics value of 72.84882 which is greater than the Critical Value of 0.05, namely 69.81889. So it can be said that the variables used in this research have a long-term relationship (cointegration) with each other. Therefore, the Error Correction Model (ECM) estimation in this research can be used.

**Error Correction Model (ECM) Testing**

The data stationarity test and cointegration test have been carried out, the results show that the research data is not stationary at the level and stationary at the first and second levels of differentiation and all variables are cointegrated. The existence of cointegration means that there is a long-term relationship or balance between these variables. In the short term there may be an imbalance, so the next method uses the ECM method. The ECM method used in this research uses the ECM method popularized by Eagle Ganger.

**(1) Long Term Analysis**

The purpose of conducting a long-term estimation test is to determine the relationship between the dependent variable and the independent variable in the long term. Variables in a study that are cointegrated in the long term, then these variables experience long-term balance.

**Table 8. Long Term Regression Results**

| Variables | Coefficient | Std. Error | t-Statistics | Prob. |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| C | -12.44594 | 5.950657 | -2.091524 | 0.0457 |
| X1 | -8.16E-05 | 9.71E-05 | -0.840831 | 0.4076 |
| X2 | -7.01E-06 | 3.58E-05 | -0.195717 | 0.8462 |
| LOGX3 | 1.430460 | 0.378010 | 3.784190 | 0.0007 |
| X4 | 0.013110 | 0.006287 | 2.085352 | 0.0463 |

Based on the long-term regression results in Table 8, the following long-term equation can be created:

$$\widehat{LogY} = -12{,}44594 - 0{,}0000816X_1 - 0{,}00000701X_2 + 1.430460logX_3 + 0{,}013110X_4$$

It can be seen that there are two independent variables that influence the dependent variable (Y) in the long term, namely GDP per capita (x3) and inflation (x4). This can be proven by looking at the coefficient value and the probability level of the two independent variables < α = 5 percent.

**(2) Short Term Analysis**

In this research, to be able to determine whether the ECM model used is a valid model, it can be seen from statistical tests on the residuals from the regression carried out at the beginning or the first regression, this model is called the Error Correction Term (ECT). If the results of the ECT test are significant in the sense that they are smaller than α = 5 percent

**Table 9. Short Term Regression Estimation Results**

| Variables | Coefficient | Std. Error | t-Statistics | Prob. |
|---|---|---|---|---|
| C | 0.008117 | 0.060165 | 0.134920 | 0.8937 |
| D(X1) | -6.24E-05 | 8.12E-05 | -0.768524 | 0.4491 |
| D(X2) | 5.52E-05 | 6.21E-05 | 0.888971 | 0.3822 |
| D(LOGX3) | 1.217169 | 0.538950 | 2.258406 | 0.0325 |
| D(X4) | 0.002010 | 0.003917 | 0.513200 | 0.6121 |
| ECT(-1) | -0.551392 | 0.131173 | -4.203540 | 0.0003 |

| | | | |
|---|---|---|---|
| R-squared | 0.497978 | Mean dependent var | 0.078874 |
| Adjusted R-squared | 0.401435 | SD dependent var | 0.287174 |
| SE of regression | 0.222178 | Akaike info criterion | -0.003315 |
| Sum squared resid | 1.283439 | Schwarz criterion | 0.271510 |
| Log likelihood | 6.053046 | Hannan-Quinn Criter. | 0.087782 |
| F-statistic | 5.158112 | Durbin-Watson stat | 1.002049 |
| Prob(F-statistic) | 0.002033 | | |

Based on Table 9, the short-term regression results can be made into the following equation:

$$\widehat{DLogY_t} = 0{,}008117 - 0{,}0000624DX_1 + 0{,}0000552DX_2 + 1{,}217169 DLogX_3 + , 0.002010DX_4 - 0{,}551392ECT$$

in the short term equation it can be seen that the coefficient of the ECT variable is equal too.551392 or 0.55which shows short-term balance fluctuations will be corrected towards long-term balance, where around 55 percent of the adjustment process occurs in the first year. In the short term, only the coefficient of the GDP per capita variable (LogX3) is positive and significant, meaning that in the short term GDP per capita has a positive effect on exports (LogY).

**Classical Assumption Testing**

**(1) Normality test**

The normality test is carried out to determine whether the residuals from the equation model are normally distributed or vice versa. This research uses the Jarque-Bera normality test to determine the residuals of the regression model. If the Jarque-Bera probability value is greater than α = 5 percent, it can be concluded that the residuals are normally distributed.

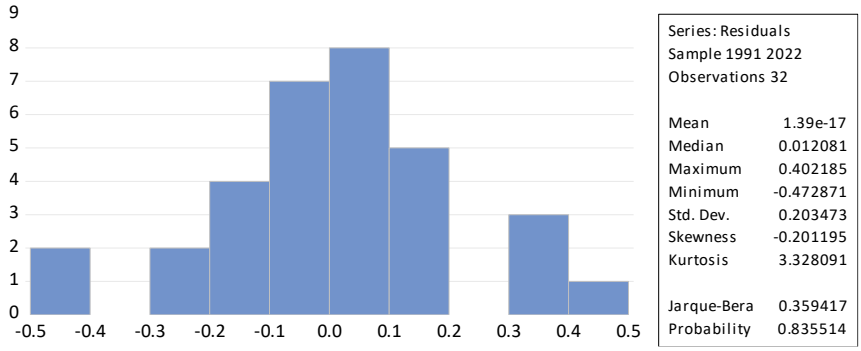



**Figure 2. Normality Test Results**

Based on Figure 2, information is obtained that the Jarque-Bera statistical value is 0.359417 with a probability value of 0.835514, which means it is greater than alpha 5 percent. So, it can be concluded that the data used in this research is normally distributed.

**(2) Multicollinearity Test**

The multicollinearity test aims to find out whether in the regression model there is a high or perfect correlation between the independent variables. If perfect multicollinearity occurs between independent variables, then the regression coefficient of the independent variable cannot be determined and the standard error value becomes infinite (Ghozali, 2017). To detect multicollinearity, it can be done by looking at the correlation between the four independent variables.

**Table 10. Multicollinearity Test Results**

| Variables | Coefficient Variance | Uncentered VIF | Centered VIF |
|---|---|---|---|
| C | 35.41032 | 9247.901 | NA |
| X1 | 9.43E-09 | 8.825117 | 2.146515 |
| X2 | 1.28E-09 | 31.99117 | 6.007367 |
| LOGX3 | 0.142891 | 10404.36 | 9.420450 |
| X4 | 3.95E-05 | 2.466356 | 1.652624 |

**(3) Heteroscedasticity Test**

The heteroscedasticity test is used to test whether in a regression model there is inequality of variance in the residuals for all observations in the regression model. A good regression model is one where heteroscedasticity does not occur. Testing can be done by looking at the results of the Glejser Test with a p-value > 0.05, which means that in a regression model there is heteroscedasticity.

**Table 11. Heteroscedasticity Test Results**

Heteroskedasticity Test: Glejser
Null hypothesis: Homoskedasticity

| | | | |
|---|---|---|---|
| F-statistic | 1.197478 | Prob. F(5.26) | 0.3378 |
| Obs*R-squared | 5.989751 | Prob. Chi-Square(5) | 0.3072 |
| Scaled explained SS | 5.669355 | Prob. Chi-Square(5) | 0.3397 |

Based on Table 11, it can be concluded that Obs*Rsquared is 5.989751 with a probability value of 0.3072. This probability value is greater than 0.05 or 5 percent so that heteroscedasticity does not occur in this regression model.

**Hypothesis test**

The hypothesis test in this research consists of two, namely the statistical test (F test) and the partial test (t test) with the following results.

**(1) Simultaneous testing of the influence of prices, exchange rates, GDP per capita and inflation on natural rubber exports (F test)**

The F test is used to test whether the regression model used can be used to predict the influence of independent variables on the dependent variable together

(Ghozali, 2017). In this research, the F-statistical test is used to determine whether the independent variables (prices, exchange rates, GDP per capita, and inflation) simultaneously influence the dependent variable in the long and short term.

**Table 12. F Test Results (Simultaneous Test) in the Long Term**

| | | | |
|---|---|---|---|
| R-squared | 0.773527 | Mean dependent var | 11.34837 |
| Adjusted R-squared | 0.741174 | SD dependent var | 0.698708 |
| SE of regression | 0.355468 | Akaike info criterion | 0.907963 |
| Sum squared resid | 3.538007 | Schwarz criterion | 1.134707 |
| Log likelihood | -9.981396 | Hannan-Quinn Criter. | 0.984256 |
| F-statistic | 23.90874 | Durbin-Watson stat | 0.832989 |
| Prob(F-statistic) | 0.000000 | | |

Based on Table 12 of the simultaneous test results at α = 0.05, df1 = 5-1, df2 = 32-5, then $F_{table}$ = 2.73 in the long term it can be seen that Fcount is 23.90874 > 2.73 and the probability value of F- statistic 0.000000 < 0.05 so it can be concluded that in the short term the variables price (X1), exchange rate (X2), GDP per capita (LogX3), and inflation (X4) simultaneously (simultaneously) have a significant effect on the volume of natural rubber exports Indonesia to South Korea 1990-2022 (LogY).

**Table 13. F Test Results (Simultaneous Test) in the Short Term**

| | | | |
|---|---|---|---|
| R-squared | 0.497978 | Mean dependent var | 0.078874 |
| Adjusted R-squared | 0.401435 | SD dependent var | 0.287174 |
| SE of regression | 0.222178 | Akaike info criterion | -0.003315 |
| Sum squared resid | 1.283439 | Schwarz criterion | 0.271510 |
| Log likelihood | 6.053046 | Hannan-Quinn Criter. | 0.087782 |
| F-statistic | 5.158112 | Durbin-Watson stat | 1.002049 |
| Prob(F-statistic) | 0.002033 | | |

Based on Table 13 of the simultaneous test results at α = 0.05, df1 = 5-1, df2 = 32-5, then Ftable = 2.73 in the short term it can be seen that Fcount is 5.158112 > 2.73 and the probability value of F- statistic 0.002033 < 0.05 so it can be concluded that the variables price (X1), exchange rate (X2), GDP per capita (LogX3), and inflation (X4) simultaneously (simultaneously) have a significant effect on the volume of Indonesian natural rubber exports to the country South Korea 1990-2022 (LogY).

**(2) Testing the influence of prices, exchange rates, GDP per capita, and partial inflation on natural rubber exports (t test)**

Partial testing or t test basically aims to see how much influence an individual independent variable has on the dependent variable. The t test (partial test) in this research is used to determine whether the coefficient of each independent variable partially (individually) has a significant influence on the dependent variable in the

long and short term. The results of the t test in this study can be seen in Table 14 and Table 15 below.

**Table 14. Results of the t test (partial test) in the long term**

| Variables | Coefficient | Std. Error | t-Statistics | Prob. |
|---|---|---|---|---|
| C | -12.44594 | 5.950657 | -2.091524 | 0.0457 |
| X1 | -8.16E-05 | 9.71E-05 | -0.840831 | 0.4076 |
| X2 | -7.01E-06 | 3.58E-05 | -0.195717 | 0.8462 |
| LOGX3 | 1.430460 | 0.378010 | 3.784190 | 0.0007 |
| X4 | 0.013110 | 0.006287 | 2.085352 | 0.0463 |

Based on Table 14, you can see the results of partial long-term testing of international price variables (X1), exchange rate (X2), GDP per capita (LogX3), and inflation (X4) with the following explanation.

1) At α = 0.05, df = 27, the ttable value = 1.703 and the t-statistic value for the international price variable (X1) is -0.840831. In conclusion, tcount -0.840 > -1.703 with a probability value of 0.4076 > 0.05, then H0 is accepted and Ha is rejected, so that in the long term international prices (X1) have a negative and insignificant effect on Indonesian natural rubber exports to South Korea (LogY ).
2) At α = 0.05, df = 27, the ttable value = 1.703 and the t-statistic value for the exchange rate variable (X2) is -0.195717. In conclusion, tcount is -0.195 > -1.703 with a probability value of 0.846 > 0.05, so H0 is accepted and Ha is rejected, meaning that in the long term the exchange rate (X2) has a negative and insignificant effect on Indonesian natural rubber exports to South Korea (LogY).
3) At α = 0.05, df = 27, the ttable value = 1.703 and the t-statistic value for the GDP per capita variable (LogX3) is 3.784190. In conclusion, tcount is 3.784 > 1.703 with a probability value of 0.0007 < 0.05, so H0 is rejected and Ha is accepted, meaning that in the long term GDP per capita (LogX3) has a positive and significant effect on Indonesia's natural rubber exports to South Korea (LogY).
4) At α = 0.05, df = 27, the ttable value = 1.703 and the t-statistic value for the inflation variable (X4) is 2.085325. In conclusion, tcount is 2.085 > 1.703 with a probability value of 0.0463 < 0.05, so H0 is rejected and Ha is accepted, meaning that in the long term inflation (X4) has a positive and significant effect on Indonesian natural rubber exports to South Korea (LogY).

**Table 15. Results of the t test (partial test) in the short term**

| Variables | Coefficient | Std. Error | t-Statistics | Prob. |
|---|---|---|---|---|
| C | 0.008117 | 0.060165 | 0.134920 | 0.8937 |
| D(X1) | -6.24E-05 | 8.12E-05 | -0.768524 | 0.4491 |
| D(X2) | 5.52E-05 | 6.21E-05 | 0.888971 | 0.3822 |
| D(LOGX3) | 1.217169 | 0.538950 | 2.258406 | 0.0325 |
| D(X4) | 0.002010 | 0.003917 | 0.513200 | 0.6121 |
| ECT (-1) | -0.551392 | 0.131173 | -4.203540 | 0.0003 |

Based on Table 15, you can see the partial test results in the short term for international price variables (X1), exchange rate (X2), GDP per capita (LogX3), and inflation (X4) with the following explanation.

1) At α = 0.05, df = 27, the ttable value = 1.703 and the t-statistic value for the international price variable (X1) is -0.768524. The conclusion is that tcount is -0.768 > -1.703 or the probability value is 0.4491 > 0.05, so H0 is accepted and Ha is rejected, that in the short term international prices (X1) have a negative and insignificant effect on Indonesian natural rubber exports to South Korea (LogY).
2) At α = 0.05, df = 27, the ttable value = 1.703 and the t-statistic value for the exchange rate variable (X2) is 0.888971. In conclusion, tcount is 0.888 < 1.703 or the probability value is 0.384 > 0.05, so H0 is accepted and Ha is rejected, meaning that in the short term the exchange rate (X2) has a positive but not significant effect on Indonesian natural rubber exports to South Korea (LogY).
3) At α = 0.05, df = 27, the ttable value = 1.703 and the t-statistic value for the GDP per capita variable (LogX3) is 2.258406. In conclusion, tcount is 2.258 > 1.703 or the probability value is 0.0325 < 0.05, so H0 is rejected and Ha is accepted, meaning that in the short term GDP per capita (LogX3) has a positive and significant effect on Indonesia's natural rubber exports to South Korea (LogY).
4) At α = 0.05, df = 27, the ttable value = 1.703 and the t-statistic value for the inflation variable (X4) is 0.513200. In conclusion, tcount is 0.513 > -1.703 or the probability value is 0.06121 > 0.05, so H0 is accepted and Ha is rejected, meaning that in the short term inflation (X4) has a positive but not significant effect on Indonesian natural rubber exports to South Korea (LogY).

**Discussion of Research Results**

**The influence of international prices (X1) on the volume of Indonesian natural rubber exports to South Korea (LogY)**

Based on the data results in Table 14, in the long term international prices (X1) have a negative but not significant effect on Indonesian natural rubber exports to South Korea (LogY) for the period 1990-2022. Meanwhile, in Table 15, in the short term, international prices (X1) also have a negative but not significant effect on Indonesian natural rubber exports to South Korea (LogY) for the period 1990-2022.

In accordance with the research hypothesis which illustrates that the higher the price of a good, the quantity demanded of that good will decrease and vice versa, so it has a negative relationship. In this research, price is not significant, this indicates that price is not the main factor in influencing the volume of Indonesian natural rubber commodity exports to South Korea.

In the long term and short term, this is supported by the theory of the law of demand where if the price of an item increases, the quantity demanded of that item decreases. Conversely, if the price of a good falls, the quantity demanded of that good will rise. The results in this study are supported by research conducted byDewi and Indrajaya (2020) which states that international prices have a negative and insignificant influence on Indonesian paper exports. In research also conducted byJuliana and Aswitari (2020) which states that international prices have a negative and insignificant effect on the volume of Indonesian shrimp exports to the United States.

**The effect of the exchange rate (X2) on the volume of Indonesian natural rubber exports to South Korea (LogY)**

Based on Table 14, it shows that in the long term the rupiah exchange rate against the US dollar (X2) has a negative and insignificant effect on the volume of Indonesian natural rubber exports to South Korea (LogY). The variable regression coefficient of the rupiah exchange rate against the US dollar (X2) is -0.00000701, which means that in the long term assuming other variables are constant, a 1 IDR/US$ decrease in the rupiah exchange rate against the US dollar will not be followed by a decrease of 0.00000701 tonnes of rubber export volume from Indonesia to South Korea. Meanwhile, in Table 15, in the short term, the rupiah exchange rate variable against the US dollar (X2) has a positive but not significant effect on the volume of Indonesian natural rubber exports to South Korea (LogY).

The data test results in Table 14 are not in accordance with the research hypothesis where in the long term the rupiah exchange rate against the US dollar has a negative and insignificant effect on Indonesian natural rubber exports to South Korea. This negative relationship shows that if there is a depreciation (weakening) of the rupiah exchange rate against the US dollar, then the rupiah needed to get 1 dollar will also increase, so the price of goods in Indonesia tends to be cheaper in the eyes

of the importing country so that exports will increase. However, this did not happen in 2018 to 2021 when the rupiah exchange rate against the US dollar tended to depreciate from 13,000 per US dollar to 14,000 per US dollar, at the same time Indonesia's natural rubber exports experienced a decline in South Korea. According to the Bank of Korea, this was caused by a slowdown in economic growth in South Korea, which initially was 2.7 percent in 2018, decreasing to 2 percent in 2019 as a result of the emergence of the US and China trade war. Apart from that, in 2020-2022 there was a Covid-19 pandemic which hit the whole world, including South Korea, resulting in disruption of the global supply chain and a decline in economic activity which caused a decline in the volume of Indonesian natural rubber exports to importing countries.

The results of the data test in Table 15 in the short term are in accordance with the research hypothesis where the rupiah exchange rate against the US dollar has a positive effect on the volume of Indonesian natural rubber exports to South Korea. So it can be said that when the exchange rate increases it will be accompanied by an increase in international prices, so that entrepreneurs will increase natural rubber production to increase Indonesia's natural rubber exports. And this is not significant in the long or short term, which means that the exchange rate is not a major factor in influencing the volume of natural rubber exports, in other words changes in the exchange rate do not have a significant impact on exports.

In the long term, this research is supported by previous research conducted byJuliana and Aswitari (2020)shows that the exchange rate has a negative and insignificant effect on Indonesian shrimp exports to the United States. Apart from that, research byBruno and Shin (2019)states that the dollar exchange rate has a negative effect on export volume. In the short term, this research is supported by previous research conducted byParamartha and Setyari (2020)which states that the rupiah exchange rate against the United States dollar has a positive but not significant effect on Indonesian palm oil exports. In addition, research conducted byPiani and Wenagama (2018)also shows that the rupiah exchange rate against the United States dollar has a positive but not significant effect on jewelry exports in several countries in the world in 2014-2018.

**The influence of GDP per capita (X3) on the volume of Indonesian natural rubber exports to South Korea (LogY)**

Based on Table 14, it shows that in the long term the variable GDP per capita of South Korea (LogX3) has a positive and significant effect in the long term on the volume of Indonesian natural rubber exports to South Korea (LogY). The regression coefficient for the South Korean GDP per capita variable (LogX3) is 1.430, which means that in the long term assuming other variables are constant, a 1 percent increase in South Korea's GDP per capita will be followed by an increase of 1.430

percent in the volume of Indonesian natural rubber exports to South Korea (LogY) for the year period. 1990-2022.

In Table 15, in the short term, it shows that GDP per capita has a positive and significant effect on the volume of Indonesian natural rubber exports to South Korea (LogY). The regression coefficient for the South Korean GDP per capita variable (LogX3) is 1.217, which means that in the long term assuming other variables are constant, a 1 percent increase in South Korea's GDP per capita will be followed by an increase of 1.217 percent in the volume of Indonesian natural rubber exports to South Korea (LogY) for the year period. 1990-2022.

Based on the test results, it is certainly in accordance with the hypothesis in this research, where in the long and short term GDP per capita has a positive and significant effect on the volume of Indonesian natural rubber exports to South Korea. If a country's national income (GDP) increases, it means that the welfare of its people also increases, so this will have an impact on the people's ability to carry out production which can ultimately be exported to other countries.

This is supported by previous research conducted byDivanka et al. (2023)where US GDP per capita has a positive effect on Indonesian tobacco exports to the United States. Additionally, according toSiburian (2012)Every increase in GDP of the export destination country will increase Indonesia's exports. As for research fromRaihanisyah (2017)namely GDP per capita of exporting countries has a positive effect on increasing Indonesian natural rubber exports. Furthermore, there is research fromWan et al. (2022)which states that GDP per capita has a positive influence on export volume.

**The effect of inflation (X4) on the volume of Indonesian natural rubber exports to South Korea (LogY)**

Based on Table 4.10, it shows that in the long term the inflation variable (X4) has a positive and significant effect on the volume of Indonesian natural rubber exports to South Korea (LogY). The regression coefficient for the inflation rate variable (X4) is 1.311, which means that in the long term, assuming other variables are constant, a 1 percent increase in the inflation rate will be followed by an increase of 1.311 tons in the volume of Indonesian natural rubber exports to South Korea for the 1990-2022 period.

Table 15 shows that in the short term the inflation variable (X4) has a positive but not significant effect on the volume of Indonesian natural rubber exports to South Korea (LogY). The regression coefficient for the inflation variable (X4) is 0.201, which means that in the long term, assuming other variables are constant, a 1 percent increase in inflation will not be followed by an increase of 0.201 tonnes in the volume of Indonesian natural rubber exports to South Korea for the 1990-2022 period.

In the long term and short term, the results of the variable data show that inflation has a positive effect on Indonesian natural rubber exports to South Korea,

which means that when Indonesian inflation falls, the price of goods tends to fall so that exports will increase as well. However, in 2018-2022 this will not happen because inflation in Indonesia tends to decrease and Indonesian natural rubber exports to South Korea also decrease, this is caused by several factors. First, obey*Bank Of Korea in 2018-2019 there was a slowdown in global economic growth where the South Korean economy only grew around 2 percent from the previous year of around 2.7 percent. This made several industries tend to reduce their import volume, especially the natural rubber industry. Second, in 2019-2022 the rubber industry sector in South Korea is sluggish because of this*implementation of social distancing strategies and strict mobility restrictions (June-October 2020) carried out by the government to limit the spread of the virus (Sari, 2020). In the long term, inflation has a significant effect, which means that when Indonesian inflation falls, the economic slowdown in South Korea will reduce Indonesian natural rubber exports to South Korea, while in the short term, the inflation rate variable does not have a significant effect on Indonesian natural rubber exports to South Korea. .

In the long and short term, this is not in accordance with the research hypothesis, namely in Sukirno's (2012) theory that inflation causes the price of goods offered to become cheaper so that it can increase the country's exports. However, in the long term, this research is supported by research conducted bySuryanto and Kurniati (2022) which shows that Indonesia's international trade, namely exports, is positively influenced by the inflation rate. In addition, research conducted byPutri et al. (2016) The results show that inflation has a positive and significant influence on Indonesian exports of electronic commodities to South Korea before the implementation of AKFTA. In the short term, this is in accordance with research conducted byRezandy and Yasin (2022) Inflation has a positive but not significant effect on the value of Indonesia's non-oil and gas exports. In addition, research conducted byRismiyati et al. (2021)Inflation has a positive but not significant effect on Indonesian ginger exports. The research according toIlmas et al. (2022) which states that inflation has a positive but not significant effect on export volume in five ASEAN countries.

## CONCLUSION

Based on the results of the analysis presented in the previous chapter, several conclusions can be drawn to answer the problem formulation as follows.

(1) In the long term and short term, international prices, the rupiah exchange rate against the US dollar, GDP per capita and inflation simultaneously influence Indonesia's natural rubber exports to South Korea for the period 1990-2022.

(2) Partially, in the long term, international prices have a negative and insignificant effect, the rupiah exchange rate against the US dollar has a

negative and insignificant effect, South Korea's GDP per capita has a positive and significant effect, and Indonesian inflation has a positive and significant effect on Indonesian natural rubber exports to South Korea in the period 1990-2022. Meanwhile, in the short term, international prices have a negative and insignificant effect, the rupiah exchange rate against the US dollar has a positive but not significant effect, South Korea's GDP per capita has a positive and significant effect, and Indonesian inflation has a positive but not significant effect on Indonesian natural rubber exports to South Korea. 1990-2022.

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