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TRANSFORMING INDONESIA'S RUBBER EXPORTS: STRATEGIES FOR GLOBAL COMPETITIVENESS AND MARKET DIVERSIFICATION

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Abstract

Indonesia is one of the largest rubber producers in the world. However, it is very unfortunate that rubber exports have continued to fluctuate over the last 30 years, this shows the unstable performance of rubber exports. The stability of rubber exports must be supported by increased domestic rubber production. However, increasing rubber production does not necessarily increase the value of rubber exports if other factors such as rubber prices on the international market, inflation and exchange rate stabilization do not support it. This research aims to analyze the role of production, international price fluctuations, inflation and exchange rate fluctuations on rubber exports so as to optimize Indonesian rubber exports. In addition, this research analyzes the effectiveness and feasibility of various government policies related to Indonesian rubber exports. The analysis method uses the ARDL model to analyze short-term and long-term relationships and influences between variables. The results of the analysis show that in the short term, the rupiah exchange rate has a significant influence on rubber exports, while in the long term, rubber production is the most influential factor. Therefore, the right strategy to face global competition is to formulate policies that combine increased production with increased added value and accompanied by increased welfare of farmers.

Keywords: Rubber Export Performance, Policy, Financial Assets.

1. INTRODUCTION

Rubber is one of Indonesia's leading commodities, playing an important role in the economy. Indonesia is one of the largest rubber producers in the world due to its favorable climate and soil conditions for rubber tree cultivation, enabling abundant rubber production. Regions such as Sumatra, Kalimantan, and Sulawesi are the main centers of rubber production in Indonesia. In addition, the rubber industry plays a significant role in contributing to Indonesia's Gross Domestic Product (GDP). Rubber also makes a significant contribution to the agricultural and processing sectors. The rubber industry also creates jobs for thousands of workers, both in the plantation sector and in processing. The following is a graph showing Indonesia's rubber production. From the graph above (Figure 1), it can be seen that although rubber plays an important role in Indonesia's economy, rubber production remains highly fluctuating, preventing optimal profits from being achieved. The main causes are weather factors and plant diseases. However, these problems have persisted for several decades, and it is unfortunate that if these issues continue to be neglected without solutions, it will have significant negative consequences, as the potential rubber market is very promising for Indonesia.

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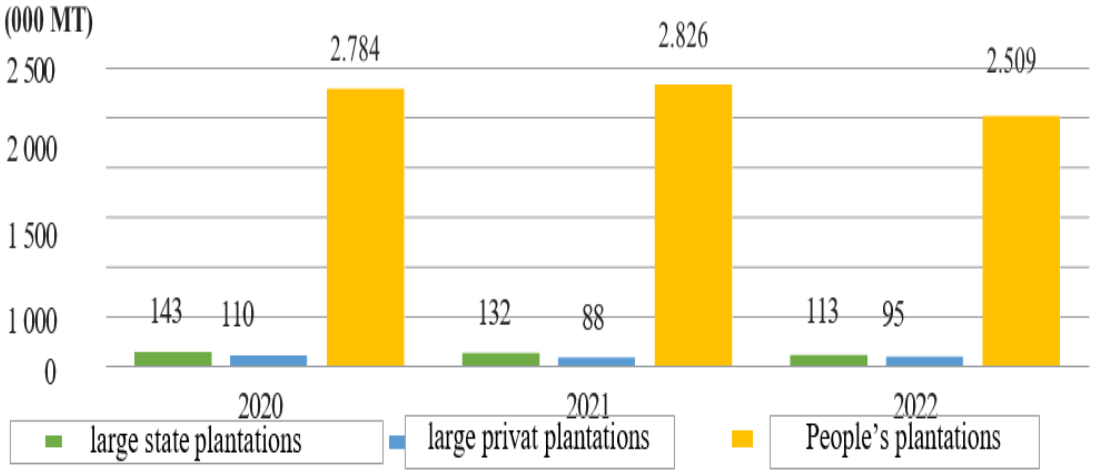

Figure 1: Indonesian Palm Oil Export Performance by Main Destination Countries

Rubber production greatly determines the quantity of rubber exports. Currently, rubber is one of Indonesia's main export commodities (Figure 2). Rubber exports play an important role in foreign exchange earnings. Indonesia exports rubber to various countries worldwide, including China, the United States, Japan, India, and European countries. However, it is unfortunate that the potential profits from rubber exports have not been fully optimized. The following shows the condition of Indonesia's rubber exports over the past eight years.

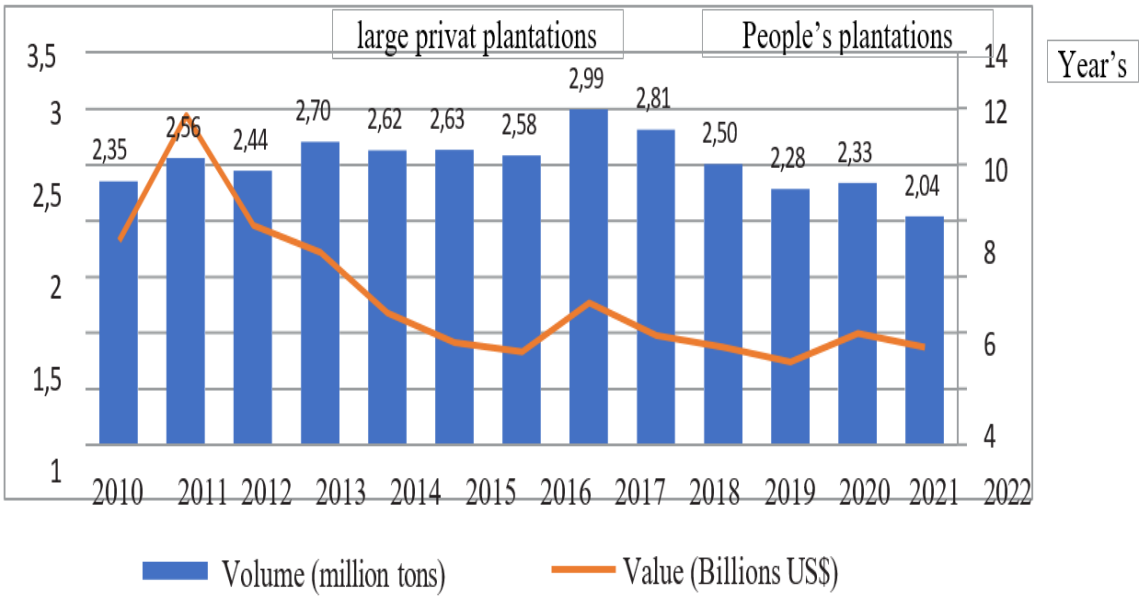

Figure 2: Indonesia's rubber exports

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From the image above, it is clearly seen that Indonesia's rubber exports continue to fluctuate and tend to decline. In addition to unstable production conditions, Indonesia's rubber exports are also facing detrimental issues such as falling rubber prices in both local and global markets. Natural rubber prices have experienced significant fluctuations in recent years, primarily due to varying global demand and competition with other rubber-producing countries.

This price decline has negatively impacted the income of Indonesian rubber exporters and reduced the competitiveness of Indonesian rubber products in international markets. Apart from that, domestic inflation conditions and the rupiah exchange rate against the dollar also experienced fluctuations. This further worsens the condition of exports of Indonesian agricultural products, especially rubber.

The lack of diversification in Indonesian rubber products is also a key factor in the suboptimal pricing of Indonesian rubber in international markets. Currently, Indonesia still relies on exporting raw natural rubber materials, such as rubber sheets or rubber latex. The lack of product diversification increases the risk of price and global demand fluctuations, which can affect Indonesia's rubber industry. Moreover, regulatory and infrastructure challenges also affect Indonesia's rubber exports. Complicated licensing processes and slow bureaucracy can hinder companies' ability to efficiently export rubber. Additionally, poor transportation infrastructure, such as damaged roads or lack of port connectivity, can make it difficult to ship rubber to international markets in a timely manner.

Another issue that limits the profitability of Indonesia's rubber exports is competition with other countries. Although Indonesia is one of the largest rubber producers in the world, it faces competition with countries such as Thailand, Malaysia, and Vietnam. These countries have comparative advantages in terms of productivity per hectare and more advanced rubber processing technologies.

This competition can affect Indonesia's share of the rubber export market and limit the growth of the rubber industry. To address the issues related to rubber exports mentioned above, it is necessary to analyze the policies that have been implemented to tackle Indonesia's rubber export problems. Then, a comprehensive and appropriate strategy must be formulated to optimize Indonesia's rubber exports.

The transformation of Indonesian rubber exports is an interesting thing to study, considering that rubber is one of the plantation products that has an important role in the Indonesian economy. The fluctuating value of rubber exports from year to year shows that export performance in the global market is not yet optimal, so it is necessary to conduct research and analysis of the factors causing these fluctuations.

This research focuses on analyzing the influence of rubber production performance, international prices, inflation and exchange rates on rubber exports in the short and long term. In addition, this research will examine the effectiveness of policies that have been implemented to optimize and increase the competitiveness of Indonesian rubber in the global market.

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2. LITERATURE AND THEORETICALREVIEW

Performance of Rubber Production and Rubber Exports in Indonesia

Production is a process of transforming raw materials into finished goods, and it influences the export supply to foreign markets. When production increases, export supply to foreign markets also increases (Afriyanti et.al., 2022; Jamilah, et.al., 2022). High production volumes occur when export supply rises to meet foreign demand, and conversely, when production decreases, export supply also declines. Therefore, the greater the production, the larger the exports that will be carried out (Mustafa & Andriyani, 2020). If production performance improves each year, it has a positive impact on exports, although the increase may not always be significant. This indicates that rubber, with its distinctive characteristics, has strong potential in international trade. The global interest in the quality of Indonesian rubber can prompt the Indonesian government to investigate factors that can boost export performance and enhance competitiveness at the international level (Septyana & Taufiq, 2022).

International Prices and Indonesian Rubber Exports

International prices refer to the prices prevailing in the international market. These prices can influence the demand for goods and services in the domestic market. If domestic prices are higher than international prices, exports will automatically decrease (Koffi, 2021). Conversely, if domestic prices are lower than international prices, exports will automatically increase (Mejaya et al., 2019). The relationship between international rubber prices and export volumes is primarily driven by supply factors. If international rubber prices rise, Indonesia, as a rubber-exporting country, will increase its export volume (Nath & Zhu, 2017). Conversely, if international rubber prices fall, Indonesia will reduce its rubber export volume. This relationship between international rubber prices and Indonesia's rubber export volumes is a key factor.

Inflation Fluctuations and Indonesian Rubber Exports

If inflation, or the rising prices of goods and services in a country, increases, domestic supply or exports will also rise, and vice versa. Rising inflation causes domestic prices to increase, which in turn raises production costs (Phongpan & Jittamai (2017). The effect of inflation on exports is negative and significant. Therefore, inflation has a negative impact on exports (Berata & Setiawina, 2017). When a country experiences inflation, the goods produced in that country struggle to compete in the international market, leading to a decline in exports. This is due to the rising cost of domestic goods, which prevents producers from maximizing their production capacity (Nurvira & Ichsan, 2021).

Exchange Rate Fluctuations and Indonesian Rubber Exports

The exchange rate is the main indicator in the economy which determines the demand and supply of money in international trade because the exchange rate is used as a means of payment in international trade. The exchange rate can affect Indonesian rubber exports. If the exchange rate experiences depreciation (a decrease in the currency), the foreign currency will increase in exchange rate, which will cause exports to increase.

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In this case, the exchange rate has a close relationship which can influence rubber exports in Indonesia. The results of previous research conducted by Berata and Setiawina (2017) simultaneously exchange rates have an influence on exports.

The value of a country's currency will be very interesting and influence export decisions. Because currency amounts are a benchmark for comparing prices of goods and services in international trade. As the country's economic situation changes, the value of the currency may also change in real terms.

The value of a currency can experience depreciation (decrease) and appreciation (increase), therefore the exchange rate is a consideration for a country in carrying out its export activities (Nguyen & Pham. (2020).

Research conducted (Setyorani, 2018) shows that the value of a country's currency has a negative and significant effect on Indonesia's export growth. In some developing countries, exports have a negative impact on long-term exchange rate conditions, while in the short term the exchange rate will weaken.

3. RESEARCH METHODOLOGY

Model Specification and Measurement of Variables

This research uses the autoregressive distributed lag (ARDL) analysis method. The ARDL method is an econometric analysis method used to estimate short-term and long-term relationships between variables when these variables are non-stationary, meaning they have unit roots (Rahmasari et al., 2019).

In general, the steps that will be taken for econometric analysis using this method are as follows: 1). Testing the stationarity of variable data in the research model, both at level level and first difference level. 2). Determination of optimum lag. 3). Granger causality test. 4). Bound test cointegration test. 5). Estimating ARDL models. 6). Test the stability of the ARDL model.

The ARDL model equation for this research is as follows: $EXP_t = \alpha + \alpha_{1t} + \sum_{i=1}^{p} \alpha_1 EXP_{t-1} \sum_{i=0}^{q} \alpha_2 Prod_{t-1} + \sum_{i=0}^{r} \alpha_3 PI_{t-1} + \sum_{i=0}^{e} \alpha_4 INF_{t-1} + \sum_{i=0}^{e} \alpha_5 ERI_{t-1} + \varepsilon_t$

Description:

EXP_t = Value export year t

EXP_{t-1} = Value export year t-1

$Prod_{t-1}$ = Production of rubber year t-1

PI_{t-1} = The export price of Indonesian rubber year t-1

INF_{t-1} = Inflation year t-1

ERI_{t-1} = Rupiah exchange rate against US $ in year t

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Policy Analysis

Policy analysis is a systematic approach to understanding, analyzing, and evaluating public policies. This method aids in identifying, comprehending, and assessing policies that have been implemented or are to be implemented.

The general steps in the policy analysis method are as follows: 1. Identifying and formulating the policy issue to be examined. 2. Defining the objectives to be achieved through the policy. 3. Analyzing existing policies related to the issue being studied. 4. Collecting relevant data for policy analysis. This data can include statistical data, research reports, policy documents, or opinions from relevant stakeholders.

Based on the results of the policy analysis, the next step is to identify alternative policies that could be adopted to address the existing problem. These policy alternatives should consider the objectives to be achieved, resource availability, and implementation constraints. This approach helps in thoroughly understanding and evaluating policies to achieve the desired outcomes.

4. DATA ANALYSIS AND DISCUSSION

Classical Assumption Tests

Classical assumption tests were carried out to ensure the accuracy and correct interpretation of statistical analysis. This research includes several classical assumption tests, including: Normality Test, Multicollinearity Test, Autocorrelation Test, Heteroscedasticity Test. And the results of this research are very good, the data is normally distributed and there is no multicollinearity, heteroscedasticity and autocorrelation.So it can be concluded that the model in this research is Best Linier Unbias Estimate (BLUE).

ARDL Testing

Stationarity testing, a fundamental concept in time series analysis, is pivotal as it indicates that the statistical properties of a time series data do not change over time. In the context of dynamic model research, stationarity testing is an initial and essential step, as it helps identify any spurious regression that may occur when estimating a model.

Multiple methods are available for assessing data stationarity, and in this study, the Phillips-Perron test is employed. The Phillips-Perron test follows a specific criterion for evaluating data stationarity. It involves comparing the Phillips-Perron probability (PP) with the pre-defined significance level.If the probability value falls below the significance level, it signifies that the variable data is stationary. Conversely, if the PP probability exceeds the significance level, the variable data is deemed non-stationary.

The Philips-Perron Unit Root Test establishes that all variables in this study exhibit stationarity in their first differences when employing a constant regression (Intercept) at the 1%, 5%, and 10% significance levels. This conclusion is evident as the probability values (Prob) fall below the critical threshold of 0.05 (Prob < 0.05), indicating that all variables are suitable for further analysis using their first differences.

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Table 1: Lag Optimum Test Results

Included observations: 28						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-152.7740	NA	0.053952	11.26957	11.50747	11.34230
1	-72.10765	126.7615	0.001047	7.293404	8.720766	7.729762
2	-12.82231	71.98934*	0.000109	4.844451	7.461281	5.644442
3	11.62788	20.95731	0.000199	4.883723	8.690021	6.047346
4	81.24869	34.81040	**3.49e-05***	**1.696522***	**6.692289***	**3.223778***

Determination of Lag Optimum, The Lag Optimum test plays a vital role in assessing the duration it takes for a variable's data to return to a state of stability or equilibrium after undergoing disturbances from other variables within the study (Gujarati, 2003). The outcomes of the Lag Optimum test in this study are presentedin Table 1.

Analyzing Table reveals that the optimal lag selection in this study points to the fifth lag as the most suitable choice. This is evident from the preponderance of asterisks (stars) associated with the fifth lag.

Specifically, the second lag exhibits the lowest values for LR (Sequential Modified LR test statistic, each test at the 5% level) and SC (Schwarz Criterion), whereas the fifth lag demonstrates the lowest values for FPE (Final Prediction Error), AIC (Akaike Information Criterion), and HQ (Hannan-Quinn Information Criterion). When considering these cumulative criteria, it becomes evident that the majority of asterisks align with the fifth lag.

Consequently, it is reasonable to conclude that the lag optimum is situated at the fifth lag. In summary, the interactions between the variables under scrutiny unfold over the subsequent five years. This implies that when one variable undergoes a change, its impact ripples through to other variables in the ensuing five years.

For instance, if cocoa production experiences an increase, it is likely to result in an upturn in cocoa export variables over the following five years.

Granger Causality Test, The Granger Causality Test, a fundamental component of our analysis, is designed to shed light on the existence of a reciprocal relationship between variables. This test helps us explore the intricate dynamics between the key elements under investigation. The evaluation of causal relationships hinges on comparing the Granger probability values with a predetermined significance level.

If the calculatedGranger probability value surpasses the significance level, it suggests that no causal link exists between the variables. However, if the probability value falls below the significance level, it signifies the presence of a significant causality.

The outcomes of the Granger Causality Test are detailed in Table 2, offering valuable insights into the intricate interplay between the variables at the core of our analysis.

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Table 2: The Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
The export price of Indonesian rubber does not Granger Cause Export	28	0.03787	0.9970
Export does not Granger Cause The export price of Indonesian rubber		0.85087	0.5107
Inflation does not Granger Cause Export	28	0.08701	0.9854
Export does not Granger Cause Inflation		2.01392	0.1333
Rupiah exchange rate against US$ does not Granger Cause Export	28	0.84852	0.5120
Export does not Granger Cause Rupiah exchange rate against US$		0.99223	0.4357
ProductionI does not Granger Cause Export	28	0.61642	0.6561
Export does not Granger Cause Production		0.76248	0.5625
Inflation does not Granger Cause The export price of Indonesian rubber	28	0.61171	0.6593
The export price of Indonesian rubber does not Granger Cause Inflation		0.40657	0.8016
Rupiah exchange rate against US$ does not Granger Cause The export price of Indonesian rubber	28	0.51521	0.7254
The export price of Indonesian rubber does not Granger Cause Rupiah exchange rate against US$		0.53446	0.7121
Production does not Granger Cause The export price of Indonesian rubber	28	0.74081	0.5758
The export price of Indonesian rubber does not Granger Cause Production		0.03425	0.9975
Rupiah exchange rate against US$ does not Granger Cause Inflation	28	2.43109	0.0831
Inflation does not Granger Cause Rupiah exchange rate against US$		32.9416	3.E-08
Production does not Granger Cause Inflation	28	1.37400	0.2802
Inflation does not Granger Cause Production		0.76116	0.5634
Production does not Granger Cause Rupiah exchange rate against US$	28	0.23634	0.9144
Rupiah exchange rate against US$ does not Granger Cause Production		1.54521	0.2294

This examination of causalrelationships provides a deeper understanding of how changes in one variable may influence others, a crucialfacet of our research objectives.

The results of the Granger Causality Test provide a clear and definitive conclusion. They indicate that no bidirectional relationship exists among the variables, signifying the absence of Granger causality. This absence of a causal relationship is established as the Granger probability values consistently exceed the predetermined significance level. Consequently, it can be confidently stated that there is no significant causalinterplay between the variables under examination.

Cointegration Test (Bound Test) The cointegration test is conducted to examine whether there is a long- term relationship and the possibility of imbalance between independent and dependent variables. If there is an imbalance, a error correction model is required. In this study, the cointegration test is performed using thebound test. The cointegration test results, The F-Statistic value of 3.789342 surpasses the I0 Bound value at multiple significance levels, including 10%, 5%, 2.5%, and 1%. This substantial difference in values stronglysupports the conclusion that there is indeed cointegration among the variables within the tested model. This cointegration signifies the presence of both short-term and long-term equilibrium among the variables, underlining the interdependence and interconnectedness of these crucial elements in our analysis.

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ARDL Model Estimation Results

Following the data input, stationarity tests, and cointegration analysis, the research proceeded with ARDL analysis. The data processing phase was segmented into two components, specifically focusing on short-termand long-term processing.

The outcomes derived from the short-term test, as presented in Table 3, offer valuable insights into the dynamicinterplay among the key variables. The short-term equation can be formulated as follows:

EXP = - 0,003670 – 1,887167*LnProd – 1,1612748*PI + 0,017034*INF – 13,29694*ERI

This equation encapsulates the immediate impacts and relationships between the variables, allowing us to draw critical conclusions about their interdependencies. To delve into a deeper understanding of this short- term equation, the following interpretations are provided:

a. Constant (-0,003670): This constant, approximately equal to - 0,003670, serves as a pivotal anchor in our analysis. It signifies that if factors such as production, inflation, and the exchange rate of the IndonesianRupiah to the US Dollar remain constant in the short term, then exports will also remain steady at aroundRp - 0,003670 million per year. Essentially, it establishes a baseline from which we can gauge the deviationscaused by changes in these factors.

b. Coefficient for Production (Prod, -1,887167): The coefficient for production, which amounts to approximately -159.10, is a crucial indicator. It tells us that in the short term, if there is a 1 percent increase in production, there will be a corresponding decrease in exports by roughly Rp -1,887167 million per year. This suggests a negative relationship between production and exports in the short run. When production goes up, it appears to have a dampening effect on export levels during this immediate timeframe.

Table 3: The Short-term test Results

Selected Model: ARDL(3, 4, 3, 4, 4)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
$D(EXP_{(-1)})$	2.014260	0.830444	2.425520	0.0723
$D(EXP_{(-2)})$	1.665249	0.541870	3.073153	0.0372
$D(EXP_{(-3)})$	0.610157	0.337690	1.806857	0.1451
D(PI)	**-1.161274**	0.433261	-2.680311	0.0552
$D(PI_{(-1)})$	-0.005431	0.321587	-0.016887	0.9873
$D(PI_{(-2)})$	0.405355	0.278873	1.453545	0.2197
$D(PI_{(-3)})$	-0.191063	0.146563	-1.303624	0.2623
$D(PI_{(-4)})$	0.680389	0.237455	2.865341	0.0457
$D(INF_3)$	**0.017034**	0.009273	1.836904	0.1401
$D(INF_{(-1)})$	0.072170	0.022571	3.197419	0.0330
$D(INF_{(-2)})$	0.351819	0.103203	3.408983	0.0271
$D(INF_{(-3)})$	0.149406	0.041900	3.565747	0.0235
D(ERI)	**-13.29694**	4.111983	-3.233705	0.0319
$D(ERI_{(-1)})$	0.905854	2.279357	0.397416	0.7114
$D(ERI_{(-2)})$	10.01223	2.632589	3.803187	0.0191

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$D(ERI_{(-3)})$	5.183966	1.329655	3.898731	0.0176
$D(ERI_{(-4)})$	-0.900807	0.676105	-1.332348	0.2536
D(Prod)	**-1.887167**	2.063853	-0.914390	0.4122
$D(Prod_{(-1)})$	-0.810890	2.413333	-0.336004	0.7538
$D(Prod_{(-2)})$	4.501172	3.607733	1.247646	0.2802
$D(Prod_{(-3)})$	9.510653	2.845123	3.342792	0.0288
$D(Prod_{(-4)})$	-5.345651	2.819922	-1.895674	0.1309
C	**-0.003670**	0.172973	-0.021217	0.9841

c. Coefficient for international price (PI, –1,1612748): The coefficient for international price, around -1,1612748, sheds light on theimpact of international price on exports in the short term. If there is a 1 percent increase in international price, it will lead to an increase in exports by approximately Rp –1,1612748 million per year. This implies a negative relationship between international price and exports during the short-term period.

d. Coefficient for inflation (INF, –1,1612748): The coefficient for Inflation, around -1,1612748, sheds light on theimpact of inflation on exports in the short term. If there is a 1 percent increase in inflation, it will lead to an increase in exports by approximately Rp –1,1612748 million per year. This implies a positive relationship between inflation and exports during the short-term period. Higher inflation seems to stimulate exports in this immediate context.

e. Coefficient for Exchange Rate (ERI, – 13,29694): The coefficient related to the exchange rate of the Indonesian Rupiah to the US Dollar, approximately – 13,29694, provides insights into the dynamics of exchange rates in the short term. A 1 percent increase in the exchange rate will correspond to an increase in exports by roughly Rp – 13,29694 million per year. This suggests a positive correlation between the exchange rate and exports during the short term. As the exchange rate strengthens, exports appear to benefit from this appreciation.

In sum, this short-term equation unveils the intricate relationships between these key variables within an immediate timeframe. It offers valuable insights for policymakers and stakeholders seeking to understand andanticipate the short-term effects of changes in production, inflation, and exchange rates on export levels. Theseinsights can inform decision-making and strategy development within the realm of our analysis.

Table 4: ARDL Model Estimation Results - Long-Term

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(PI)	0.082691	0.106612	0.775623	0.4813
D(INF)	-0.179480	0.047270	-3.796944	0.0192
D(ERI)	-0.578873	0.301205	-1.921861	0.1270
D(Prod)	-1.814202	1.181484	-1.535527	0.1995
C	0.001116	0.052734	0.021155	0.9841

In the context of the long-term estimation results provided in Table 4, we can decode the implications of thesecoefficients to better understand the dynamics at play. Let's explore the long-term relationships between the variables:

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a. **Coefficient for Production (Prod, -1, 814202):** This coefficient indicates that in the long term, a change in production, specifically an increase, results in a decrease in exports. More precisely, a 1 percent increase in production will lead to a decrease in exports by approximately -1,814202. This negative coefficient implies that in the long term, there is an inverse relationship between production and exports. When production increases, exports tend to decrease.

b. **Coefficient for international price (PI, 0.082691):** The coefficient for international price reveals that in the long term, a 1 percent increase in inflation corresponds to a substantial increase in exports, approximately 0.082691. This positive coefficient suggests a strong positive relationship between international price and exports in the long run. Higher international price seems to boost exports significantly over an extended period.

c. **Coefficient for Inflation (INF, -0.179480):** The coefficient for inflation reveals that in the long term, a 1 percent increase in inflation corresponds to a substantial increase in exports, approximately -0.179480. This positive coefficient suggests a strong positive relationship between inflation and exports in the long run. Higher inflation seems to boost exports significantly over an extended period.

d. **Coefficient for Exchange Rate (ERI, -0.578873):** The coefficient associated with the exchange rate showcases that in the long term, a 1 percent increase in the exchange rate leads to a substantial increase in exports, approximately -0.5788731. Similar to the effect of inflation, this positive coefficient indicates a significant positive correlation between the exchange rate and exports over the long term. As the exchange rate strengthens, exports experience a notable boost.

e. **Constant (C, 0.001116):** The constant of 0.001116, or roughly 0.001116, signifies the baseline for exports when the other variables remain constant. It indicates that in the long term, with production, inflation, and the exchange rate held constant, exports are expected to reach approximately Rp 0.001116 million per year.

To summarize, the long-term equation offers a comprehensive view of how these variables interact over an extended timeframe. In this context: Production appears to exert a long-term negative influence on exports. Inflation demonstrates a substantial and positive long-term effect on exports. The exchange rate also displays a significant and negative long-term relationship with exports

Model Stability Test

Model stability tests are essential in the ARDL method to ensure the reliability and consistency of the structural model used. These tests help identify any potential structural breaks or instability in the model. There are two primary types of structural model stability tests: CUSUM (Cumulative Sum of Recursive Residual) and CUSUMQ (Cumulative Sum of Square of Recursive Residual).

In this context, we will focus on the CUSUM test results with the Export variable as the dependent variable. The CUSUM test is crucial for assessing the stability of the model. Below,

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Figure 3 illustrates the outcomesof the CUSUM test, enabling us to gauge the model's reliability and structural stability.

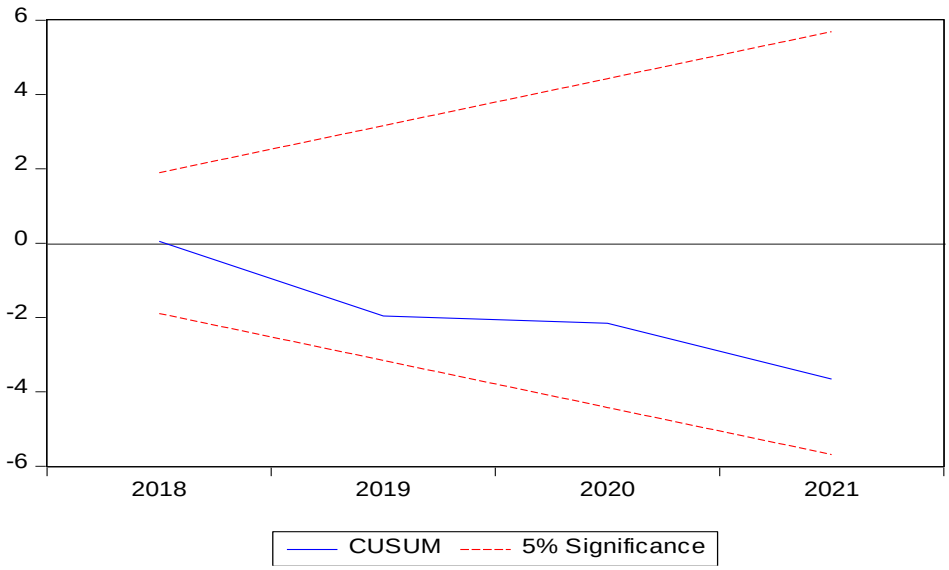

Figure 3: The outcomes of the CUSUM test

The outcomes of the CUSUM Test, as depicted in Figure, provide valuable insights into the stability of the model. It is noteworthy that the blue line does not intersect or touch the red boundary line, which is a positivesign.

This observation leads us to conclude that the ARDL model under examination is stable and successfullypasses the CUSUM test. All the variables considered in the analysis have been verified for stability. Essentially, this means that the quantity plot, represented by Wr, remains below the boundary line at the 5% significance level, affirming the model's structural integrity.

In addition to the CUSUM test, a Correlogram of Residuals Squared is presented as another diagnostic tool to assess the model's validity. This graphical representation will help further evaluate the model's overall stabilityand provide a more comprehensive understanding of its reliability and robustness.

Feasibility Analysis of Policies and Their Impact on Rubber Farmers' Income

a. Value Addition and Downstream Industry Development Policy (2014-present):

The government encourages the development of the downstream rubber industry to increase export value through fiscal and non-fiscal incentives for rubber processing industries. This policy is expected to increase export value and create jobs.

However, it requires substantial investment and time to develop a globally competitive downstream industry. The policy is feasible to continue with adjustments. A specific program is needed to facilitate small farmers' involvement in the higher value chain, for instance, through cooperatives or farmer groups capable of preliminary processing.

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b. Rubber Quality Standardization (2015-present):

The application of Standard Indonesian Rubber (SIR) aims to improve the quality of rubber exports through periodic updates to Ministry of Trade Regulation No. 53/M-DAG/PER/8/2009. This policy has a positive impact by increasing Indonesia's rubber reputation and competitiveness in the global market. However, implementation at the smallholder farmer level still faces challenges. This policy is feasible to continue but must be accompanied by training programs and technical assistance for small farmers to meet the required standards.

c. Fiscal Incentives (2016-present):

This policy provides tax reductions or exemptions for processed rubber products and tax incentives for rubber processing industries. It has a positive impact by enhancing export competitiveness and encouraging investment. However, the challenge lies in the potential short-term decline in state revenues. This policy needs reform to be more favorable to small farmers, for example, by offering tax incentives to companies that buy directly from farmers at fair prices.

d. Trade Diplomacy (2014-present):

Active participation in the International Tripartite Rubber Council (ITRC) alongside Thailand and Malaysia, and negotiation of bilateral and multilateral trade agreements. This policy positively helps stabilize prices and expand market access. However, its effectiveness is limited given the complex dynamics of the global market. The policy is feasible to continue and strengthen. Indonesia should be more proactive in international forums to promote more effective price stabilization mechanisms.

e. Exchange Rate Policy (2015-present):

Bank Indonesia participates by applying a managed floating exchange rate policy and promoting the use of hedging instruments for exporters. This policy positively helps maintain exchange rate stability and reduces risks for exporters. However, the adoption of hedging instruments by small and medium exporters remains low. The policy is feasible to continue, accompanied by guidance and assistance to small exporters.

f. Rubber Plantation Rejuvenation Program (2017-present):

A program to assist smallholder rubber plantation rejuvenation with superior seeds targets 50,000 hectares of rejuvenation per year. This has the potential to increase long-term productivity. However, the challenge is the slow implementation and limited coverage. The program is feasible to continue, but the government should focus on equitable coverage and consistent implementation.

g. Rubber Industry Cluster Development Policy (2018-present):

This policy focuses on developing integrated rubber industry clusters in key rubber-producing regions. It has a positive impact by improving supply chain efficiency and adding value. However, implementation requires complex cross-sectoral coordination. The policy is feasible to continue but needs improvement in the coordination system.

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h. Rubber Trade Digitalization (2019-present):

The policy includes developing an electronic trade platform for rubber and integrating blockchain technology to enhance supply chain transparency. This policy can improve trade efficiency and transparency but faces challenges with low technology adoption by small farmers. It is feasible to continue but must be accompanied by cooperation with academia to help small farmers adopt the technology.

i. Price Stabilization Policy (2020-present):

The price stabilization policy involves purchasing rubber from farmers by state-owned enterprises (SOEs) during price drops and developing a warehouse receipt system for rubber. This policy positively helps protect farmers' income from extreme price fluctuations but imposes financial burdens on SOEs and potential market distortions. This policy is not feasible to continue as it does not effectively address the underlying issues.

j. Climate Change Adaptation Policy (2021-present):

The program focuses on research and development of climate-resistant rubber varieties and integrating sustainable agricultural practices in rubber production. This policy can enhance the long-term resilience of the rubber industry. However, implementation requires significant time and investment. The policy is feasible to continue if accompanied by efforts to attract investment from rubber consumers.

5. CONCLUSION

This study employed the Best Linear Unbiased Estimate (BLUE) principle to ensure the robustness of the regression analysis. The chosen variables, examined through the ARDL model, exhibited a harmonious blendof characteristics that made them well-suited for inclusion in this analysis. These characteristics included co-integration, stationarity at the same order, and the absence of causal relationships between the variables. Furthermore, the short and long-term stability of the model was verified, indicating its reliability over time. One noteworthy observation made in this study was the dynamic nature of the variables.

Changes in one variable were shown to exert effects on other variables over a period of four years. Specially, Indonesia's rubber production performance has a negative and significant impact on the country's rubber export value in both the short and long term. Inflation changes have a positive and significant effect on Indonesia's rubber export value in the short term but a negative and significant effect in the long term.

Changes in international rubber prices have a negative and significant impact in the short term but a positive and significant influence on rubber export value in the long term. The exchange rate variable has a negative and significant effect on rubber export value in both the short and long term. The most influential variable on rubber exports in the short term is the exchange rate, while in the long term, production is the most influential variable.

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