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Evaluation Impact of the European Union Anti-Deforestation Regulation (EUDR) Policy: Empirical Study of Indonesian Agricultural Product Exports

Haryo Bimo Budi Indrasto[1], Hanif Nindy Asyifa[2], Trian Gigih Kuncoro[3]

[1] Economic Development, Faculty of Economic and Business, Universitas Muhammadiyah Surakarta
[2] Economic Development, Faculty of Economic and Business, Universitas Muhammadiyah Surakarta
[3] Economic Development, Faculty of Economic and Business, Universitas Muhammadiyah Surakarta

Corresponding author: b300220233@student.ums.ac.id

Abstract

Purpose: This study aims to analyze the impact of the European Union Anti-Deforestation Regulation (EUDR) on the export performance of Indonesia's agricultural products. Specifically, it evaluates how the EUDR affects export volumes to European Union (EU) member countries compared to non-EU countries. Additionally, the study examines the role of macroeconomic variables such as Gross Domestic Product (GDP), population size, exchange rates, and economic distance in shaping Indonesia's international trade patterns.
Methodology: This research employs a quantitative approach using the gravity trade model as the analytical framework. Panel data from 20 of Indonesia's trading partners, including both EU and non-EU countries, for the period 2018–2023 were used. The Poisson Pseudo Maximum Likelihood (PPML) estimation method was applied to address issues of heteroskedasticity and zero trade values in bilateral trade data. Key variables analyzed include GDP, population size, exchange rates, economic distance, as well as dummy variables for the implementation of EUDR and trading partner status (EU vs. non-EU).
Results: The findings indicate that the implementation of EUDR has a significant negative effect on the export volume of Indonesia's agricultural products to EU member countries. Conversely, the EUDR's impact on exports to non-EU countries is statistically insignificant. The analysis also reveals that GDP growth in trading partner countries positively influences export volumes, while the depreciation of the Indonesian Rupiah against the US Dollar significantly reduces export performance, particularly in sectors dependent on imported raw materials. Economic distance between countries has a minimal impact, largely due to international trade agreements that reduce trade barriers.
Applications/Originality/Value : This study provides valuable insights into the impact of international environmental regulations on the export performance of developing countries. By integrating the gravity trade model with the PPML approach, the research offers an innovative method for assessing the effects of EUDR in the context of global trade. The findings are relevant for policymakers in designing strategies to adapt to global environmental regulations, such as strengthening trade relations with non-EU countries and promoting sustainable practices in the agricultural sector. The originality of this study lies in its use of multi-country panel data and its focus on the interplay of economic, policy, and environmental variables in shaping trade patterns.

Keywords: ***EUDR, Export, Agrobased, European Union***

Introduction Section

International trade is a gateway to connect commodities from one country to other countries. International trade patterns can be explained using the gravity trade model as an instrument to see how big the international trade interaction pattern is as seen from Gross Domestic Product and the distance between the two countries. As a producing country in the plantation sector, industry in the plantation sector has become an important part of the Indonesian economy. According to research Hary et al., (2021), exports in the plantation sector are still one of the buffers for Indonesia's exports, this sector contributes to Indonesia's income. However, Indonesia's export plantation sector is faced with new challenges. In 2021 the European Union Parliament agreed to use environmentally friendly energy and reduce the use of Crude Palm Oil to a maximum of seven percent (Wirambodo et al., 2019). Due to this policy, the quantity of exports of palm oil and its derivatives is reduced. This is also confirmed by research fromSuwarno (2019) which states that the existence of restrictions on palm oil exports and their reductions has a negative impact and disrupts plantation export performance.

Then in mid-May 2023, the European Union Parliament agreed to establish the European Union AntiDeforestation Regulation (Decision (EU) 2022/591, 2022). As a result of this EUDR, every plantation product, namely palm oil, coffee, cocoa, rubber, wood, cattle, soybeans and their derivatives, every product exported to Europe must meet established standards, namely being free from deforestation practices if they are to be sold to the European Union. These export restrictions will threaten to reduce the performance of agricultural exports, especially Indonesian exports to the European Union. This is supported by research (Hanif Imaduddin et al., 2023) which states that there is a negative and significant influence from restrictions on exports of plantation products on the export performance of Indonesian Crude Palm Oil (CPO). These export restrictions create uncertainty in the export performance of the plantation sector in Indonesia. Moreover, this EUDR is a follow-up to restrictions on palm oil exports.

The European Union Deforestation-free Regulations or abbreviated as EUDR itself is an extension policy of a number of its predecessor policies which initiated concern for environmental sustainability. In response to these conditions, the EUDR aims to tighten control over products entering the European Union market, especially those that have the potential to be linked to deforestation. This includes products such as palm oil and rubber, which are often linked to environmentally damaging deforestation practices. The European Union is encouraged by the people of its member countries who are starting to press for action on increasing greenhouse gas emissions, mainly due to high consumption by the European Union(Advent et al., 2021). The European Union established EUDR because the policies and efforts that had been implemented in the global realm were ineffective and had little impact, primarily in stopping deforestation, structural changes in forest cover, and the scarcity of flora and fauna (Hendriani et al., 2023).

Several previous studies have proven that international trade access has an important role in a country's industrial performance and development (Banik & Roy, 2021). International trade is one way for a country to increase foreign exchange, when exports decrease it will have an impact on the weakening of the country's currency. This is confirmed by research from(Handoyo et al., 2023) A weak currency will also have an impact on the country's economy. In fact, in this era of globalization, international trade activities have become an arena for the existence of how strong an economy and a country are. If there are export restrictions, it will increase uncertainty about exports themselves.

According toRahman et al., (2019) export uncertainty caused by the EUDR will have an impact on the decline in export performance of the palm oil industry in Indonesia. The results of this research also state that these export restrictions will have a negative impact on the export performance of the plantation sector in Indonesia. Depreciation of the exchange rate generally has two impacts, namely that domestic goods are considered to be cheaper, where this condition will increase exports (Advent et al., 2021). The next impact of depreciation is that imported goods become more expensive, which from the perspective of domestic producers who use imported inputs, will disrupt their production and tend to reduce their export volume(Prabheesh & Laila, 2020).

This research aims to analyze the uncertainty in the export performance of the plantation sector in Indonesia as a result of the EUDR. Apart from that, this research also examines European Union regulations regarding the protection of deforestation in Indonesia. This research looks at the quantity of exports from 20 countries divided into European Union and non-European Union member countries with a time span from 2018 - 2023. The variables in this research were developed from the gravity trade model to adjust the research objective, namely by looking at the Gross Domestic Product interaction between countries. , Population between countries, relationship between country exchange rates and the US Dollar. Using the Poisson Pseudo Maximum Likelihood analysis tool which is expected to explain in more detail the patterns of international trade interactions. The author also involves various global characteristics which aim to develop strategies so that the plantation and other forestry sectors are not affected by the anti-deforation EUDR. Then prepare which export partner countries are the safest in determining the focus of international market penetration.

2 Literature Review and Hypothesis Model

2.1. Euroepan Union Anti Deforestation Regulation Between International Trade

International trade is based on the exchange of goods, services and resources between one country and another. Through international trade, people in a country can access various goods at cheaper prices or better quality, improving the welfare of society as a whole. When international trade occurs, there will be interactions between exporting and importing countries. This interaction pattern is explained in more detail in the gravity trade model which explains the interaction patterns of international trade (Rahman et al., 2019). In general, international trade is influenced by exchange rates, GDP, and the population of the transacting countries (Bahmani-Oskooee et al., 2015).

The export demand model was developed from the baseline gravity model, where demand is a function of Indonesian GDP, partner country GDP, market size, and distance between countries (Banik & Roy, 2021). This model is inspired by Newton's physical law of gravity, which states that the gravitational strength between two objects is directly proportional to the mass of each object and inversely proportional to the square of the distance between them. In the context of trade, this model assumes that the amount of trade between two countries (or regions) is proportional to the economic size of both countries' GDP and inverse to the distance between them (Martin & Pham, 2020). This function shows that the greater the economic size of two countries, the greater the pattern of trade interactions between the two. Conversely, the greater the geographic distance between two countries, the less trade is expected between them.

The Europan Union Anti-Deforestation Regulation or abbreviated as EUDR is a regulation issued by the European Union parliament to reduce consumption of products that are indicated to be the result of deforestation. One of the impacts of implementing EUDR is restrictions on export activities of agricultural sector products, which in general these restrictions will affect a country's aggregate output (Asteriou et al., 2016). This regulation aims to increase the European Union's contribution to reducing deforestation, structural changes in forest cover, as well as encouraging awareness of human rights and indigenous groups. This regulation will ensure that commodities that will circulate on the European Union market meet certain requirements. One commodity included in this regulation is coffee, palm oil, wood, soybeans, cattle, rubber and their derivative products.

H1: The implementation of the EUDR significantly reduces the export volume of Indonesian agricultural products to European Union member countries.

H1: The EUDR has an insignificant impact on the export volume of Indonesian agricultural products to non-European Union countries.

H1:The economic distance between Indonesia and its trading partner countries does not significantly influence the export volume of agricultural products, especially in the presence of international trade agreements.

2. Relationship Between Economic Scale And Exports

A country's economic scale, measured through Gross Domestic Product (GDP) and population, plays an important role in determining export performance. The gravity model of international trade assumes that the greater a country's GDP, the greater the country's ability to produce goods and services that can be exported. The increase in GDP reflects stronger economic capacity, which in turn increases the competitiveness of products in international markets and boosts export volumes. Population is also an important factor in international trade. Countries with large populations have greater labor capacity, which supports the production of goods for export. In addition, a large population indicates a strong domestic market, thereby affecting the balance between production for domestic consumption and exports. Research by Zuhaid (2024) shows that countries with large GDP and population tend to have higher trade interactions with other countries because of the large production capacity and strong purchasing power of trading partner countries. Thus, an increase in economic scale, whether through GDP or population, is generally positively related to an increase in export volume.

H1: An increase in the GDP of trading partner countries positively influences the export volume of Indonesian agricultural products, both in European Union and non-European Union countries.

2.3. Relationship Between Exchange Rate And Exports

The exchange rate has a direct influence on export performance, because changes in the exchange rate can affect the competitiveness of a country's products in the international market. Depreciation of the domestic currency, for example the Rupiah against the US Dollar, makes Indonesian goods cheaper on the global market, thereby increasing the competitiveness of export products. However, the impact of exchange rate depreciation can be two-way. On the one hand, depreciation increases the attractiveness of exports, but on the other hand, if the country relies on imports of raw materials for the production process, production costs will increase thereby reducing profits from exports. Apart from that, exchange rate volatility also creates uncertainty for exporters and importers. Unstable exchange rates make it difficult for companies to plan prices and trade strategies, which can ultimately reduce export volumes. According toMaharani & Setyowati (2024) shows that exchange rate depreciation is generally negatively related to export volume, especially in sectors that are highly dependent on imported production inputs. Exchange rate volatility is also a concern for developing countries, where sharp exchange rate fluctuations can disrupt the stability of international trade.

H1: The depreciation of the Rupiah exchange rate against the US Dollar has a significant negative effect on the export volume of Indonesian agricultural products.

2.4. Empirical Finding

Several previous studies have confirmed that the exchange rate has a significant impact on export performance. The meta-analysis study conducted Setiawan et al (2020) accommodates 41 empirical studies and all study samples prove that the exchange rate has an impact on exports. The interesting thing is that the impact of the exchange rate is quite diverse, having

both negative and positive impacts in a particular industrial sector (Umar Djalo et al., 2023). Furthermore, according to (A'nnisa et al., 2020) the severity of this decline in exports also really depends on the government's skills, each individual's decisions, and a country's health system. Supported by research (Hanif et al., 2023) export restrictions have a negative effect on export performance in partner countries.

To provide a more in-depth explanation, a dummy variable is provided to see the effect of the EUDR and the separation of European Union and non-European Union member countries. The use of the Poisson Pseudo Maximum Likelihood analysis tool is based on the fact that this analysis tool is more sensitive to zero values which are very common in international trade. Several studies that use this analytical tool are which uses this analytical tool to look at international trade agreements in South Africa (Fofack et al., 2021). Then in research(Hoang et al., 2020) which estimates the determinants of international trade between ASEAN countries and Taiwan. The use of this analytical tool is also to adjust the gravity trade model to the research objectives. The aim of this model is to identify Indonesia's agricultural trade patterns, especially after the implementation of EUDR. Furthermore, several adjustments were made to the model to better explain demand from abroad(Ayompe et al., 2021).

3. Metodology

3.1. Data and Sampling

The data used in this study are secondary data sourced from trusted platforms such as the International Trade Map, World Bank, IMF, and Geo-CEPII. The time period covered is 2018-2023, encompassing 20 of Indonesia's trading partner countries, including both European Union (EU) and non-EU countries. This time period was selected based on the implementation timeline of the EUDR regulation and the availability of the most recent trade data, making it suitable for evaluating the empirical impact of the policy. The sample selection criteria focus on Indonesia's trading partners involved in the export of agricultural products affected by the EUDR regulation. The primary agricultural products considered are coffee, palm oil, timber, soybeans, rubber, and their derivative products. Partner countries are selected based on their involvement in the trade of these commodities and their relevance in the context of EUDR. This research took 13 agricultural sector products that were threatened with restrictions by the EUDR, the product names are explained further in Table 1.

Table 1.
HS Code Definiton

HS Code	Product Name	Source
9010	Green Bean	Trade Map
9011	Roasted Coffee	
1800	Raw Chocolate	
1803	Chocolate Paste	
1805	Cocoa powder	
4401	Cut Wood	
4412	Plywood	
9403	Furniture	
1511	*Crude Palm Oil*	
3401	Soap	
4001	Raw rubber	
1301	Rubber Process	
4009	Rubber tires	

3.2. Estimation Method

This study adopts a quantitative approach using the Poisson Pseudo Maximum Likelihood (PPML) method, which was specifically chosen for its ability to handle common issues in international trade data, such as the presence of zero trade flows. PPML is highly effective in addressing zero trade flows, which frequently occur in bilateral trade analysis, especially when there are significant differences in geographic distance or trade barriers between countries. This method is appropriate for the research objective, which is to evaluate the impact of the European Union Anti-Deforestation Regulation (EUDR) on the export performance of Indonesia's agricultural products. Additionally, the gravity trade model is used as the baseline model, as it consistently explains international trade patterns based on economic size and distance between countries. The choice of the PPML method is based on the characteristics of international trade data, which often contain a large number of zero values, especially in bilateral trade affected by protectionist policies such as EUDR. This method was also selected for its robustness to heteroskedasticity, which is common in trade data. PPML offers advantages in handling zero trade flows, a frequent issue in trade with distant countries or those with limited prior trade relations

3.3. Model Equation

This research takes the initial equation from the gravity model of international trade, this model is used to see the interaction of international trade patterns between countries (Tinbergen, 1962). The general gravity trade model is:

$$FF_{iiiii} = \frac{GGGGGG_{iiiiaa} * GGGGGG_{iiiiββ}}{GG_{iiiiθθ}}$$

FF_{iiiii} explains the trade patterns of country I and country j in year t, then $GGGGGG_{iiii^{aa}}$ explains the economic scale of country I in year t. $GGGGGG_{ii^{aa}}$ describes the economic scale of country j in year t, while $GG_{iiii^{\theta\theta}}$ describes the distance between the two countries. To adjust the objectives of this research, the author adjusted the gravity model in this research with other variables to explain how the EUDR impacts the performance of Indonesian agricultural exports. For this reason, the author reduces the gravity model to equation 1 to obtain a model that better describes the objectives. To obtain good estimation results, in this study several tests were carried out to test the consistency of the estimation results. Referring to previous empirical studies (Handoyo et al., 2021), to obtain consistent estimation results in the gravity model to convert the gravity model into a dynamic model.

The estimation model in this research is:

$$llllll_{iiiiii} = ββ_0 + ββ_1 llllGGGGGG_{iiiiii} + ββ_2 llllGGllGG_{iiiiii} + ββ_3 llllRRRRRRRR_{iiiiii} + ββ_4 llllRRllllGGllllll_{iiiiii} + ββ_5 RREEGGRR_{iiiiii} + ββ_6 CCllEECCllRRCC_{iiiiii} + εε_{iiiiii}$$

In equation 1, ll_{iiiiii} is the dependent variable in the model that represents the volume of agricultural exports for commodity i in importing country j and in year t. By what happened as explained previously, 3 variables were interacted with, namely REER, GDP, and POP. This interaction process aims to overcome the problem of data repetition that occurs due to the analytical data construct used by one exporter. The REER variable explains how the Indonesian Rupiah interest rate interacts with the US Dollar and partner countries‘ interest rates with the US Dollar.

GDP and POP represent the economic scale between two countries. GDP explains the availability of capital to carry out export and import activities between countries, while POP explains market share for partner countries and production scale for exporting countries, namely Indonesia. The variable EUDR explains the range of years when the European Union Anti-Deforestation Regulation started. The value 1 in the EUDR variable explains the year when the EUDR began to be implemented, namely starting in 2022. Then the COUNTRY variable further explains whether agricultural sector exports to European Union member countries have decreased due to the EUDR. The value 0 in the COUNTRY variable represents non-EU partner countries, while the value 1 represents European Union partner countries. Further explanation of the variables will be shown in Table 2.

Table 2.
Definiton Variable

Variable	Definition	Source
$lllll_{iiiiii}$	The volume of agricultural products exported from Indonesia to partner countries (in tons)	TradeMap
$llllGGGGGG_{iiiiii}$	The relationship between Indonesia's GDP and the GDP of partner country j in year t.	World Bank
$GGllGG_{iiiiii}$	Relationship between Indonesia's population and the population of partner country j in year t.	World Bank
$RRRRRRRR_{iiiiii}$	The rupiah exchange rate against the currency of partner country j in year t. (ratio IDR-USD/country currency j-USD).	International Monetary Fund (IMF)
$RRllllGGllllll_{iiiiii}$	Economics distance $RRllllGGllllll_{iiiiii} = \frac{GGGGGG_{iiiiaa} * GGGGGG_{iiiiββ}}{GG_{iiii}}{}^{\theta\theta}$	Geo-CEPII
$RREEGGRR_{iiiiii}$	Export restriction dummy variables: Before EUDR determination: 0 After the EUDR determination: 1	
$CCllEECCllRRCC_{iiiiii}$	Indonesian trading partner dummy variables: European Union : 1 Apart from the European Union: 0	

3.4 Limitation

Several limitations of this study must be acknowledged. First, the presence of zero trade data is notable, as some products may show a high frequency of zero trade flows, potentially affecting the accuracy of estimation results. Second, the study covers the period from 2018 to 2023, which is relevant for examining the impact of the EUDR; however, more recent policy changes or trade trends beyond this timeframe are not addressed. Finally, significant variations in economic size and market structure across partner countries may influence the analysis, and these differences are recognized as a limitation of the study.

4. Result And Discusions

4.1. Result

International trade between countries is influenced by the relationship between economic growth, population, exchange rate levels, and distance between countries (Greaney & Kiyota, 2020). Then according to (Prinadi et al., 2022) the existence of export restrictions and regulations will also reduce export performance in a country. The estimated results of the model estimation on the export performance of the plantation sector using the gravity model approach with the Pseudo Maximum Likelihood analysis tool are depicted in Table 3 and Table 4.

Table 3.
PPML Result

HS Code	**9010**	**9011**	**1800**	**1803**	**1805**	**4401**	**4412**
Cons	1.493**	1.281*	0.5472	1.008	2.632***	11.951***	-0.441
lnGDP	-0.023	-0.023	-0.022	0.038	-0.069***	0.258***	0.047***

lnPOP	0.044**	0.043**	0.079***	-0.023	0.104***	-0.116**	-0.018
lnREER	-0.015	-0.015	-0.028**	-0.121***	0.053***	-0.185***	-0.064***
lnDist	0.017***	0.019***	0.097***	0.009*	-0.006	0.056***	0.018***
EUDR	0.041	0.055**	-0.003	-0.038	-0.049	-0.183	0.028
COUNTRY	-0.137***	-0.117***	-0.387***	-0.869***	-0.714***	-0.005	-0.483***
R^2	0.2603	0.2374	0.4655	0.4854	0.7638	0.6037	0.6306

Table 4.
PPML Result

HS Code	**9403**	**1511**	**3401**	**4001**	**1301**	**4009**
Cons	-2.433***	-0.67	3.211***	-6.200***	2.168*	5.659***
lnGDP	0.104***	0.031	-0.061***	0.074*	-0.104***	-0.135***
lnPOP	-0.045***	0.045***	0.065***	0.076***	0.143***	0.055**
lnREER	-0.128***	-0.023	0.026*	-0.067***	0.097***	0.033
lnDist	0.015***	-0.0067**	0.009	0.022***	0.002	0.049***
EUDR	-0.008	-0.02	0.002*	-0.085	-0.012	0.061
COUNTRY	-0.039	-0.140**	-0.375***	0.261***	-0.178*	-0.681***
R^2	0.5528	0.2443	0.6712	0.444	0.4672	0.5937

*Note: significance level ***) 1%, **) 5%, *) 1%*

The test results on the lnGDP variable from testing 13 plantation sectors showed that 7 plantation sectors showed negative coefficients and some were significant. This shows that the greater the economic scale of the partner country will reduce the quantity of plantation exports. Then in the lnPOP variable only 5 sectors show negative coefficient values, and the rest are positive. This shows that the Indonesian plantation sector is still in demand by Indonesian partner consumers. Furthermore, the lnREER variable almost all sectors show negative coefficients, this could be caused by the more the rupiah depreciates, the quantity of plantation exports will show a decline. In the lnDIST variable which shows economic scale compared to distance between countries, only two sectors show negative coefficient values, and the rest are positive. This can happen because even though the distance between Indonesia's partner countries is far, Indonesia has many Free Trade Area agreements which can eliminate international trade restrictions and barriers, plus Indonesia also has international ports which are very easy to reach.

Next, going into the impact of implementing EUDR which targets the plantation sector and its derivatives, it can be seen that in the EUDR variable, namely when 1 is the year when EUDR began to be implemented. In the test results of 13 export results, there were 5 export results that did not experience a decrease and instead saw an increase. This can happen because even though the European Union Parliament has approved the EUDR, countries other than European Union members do not implement this policy. Then the COUNTRY variable, namely when 1 is exports to European Union partners, shows a tendency for a significant decrease in export quantity.

In the results of the Pseudo Poisson Maximum Likelihood test, it was found that with increasing economic growth between exporting and partner countries, export results tend to decrease. This is based on the fact that the higher a country's income level, the lower their import consumption will be (Rahmandani & Dewi, 2023). However, on the other hand, the increase in population tends to increase the quantity of exports, this is due to an increase in demand by some

markets which still need various plantation sectors. This will benefit plantation sector exporters and can also increase the country's foreign exchange reserves. Furthermore, differences in exchange rates between exporting countries and their partners can influence the quantity of exports. The test results show that the exchange rate can reduce the quantity of exports in the plantation sector. This can be confirmed by research from Banik & Roy (2021) which states that when the exchange rate depreciates it will reduce the quantity of exports to partner countries. However, on the other hand, if we look at the economic scale compared to distance, the trade cooperation that Indonesia has carried out with its trading partner countries means that the distance that export goods must reach to buyers tends not to reduce the full amount of exports. Research by Umar Djalo et al., (2023) shows that if a country has entered into an agreement with another country regarding trade, it will increase their export performance. Indonesia can take advantage of this to further tighten its cooperation with partner countries.

Then we enter the EUDR policy which places restrictions on plantation products and their derivatives, but it turns out that European Union member countries have started to implement them, even though there are several Indonesian export products that are still consumed by European Union member countries. It can be seen in the EUDR variable which shows that not all countries have implemented export restrictions, even though it has a negative coefficient, there are no significant results. This is based on the fact that there are still many countries that need Indonesian plantation products, in fact there has been an increase in coffee and palm oil derivative commodities, namely roasted coffee and soap. Research by (Santos et al., 2022) also states that the EUDR has not had a global impact and export activities are only substituted to partner countries other than European Union member countries.

Furthermore, Indonesia's trading partners as indicated by the COUNTRY variable indicate that the European Union partner countries have implemented EUDR regulations. Of all the sectors whose exports are limited, there is one derivative product whose exports have actually increased, namely raw rubber. This is a criticism of European Union member countries because member countries should have reduced their exports of plantation products where there are indications of deforestation. According to (Prabheesh & Laila, 2020) European Union countries still need Indonesian plantation products and have not yet found countries producing plantation products that are truly deforestation-free.

4.2. Discussion

The implementation of the EUDR significantly reduces the export volume of Indonesian agricultural products to European Union member countries. The findings from the study demonstrate that the EUDR imposes a considerable negative impact on Indonesia’s agricultural export performance to EU countries. The EUDR enforces stringent regulations on products linked to deforestation, such as palm oil, rubber, and coffee, which are major agricultural exports for Indonesia. These regulations demand that commodities exported to the European Union meet specific environmental standards, including being free from deforestation practices. Consequently, this has led to a reduction in the quantity of Indonesian products that can enter the EU market, resulting in a significant decrease in export volumes. The policy thus creates substantial barriers for Indonesian exporters, especially in sectors that are heavily scrutinized for their environmental impact.

In contrast, the EUDR has an insignificant impact on the export volume of Indonesian agricultural products to non-European Union countries. The study reveals that non-EU countries do not impose the same rigorous environmental regulations as the European Union, allowing Indonesian exporters to continue trading agricultural products without significant disruptions. This is a critical finding, as it suggests that Indonesian agricultural exports are largely unaffected in regions where deforestation-linked policies like the EUDR are not in place. As a result, Indonesia can maintain its trade relationships and export volumes with non-EU countries, which continue to be important markets for its agricultural products. The absence of such regulatory barriers in non-EU markets allows trade to proceed smoothly, thereby cushioning the potential economic impact of the EUDR.

The depreciation of the Rupiah exchange rate against the US Dollar has a significant negative effect on the export volume of Indonesian agricultural products. Currency depreciation typically makes exports more competitive by lowering the relative price of goods in international markets. However, in the case of Indonesia’s agricultural exports, this advantage is offset by the rising costs of imported raw materials required for production. Many sectors within Indonesia’s agricultural industry, such as palm oil, rely on imported inputs to meet production demands. The higher costs associated with these imports, driven by the weaker Rupiah, reduce profitability and ultimately decrease the volume of agricultural exports. Thus, while a depreciated currency might theoretically enhance export performance, the associated increase in production costs can negate these benefits, particularly in sectors dependent on imports.

An increase in the GDP of Indonesia's trading partner countries positively influences the export volume of Indonesian agricultural products, both in European Union and non-European Union countries. The study confirms that stronger economic growth in partner countries boosts demand for imported goods, including agricultural products from Indonesia. A higher GDP in these countries reflects greater economic capacity, increased consumption, and stronger demand for a variety of agricultural imports. This relationship holds true for both EU and non-EU countries, indicating that the economic scale of trading partners plays a crucial role in fostering trade interactions. As partner countries experience economic growth, their markets are more capable of absorbing larger volumes of agricultural exports from Indonesia, reinforcing the importance of economic scale as a key driver of international trade.

The economic distance between Indonesia and its trading partner countries does not significantly influence the export volume of agricultural products, especially in the presence of international trade agreements. Despite geographical and economic distance, trade agreements such as Free Trade Area (FTA) arrangements help mitigate the challenges posed by distance. These agreements reduce trade barriers, facilitate market access, and promote smoother trade flows between countries. The study highlights that such agreements have been instrumental in allowing Indonesia to maintain and even enhance its agricultural exports to distant markets. By providing a framework for more efficient trade, FTAs help reduce the friction that would otherwise be caused by long geographic distances, making it easier for Indonesian products to reach international markets. As a result, the impact of economic distance on trade volumes is minimized in the presence of these agreements.

With there still being a gap for Indonesia to export plantation products to countries other than European Union member countries, the EUDR policy is still not effective and is only implemented by European Union member countries. Although in practice the restrictions on exports in the plantation sector have not been implemented in full because it has been found that European Union member countries are still importing Indonesian plantation products, namely raw rubber, which should be included in their blacklist. With this policy, Indonesia can start making policies by seeking land that is free of deforestation and start educating farmers to start using land that is free of deforestation. On the other hand, to maintain the quantity of plantation sector exports, Indonesia can carry out closer cooperation with non-EU member trading partners that have not yet implemented the EUDR policy.

5. Conclusion and Suggestions

This study systematically examines the impact of the European Union Anti-Deforestation Regulation (EUDR) on the export performance of Indonesian agricultural products, utilizing the gravity trade model with the Poisson Pseudo Maximum Likelihood (PPML) estimation technique. The empirical results indicate that the implementation of the EUDR exerts a statistically significant negative effect on Indonesia's agricultural exports to European Union member states, whereas its impact on exports to non-European Union countries is statistically insignificant. The findings further reveal that the depreciation of the Indonesian Rupiah against the US Dollar has a detrimental effect on the export volume of agricultural products, particularly in sectors heavily dependent on imported inputs. Moreover, the Gross Domestic Product (GDP) of Indonesia's trading partners is positively correlated with export volumes, reinforcing the importance of economic size in facilitating trade flows. Conversely, geographic and economic distance between Indonesia and its trading partners shows limited influence on trade volumes, especially in the presence of robust international trade agreements.

In conclusion, this research contributes to the understanding of the multifaceted effects of regulatory policies, macroeconomic variables, and trade agreements on Indonesia's agricultural export performance. The findings have important implications for policymakers, suggesting that compliance with environmental regulations such as the EUDR may pose significant challenges to Indonesia's agricultural exports, particularly to European markets. Additionally, managing exchange rate fluctuations and enhancing the competitiveness of Indonesia's agricultural sector remain critical in sustaining and expanding its role in the global trade network. Further research is recommended to explore the long-term effects of the EUDR and similar policies on both the Indonesian economy and global agricultural trade.

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