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Competitiveness and Determinants of Indonesian Plywood Export

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ABSTRACT

Since 1998, Indonesia has been the largest plywood exporter in the world. However, at this time, Indonesia's position no longer dominates; even the plywood export volume and value tend to decline. This condition is determined by many factors and is closely related to the competitiveness concept. Therefore, this study aimed to analyze the competitiveness, determinants, and export potential of Indonesian plywood. This study uses panel data from 11 major trading partner countries from 2004 to 2020. The data analysis method used in this study includes Revealed Comparative Advantage (RCA), gravity model, and trade potential analysis. The results show that Indonesian plywood has strong competitiveness in 11 major trading partner countries with a positive growth trend. The estimation of the gravity model shows that the importer population, economic distance, and the RCA index have a positive effect on Indonesian plywood exports. In contrast, Indonesia's real GDP, importers' GDP, exchange rates, and export prices are negatively affected. The population of importers is the most significant elasticity variable. Indonesia still has the potential to expand in 11 major trading partner countries because of the plywood under-trade current condition. So, development efforts on plywood exports should be aimed at under-trade countries and large populations.

1. Introduction

Indonesia is listed as one of the countries with the largest forest area in the world, consisting of 120,495,702 ha forest area with 57.12% production forest area (MoEF 2019), making Indonesia one of the world's largest exporters of tropical wood. One of the mainstay wood products in Indonesia is plywood (Simanjuntak et al. 2017). Plywood is produced from the development of wood processing downstream industries and is made from roundwood raw materials (Marbun 2015). Plywood is a composite panel made by laminating thin veneers to produce a thick and strong wood product (Komus and Beley 2017). Plywood can usually be used as a material for construction, furniture production, and the aviation industry (Fekiač et al. 2021). In addition, the plywood industries increase state revenue through exports, labor absorption, and increasing added value of timber.

Since 1988, Indonesia has been the largest exporter of tropical hardwood (Makkarennu and Nakayasu 2013; Widyastutik and Arianti 2014). From 1988 to 2002, Indonesia was the dominant exporter of plywood with an ever-increasing export value. Even Indonesia can be considered as a market leader, especially for tropical plywood (Dwiprabowo 2009; Nurrochmat and Tiryana 2000). This condition is inseparable from various policies issued by the government, such as log export that was banned in 1985, the imposition of high export taxes on sawn wood and policies that require holders of Forest Business Rights (HPH) to have a timber processing industry (Brockhaus et al. 2012; Makkarennu et al. 2014). The policy has been proven to encourage the national timber processing industry growth so that Indonesia's plywood exports increased significantly.

Indonesia no longer dominates position in the world plywood trade. The declining value of Indonesian plywood exports has occurred since 2002. Contrary, the export value of competing countries such as Malaysia tends to increase consistently and, since 2004, has exceeded Indonesia's export value **(Fig. 1)**. Even China appears as a new competitor in the world plywood trade and has become the world's largest exporter of plywood. Based on data from 2001 to 2020, China dominates the world of plywood trading with an average market share of 25.31%. Indonesia's position decreased to the second-largest exporter in the world with an average market share of 15.08%, followed by Malaysia with an average market share of 11.43% (Trade Map 2021). Moreover, Indonesia also has to compete with other exporters such as Russia, Brazil, and Finland in the world's plywood trade.
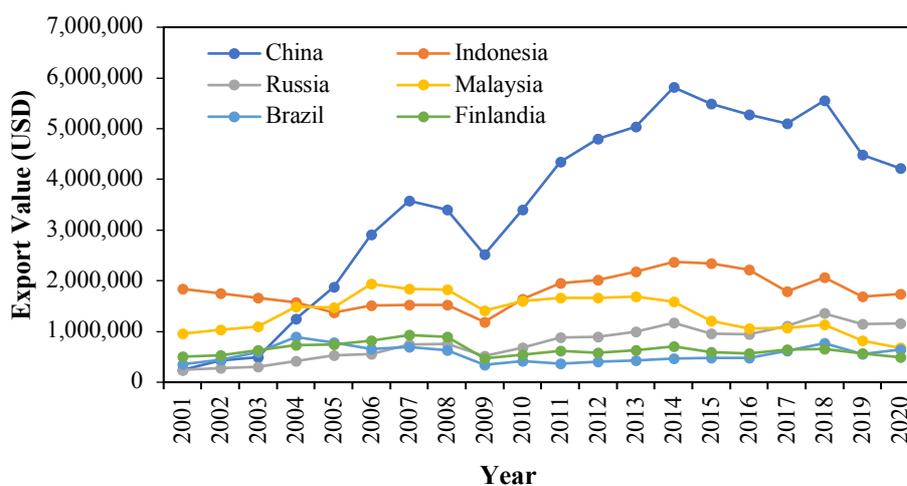

Fig 1. Plywood export value of major exporter countries (Source: Trade Map 2021).

Although still one of the world's largest plywood exporters, Indonesia's export value fluctuates with a downward trend. Indonesia's average export growth from 2001 to 2020 was only 0.66% per year, smaller than other exporters such as China (21.39%), Russia (10.21%), and Brazil (5.83%). The decrease in the value of Indonesian plywood exports is due to a supply decrease of log raw materials due to the forest resources degradation (Makkarennu et al. 2014). However, Indonesia also faces other obstacles like illegal logging that is actually smuggled and increasing the supply of raw materials in the Malaysian plywood industry (Dwiprabowo 2009). In addition, Indonesia's plywood export market is also concentrated in Asian regions such as Japan, South Korea, Saudi Arabia, and Taiwan, with a ± 50% share of exports (Marbun 2015; Simanjuntak et al. 2017).

Indonesia's position in the world plywood trade has changed from a major exporter to a fairly large exporter (mediocre) (Dwiprabowo 2009). The change in Indonesia's market share as one of the world's plywood exporters and the appearance of China as the world's top exporter of plywood are presumed to affect Indonesia's competitiveness. The competition of exporter countries in global trade that shows fluctuations in export value cannot be separated from the concept of competitiveness (Baroh et al. 2014). Competitiveness is an essential concept with two main objectives to increase a country's capacity to increase national income and provide a way to improve a country's performance related to export and import activities (Vu et al. 2019). To increase competitiveness, it is necessary to understand the competitive position of Indonesian plywood exports so that appropriate measures are known in the development of the national plywood industry.

It is important to take note of Indonesia's plywood export fluctuations that tend to decline. It might be due to export activities as part of international trade having an essential role in the economy, including the export of forestry products (Morland et al. 2020). This role makes international trade in forestry products such as plywood important to analyze. Concerning Indonesia's plywood exports, it is suspected that many factors cause a decline in exports. In addition, Indonesia exports plywood to several importing countries with different characteristics that affect Indonesia's exports to the countries. Previous empirical studies before reported that many factors affect a country's exports, including economic size (GDP), distance, exchange rate, population, language similarity, infrastructure, trade cooperation, and competitiveness (Fevriera et al. 2021; Ganbaatar et al. 2021; Nasrullah et al. 2020; Nurhayati et al. 2019; Shobande 2019; Wu et al. 2020; Yemima and Novianti 2020). To increase Indonesia's plywood exports, it is necessary to analyze the determining factors of the flow of Indonesian plywood exports to the destination countries. Therefore, the objectives of this study were to analyze the competitiveness of Indonesian plywood exports in the main destination countries, analyze the Indonesian plywood export determinants in the main destination countries, and analyze the potential export market of Indonesian plywood to the main destination countries.

2. Materials and Methods

2.1. Data Type and Resources

The study used secondary panel data. The panel data is a combined time-series data from 2004 to 2020 and covers 11 major destination countries for Indonesian plywood exports. The 11 major destination countries analyzed were selected based on the highest average volume and export value in the past 17 years, namely Japan, China, United States of America, South Korea, Saudi Arabia, Singapore, Malaysia, England, Germany, Australia, and Belgium. The plywood type analyzed is plywood with HS (Harmonized System) code 4412, namely plywood, veneered panel, and similar laminated wood. Details of the secondary data used are presented in **Table 1**.

2.2. Data Analysis Method

2.2.1. Revealed Comparative Advantage

Revealed Comparative Advantage (RCA) describes competitiveness and is widely used to analyze a country's exports (Vu et al. 2019). Competitiveness measurement using RCA was introduced by (Balassa 1965) as an indicator that shows the strength of a country's commodity

competitiveness in the global market. RCA compared the shares of commodity exports in that country's total exports to the same commodity export market in the total world exports. RCA is calculated using Equation 1 (Matkovski et al. 2022; Mizik et al. 2020; Vu et al. 2019).

$$RCAij = \frac{X_{ij}/X_{it}}{W_{ij}/W_{it}} \qquad (1)$$

where RCA_{ij} is the country's competitiveness j over commodities i, X_{ij} is commodity exports value of i from j countries, X_{it} is the total export value of all j country commodities, W_{ij} is the export value of i commodities from the world, and W_{it} is the total export value of all world commodities.

Table 1. Data type and resources

No	Data type	Sources
1	Export-Import	ITC-Trademap (Trade Map 2021)
2	Real GDP	World Bank (World Bank 2021)
3	Nominal exchange rate	UNCTAD (UNCTAD 2021)
4	Population	World Bank (World Bank 2021)
5	Geographical distance	Centre d'Etudes Prospectives et d'Information (CEPII) (CEPII 2021)
6	Export price	ITC-Trademap (Trade Map 2021)
7	Consumer price index	World Bank (World Bank 2021)

2.2.2. Gravity model

The gravity model is one of many approaches used to analyze a country's trade in modern econometrics. Leibenstein and Pöyhönen first introduced the gravity model as a model for calculating the amount of bilateral trade between two countries (Dumor and Yao 2019). The gravity model assumes that national income and distance between two trading partners play a major role in trade occurrence (Morland et al. 2020). Furthermore, the goods exports gravity model from country i to country j is explained by the size of the economy (GDP), population, and distance between countries (Yamarik and Ghosh 2005). The basic equations of gravity models are formulated as follows (Dumor and Yao 2019):

$$T_{ij} = \alpha \frac{GDP\beta 1i - GDP\beta 2j}{Dij} \qquad (2)$$

where Tij is trade volume between country i (origin country) and j (destination country), $GDPi$ is GDP of country i (origin country), $GDPj$ is GDP of country j (destination country), Dij is the distance between countries i and j, and α, β are the estimated parameters.

Gravity models in international trade studies have undergone many developments and modifications. The gravity model in this study refers to the research of (Dumor and Yao 2019; Wu et al. 2020). Using gravity models in this study aimed to analyze the factors that affect Indonesia's plywood exports to main destination countries. The variables used in this study came from adopting and modifying previous research (Ardiyanti and Saputri 2018; Ganbaatar et al. 2021; Kahfi 2016; Meiri et al. 2013; Nurhayati et al. 2019; Sabaruddin 2016). The econometric model used in this study can be seen through the following equation:

$$lnEXP_{jt} = \beta_0 + \beta_1 lnGDPX_{it} + \beta_2 lnGDPI_{jt} + \beta_3 lnRER_{jt} + \beta_4 lnPOP_{jt} + \beta_5 lnPRC_{jt} + \qquad (3)$$
$$\beta_6 lnDIST_{jt} + \beta_7 lnRCA_{jt} + \varepsilon_{jt}$$

where EXP_{jt} is Indonesia's plywood exports volume to j country in year t (ton), $GDPX_{jt}$ is j country real GDP in year t (USD), $GDPI_{jt}$ is Indonesia's real GDP in year t (USD), RER_{jt} is Indonesia's real exchange rate against the j country's currency (IDR/LCU), POP_{jt} is the importing country population (people), PRC_{jt} is Indonesia's plywood export price in j country (ton/USD), $DIST_{jt}$ is Indonesia's economic distance to country j (USD), RCA_{jt} is Indonesia's plywood export competitiveness in j country (index), β_0 is the intercept, β_1- β_7 are the parameters to be estimated, ln is the natural logarithm, t is the period (2004-2020), i is cross-section data of Indonesia, j is cross-section data of export destination countries, and ε is the error term.

One of the gravity model characteristics was the distance as an independent variable. This study used economic distance to avoid the singular matrix in econometric models. Economic distance is obtained based on (Inayah et al. 2016) calculations, as equation follows:

$$DIST_{ijt} = EO_{ij} \frac{GDPjt}{\sum GDPj} \qquad (4)$$

where $DIST_{ijt}$ is the economic distance between Indonesia and j country in the year t, EO_{ij} is the geographical distance of the Indonesian capital to the j country's capital (km), GDP_{jt} is j country GDP in year t (USD), and $\sum GDP_j$ is the total GDP of j country in the observation period (USD).

The estimated gravity model used in this study was panel data regression. The estimated regression model of the panel data had three approaches, namely Pooled Least Square Model (PLS), Fixed Effect Model (FEM), and Random Effect Model (REM) (Juanda 2009). The right model selection in the panel's data estimation was used the Chow test, Hausman Test, and LM test. The Chow test was used to choose between PLS or FEM, the Hausman test was used to select FEM or REM, and the LM test was used to select REM or PLS (Juanda 2009). Furthermore, several basic assumption tests for selected models were conducted to produce a model that meets the criteria of Best Linear Unbiased Estimator (BLUE). The tests were normality, multicollinearity, heteroscedasticity, and autocorrelation. In addition, selected models also conducted hypothesis tests (F-test and t-test). The hypothesis test aimed to test the significance of the variables contained in the model.

2.2.3. Trade potential ratio

Trade potential ratios were used to analyze future trading objectives. The trade potential between countries was measured using coefficients resulting from the gravity model equation that predicted the actual trade and trade volume of a country (Gul and M Yasin 2011). The trade potential ratio is formulated as follows (Meiri et al. 2013):

$$PP = \frac{P}{A} \qquad (5)$$

where PP is the potential trade ratio, P is the predicted trading volume from gravity model estimation, and A is the actual trading volume.

The trade potential ratio has two possibilities; firstly, if $PP > 1$, meaning that Indonesia is "under-traded" compared to its trading partners, so Indonesia still has the potential to expand trading in the country in the future. Secondly, if $PP < 1$, means that Indonesia is "over-traded" compared to its trading partners, so it has no potential trading with the country in the future.

3. Results and Discussion

3.1. Indonesia's Plywood Export Competitiveness in the Main Destination Countries

Indonesia is known as one of the plywood producers and exporters. Plywood has many functions so that it is in demand by the importer country and it can contribute to increasing Indonesia's foreign exchange. Indonesia's position as the largest plywood exporter has been transformed into a mediocre exporting country (Dwiprabowo 2009) and replaced by China with an average market share in 2004-2020 up to 28.78% (Trade Map 2021). Declining Indonesian plywood exports impact the declining market share, affecting the competitiveness of Indonesian plywood in the international market. The average market share of Indonesian plywood exports from 2004 to 2020 decreased by 1.45% per year. The decline is due to the decrease in the availability of plywood raw materials due to forest degradation (Dwiprabowo 2009), strengthening of environmental issues that attack forestry products, and intense competition with other plywood exporters. The rapid increase in the plywood price also caused plywood users to start using cheaper materials such as fiberboard, particleboard, and plywood derived from softwood. The decline in export market share is reflected in the average RCA value of Indonesian plywood exports in main destination countries because market share is interrelated to competitiveness. According to Jamil (2019), export market share can be used as one of the indicators of competitiveness.

The average RCA value shows that Indonesia's plywood exports have competitiveness in 11 major destination countries indicated by the RCA > 1 **(Table 2)**. Widyastutik and Arianti (2014) used export data from 1990 to 2009 and stated that Indonesian plywood has competitiveness in 9 major export destination countries with an RCA value > 10 or strong. According to Vu et al. (2019), if the value of RCA > 2.5, then the export competitiveness of the product is categorized as strong. Thus, Indonesia has a strong plywood export competitiveness in major destination countries with an average RCA > 2.5. The highest average RCA scores were in China (145.13), Australia (55.47), and Saudi Arabia (45.18). The smallest RCA scores were in Singapore (6.10), the United States of America (10.13), and South Korea (11.27).

Table 2. Indonesia's plywood RCA value in main destination countries in 2004-2020

Year	JPN	CN	USA	KOR	KSA	MLAS	SG	UK	DE	ASTL	BE
2004	9.08	41.19	9.36	11.28	76.64	13.93	5.49	23.83	14.26	63.61	33.56
2005	8.55	33.37	8.09	7.29	66.18	4.62	4.80	16.43	13.54	54.65	27.57
2006	8.14	40.10	7.51	5.32	91.10	6.76	4.77	8.86	11.42	68.85	30.09
2007	7.56	45.39	7.54	6.88	35.74	19.14	2.79	11.29	27.39	54.12	30.66
2008	7.80	46.67	7.21	7.26	44.80	17.13	3.91	12.30	36.01	54.62	37.97
2009	9.35	47.50	8.20	5.97	44.10	7.17	4.39	129.50	32.25	46.04	34.16
2010	9.29	74.92	9.45	4.93	51.09	8.03	4.77	8.53	28.13	46.20	40.06
2011	8.69	131.96	8.70	5.03	44.00	7.24	4.41	13.11	23.06	40.83	39.41
2012	10.02	220.32	10.47	4.67	34.44	8.10	4.34	17.06	28.78	40.02	28.54
2013	11.14	356.88	11.02	6.52	42.98	8.89	5.27	10.62	22.21	44.68	18.07
2014	12.49	448.59	9.35	9.03	32.53	8.41	5.48	13.16	24.44	41.06	28.92
2015	12.83	511.07	11.36	14.44	33.54	9.92	6.60	17.38	20.84	52.89	26.06
2016	14.63	359.60	8.59	16.44	30.05	9.74	7.58	23.09	21.65	60.29	27.61
2017	14.41	60.10	9.55	18.47	36.23	9.53	9.41	25.64	16.44	67.19	18.89
2018	16.13	15.10	14.06	18.18	38.33	7.74	10.02	29.20	15.64	68.01	19.83
2019	17.60	15.61	13.09	24.19	30.86	8.07	9.49	30.16	17.63	74.00	11.19
2020	18.59	18.89	18.57	25.67	35.49	6.03	10.02	21.65	11.23	66.00	12.79
Average	11.55	145.13	10.13	11.27	45.18	9.44	6.10	24.22	21.47	55.47	27.38
Growth (%)	4.92	9.88	6.07	8.37	-1.10	5.41	5.69	59.61	3.63	1.53	-2.59

Notes: JPN = Japan, CN = China, USA = United States of America, KOR = South Korea, KSA = Saudi Arabia, MLAS = Malaysia, SG = Singapore, UK = United Kingdom, DE = Germany, ASTL = Australia, and BE = Belgium.

The RCA value for each export destination country has a diverse trend. Indonesia's plywood export competitiveness in most major destinations is experiencing positive growth every year, except for Saudi Arabia and Belgium. Despite having the third-highest RCA average, Indonesia's average RCA growth in the Saudi Arabia market showed negative growth (-1.10%). This tendency was in line with the trend in the value of Indonesian plywood exports to Saudi Arabia, which decreased by 9.66% per year (Trade Map 2021). With the highest average RCA value, China also has a positive trend with an average RCA growth of 9.88%. As Indonesia's largest export market, Japan also has a positive trend with an average growth of 4.92% per year. The average value of Indonesian plywood exports to Japan ± 30% of Indonesia's total plywood exports. The positive trend of RCA growth indicates the prospects and open opportunity for improvement of Indonesian plywood exports (Malau et al. 2021). Although the export value and market share of Indonesian plywood exports tend to fall, the value of Indonesia's RCA, based on calculations, is known to be relatively high. Likewise, Malau et al. (2022) also reported that Indonesia's RCA is higher than other competing countries, including Malaysia, China, Russia, Finland, and Brazil. The RCA calculation could cause it is based on a comparison between the export market share of a commodity against the export market share of all commodities in the country (Vu et al. 2019). The ratio between plywood exports and the total exports of all Indonesian commodities is quite large. The ratio of plywood exports and total exports of all Chinese commodities is very small, while China is the largest exporter of plywood. Plywood is not China's main export commodity; it is dominated by technology-based industrial products such as data processing machines and communication equipment with very high competitiveness (Sabaruddin 2014). To develop the competitiveness of Indonesian plywood exports, it is necessary to analyze the factors that affect exports which will be discussed in the next section.

3.2. Factors Affecting Indonesia's Plywood Exports in the Main Destination Countries

The gravity model was used to analyze Indonesia's plywood exports affecting factors in the main destination countries. The selection of used models in the analysis uses the Chow and Hausman tests. Both Chow tests showed a real probability value of 1% or FEM better than PLS. However, the Hausman test showed invalid probability values because there were independent variables that did not qualify for a random effect. This condition can occur because Eviews software automatically rejects the Hausman test after the research data does not meet random effect requirements (Hendra and Hartomo 2017). Therefore, it can be concluded that FEM is the best model (**Table 3**).

Table 3. Selection of the best models

Type of test	Chi-square probability	Decision
Chow test	0,0000**	FEM
Hausman test	1,0000	FEM

Note: ** Significant at 1% level.

A classical assumption test was conducted to produce the Best Linear Unbiased Estimator (BLUE) model in the selected model. The normality test is used to check the error-term distribution in the model using Jarque-Bera's probability values. Jarque-Bera's probability value shows a value of 0.8891 > significance level of 5%, meaning that the term error has been distributed normally. Multicollinearity tests are used to measure correlations between independent variables. The

analysis results showed the value of correlation between independent variables <0.8, so it can be concluded that there is no multicollinearity. The model used has also been weighted with a SUR cross-section to address deviations in classical assumptions of heteroscedasticity and autocorrelation.

The estimated results in **Table 4** show a probability value (F-statistic) smaller than the significance level of 5% (0.000<0.05) so that it can be concluded that the model is worth using or that there is at least one significant independent variable in the model. The R-squared model value of 0.9928 meaning that the model built can explain the diversity of Indonesian plywood exports by 99.28%. In contrast, the rest is explained by other variables that are not included in the model. The t-test results showed that all independent variables significantly affected Indonesia's plywood exports to the main destination countries.

Table 4. Estimated results of factors affecting Indonesian plywood exports

Variable	Coefficient	Probability
C	-8.510817	0.4064
LnGDPI	-0.567506	0.0000**
LnGDPX	-9.354275	0.0000**
LnRER	-0.998860	0.0000**
LnPOP	13.76251	0.0000**
LnPRC	-0.387387	0.0000**
LnDIST	10.08110	0.0000**
LnRCA	0.681963	0.0000**
R-squared	0.992870	
Adjusted R-squared	0.992152	
Probability (F-statistic)	0.000000	

Note: ** Significant at 1% level.

Indonesia's real GDP as an exporter has a negative and significant effect on Indonesia's plywood exports. The variable coefficient of real GDP of -0.5675 means that an increase in Indonesia's real GDP by 1% will cause the fall of Indonesian plywood export volume to the main destination countries by 0.5675%, ceteris paribus. Real GDP describes the level of a country's economy. In other words, increasing Indonesia's GDP will increase the domestic people's purchasing power and consumption. The increase in domestic plywood demand and consumption will further impact the reduced supply of plywood that will be exported, and it can cause a decrease in Indonesia's exports. In line with the results of this study, (Meiri et al. 2013) also reported that the GDP of exporting countries has a negative effect on Indonesia's cocoa exports in 9 major destination countries. (Wardani and Mulatsih 2017) also reported that the GDP of exporting countries has a negative effect on Indonesia's tire exports in Latin America. Previous studies also reported that exporters' GDP negatively affects exports (Rosyadi et al. 2021; Subhan et al. 2021).

The real GDP of the importing countries also negatively and significantly affects Indonesia's plywood exports, but the coefficient marks of this variable do not fit the hypothesis. The real GDP coefficient of the importing countries of -9.3542, meaning that the increase of 1% in the GDP of the importing country will cause a decrease in the export of Indonesian plywood by 9.3542%, ceteris paribus. This result probably occurs because the economic increase of the importing country causes a shift in the use of plywood types from other countries with better quality. Likewise, Simanjuntak et al. (2017) also found a lower elasticity of demand and expenditure of Indonesian plywood than in Malaysia due to the low quality of Indonesian plywood. A negative

relationship between the importer's GDP and export volume is also possible if the type of exported goods is inferior goods (Carolina and Aminata 2019). Therefore, the increase in the importer's real GDP reduces the demand for Indonesian plywood. Consumers with higher income tend to choose similar products from other countries with better quality.

Exchange rate variables have a negative and significant effect on Indonesia's plywood exports. The exchange rate is the rupiah exchange rate against the currency of the export destination country. The exchange rate variable coefficient of -0.9988, meaning that if the rupiah exchange rate depreciates by 1%, it will cause a decrease in Indonesian plywood exports by 0.9988%, ceteris paribus. Theoretically, currency depreciation makes the price of Indonesian export goods in the international market seem to be cheaper. Under the law of demand, the decrease in the price of goods will be responded to by an increase in demand for the goods. Therefore, currency depreciation should impact increasing exports (assuming normal goods, ceteris paribus). Similar to this result, Inayah et al. (2016) reported that the exchange rate has a negative effect on Indonesia's pepper exports. Kanaya and Firdaus (2014) also concluded that the exchange rate has a negative effect on Indonesia's agarwood wood exports. Our results were in line with the previous studies that the exchange rate negatively affected exports (Kahfi 2016; Ridwannulloh and Sunaryati 2018; Riyani et al. 2018; Syachbudy et al. 2018). Kahfi (2016) explained that this condition could occur because of the depreciation of the rupiah currency that causes the lower price of Indonesian export goods for the international market so that consumers spend less money than before depreciation (assuming no change in the quantity purchased).

The importing country's population has a positive and significant effect on Indonesia's plywood exports in the main destination countries, with a coefficient of 13.7625. This coefficient means that the 1% increase in the importing country's population will increase Indonesia's plywood exports by 13.7625%, ceteris paribus. The population of the importer country becomes the variable with the greatest elasticity compared to other variables. The population of the importing country illustrates the potential market demand and consumption so that the increase in population will have a positive impact on the demand for Indonesian plywood. Demand will increase along with the population because plywood has many uses for building construction, transportation, and furniture processing. Similar findings in the Maulana and Kartiasih (2017) study reported that importing countries' population positively affects Indonesia's processed cocoa exports. Kanaya and Firdaus (2014) also concluded that the population of the importing country has a positive effect on Indonesia's turmeric exports. This finding is also supported by some previous studies that state that the importing countries' population has a positive effect on exports (Fevriera et al. 2021; Inayah et al. 2016; Subhan et al. 2021; Wardani and Mulatsih 2017)

Indonesia's plywood export price has a negative and significant effect on Indonesia's plywood exports to the main destination countries, according to economic hypotheses and theories. Based on the law of demand, price and demand have a negative relationship; when the price rises, the demand for the goods will fall. The export price coefficient has a value of -0.3873, meaning that every 1% increase in plywood prices will cause a fall of 0.3873% in Indonesian plywood exports, ceteris paribus. Nibras and Widyastutik (2019) also reported that the increase in export prices would decrease the Indonesian palm oil exports volume. This study reinforces previous research that concluded the negative influence of export prices on export volumes (Maulana and Kartiasih 2017; Nurhayati et al. 2019). Furthermore, the coefficient of gravity model results shows that plywood is an inelastic item, so the policy of lowering prices will cause a decrease in export

receipts. Therefore, to increase export receipts, it is necessary to maintain the stability of plywood export prices.

The economic distance as the main driver of the gravity model has a positive and significant effect on the Indonesian plywood export volume with a coefficient of 10.0811. This coefficient means that if the economic distance increases by 1%, the export volume will increase by 10.0811%, ceteris paribus. Economic distance describes the transportation costs for the delivery of export goods to the destination country so that the longer the distance traveled will increase transportation costs. Therefore, increasing transportation costs will increase goods prices and decrease export volume. The results of this study do not fit the hypothesis. This condition is possible because most of the world's plywood producers are in Asia, such as Indonesia, China, and Malaysia. Hence, importers continue to trade to meet their needs despite increasing economic distance. Some reasons heavily influenced the trading, including political reasons (Atici and Guloglu 2006), trade relations or agreements (Abidin et al. 2014), and product characteristics (Shepherd and Wilson 2013). Meiri et al. (2013) explained that these conditions can also occur because the high economic distance is offset by high selling prices as well so that the exporter still chooses to trade with countries that are further away. For example, Indonesia's export destination countries with longer distances, such as the United States of America, United Kingdom, Germany, and Belgium, actually have higher export prices. Further, Suryana et al. (2014) stated that distance is not a significant obstacle to Indonesia's cocoa powder exports because it can be stored for a long time. In line with this, plywood also has a relatively long shelf life so that the importer country can store plywood in large quantities. In line with this results study, Hartanto (2021) reported that the increase in economic distance positively affects Indonesia's export of Tunas, Skipjack Tunas, and Eastern Little Tunas. Khaliqi et al. (2018) also stated that the increase in transportation costs also increases exports due to the uniqueness of Indonesian shrimp types that are not produced by other countries.

RCA has a positive and significant effect on Indonesia's plywood exports with a coefficient of 0.6819. The coefficient means that if the RCA increases by 1%, Indonesia's plywood exports will increase by 0.6819%, ceteris paribus. RCA is a competitiveness index that illustrates the comparative advantages of Indonesian plywood in export destination countries. Competitiveness is the ability of a country's commodities to enter and survive in the international market. Therefore, commodities with higher competitiveness value will impact increasing demand to increase export volume. Maulana and Kartiasih (2017) stated that increasing export competitiveness of a commodity would be more in demand by consumers in the importer country so that demand for the commodity will also increase. In line with these results, Hartanto (2021) and Yemima and Novianti (2020) also found a positive influence of competitiveness (RCA) on increasing export volumes.

3.3. Indonesian Plywood Potential Trade in the Main Destination Countries

The estimation results of the gravity model are used to analyze the potential of Indonesia's plywood trade by comparing the trading volume of the gravity model to the actual trading volume. The results show that the ratio of Indonesia's plywood trade potential in all destination countries is > 1 **(Table 5)**, meaning that Indonesia's plywood trade in destination countries is in an "under trade" condition. Therefore, Indonesia still has the potential to expand trade in these countries. Countries with the largest trade potential are South Korea (9.00), China (8.13), and Japan (7.82).

On the other hand, the countries with the smallest trade potential are the United States of America (1.03), Malaysia (1.19), England, and Germany (1.24).

Table 5. The ratio of Indonesian plywood potential trade in the main destination countries

No	Country	Average potential trade
1	Japan	7.82
2	China	8.13
3	United States of America	1.03
4	South Korea	9.00
5	Saudi Arabia	5.30
6	Malaysia	1.19
7	Singapore	7.60
8	United Kingdom	1.24
9	Germany	1.24
10	Australia	4.67
11	Belgium	2.31

In the context of developing plywood exports, Indonesia can focus on "under-trade" markets such as South Korea, China, and Japan. These three countries are also classified as large real GDP countries, so they have great potential for export market development. These three countries are also the main focus of Indonesia's plywood exports. The development of China's furniture and processed wood industries requires plywood as raw material. On the other hand, China is also developing a plywood re-export industry to require large quantities of plywood. The value of Indonesian plywood exports to China has increased every year, supported by China's growing economic development. However, Indonesia has to compete with Russia, Taiwan, and Malaysia to win the competition in the Chinese market. Currently, Indonesia is not a major exporter of China and is expected to increase its competitiveness to win the competition over other exporters. For a long time, Japan has also become the main export market for Indonesian plywood, with an export share of ± 30% of Indonesia's total plywood exports (Trade Map 2021). However, currently, Indonesia has to compete with Malaysia and China for plywood exports in the Japanese market. Declining in demand for Indonesian plywood in the Japanese market was due to the low-quality factor compared to other competing countries (Simanjuntak et al. 2017).

Countries with relatively limited trade potential, such as the United States of America, Malaysia, United Kingdom, and Germany, also need attention. The low potential of Indonesia's plywood trade to the United States of America, United Kingdom, and Germany is caused by non-tariff barriers related to environmental sustainability issues (WTO 2021). Non-tariff policies have become an important issue in international trade and have been widely implemented, especially in developed countries (Ardiyanti and Saputri 2018; Darhyati et al. 2017). The forestry sector is one sector that implements many non-tariff policies in the form of Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) (Sun et al. 2010; Turner et al. 2008).

4. Conclusions

Indonesian plywood has strong competitiveness in 11 main destination countries from 2004 to 2020. Indonesia's export competitiveness growth also shows an increasing trend, except in Saudi Arabia and Belgium. The development of Indonesian plywood exports can be carried out by factors that significantly affect exports in the main destination countries. The importing country's

population, economic distance, and competitiveness index (RCA) positively and significantly impact Indonesia's plywood exports. Meanwhile, Indonesia's real GDP, importers' real GDP, exchange rates, and export prices have a negative effect on Indonesia's plywood exports. The population of the importing country is the variable with the highest elasticity, so efforts to develop Indonesian plywood exports should be directed to countries with large population growth. Population growth will align with the increasing need for construction buildings, transportation equipment, and furniture using plywood as the main raw material. Indonesia also has the potential to expand trade to partner countries because of the current under-trade condition. Therefore, trade expansion should be directed to countries with great potentials, such as South Korea, China, and Japan.

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