Agro Bali : Agricultural Journal
Vol. 7 No. 1: 92-103, March 2024
e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

Indonesia's Pulp Export Performance In the China Market: An Analysis Using Almost Ideal Demand System Approach

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Article history: submitted: December 16, 2023; accepted: March 25, 2024; available online: March 30, 2024

Abstract. Indonesia is one of the world's leading pulp producers. Both domestic consumption and global demand are increasing annually. As Indonesia seeks to meet the escalating global demand for pulp raw materials, China is emerging as a major destination for its exports, which underscores the strategic importance of this market. This study aims to evaluate the comparative advantage of Indonesian pulp exports and to identify the price, cross-price and expenditure elasticities of pulp demand in the Chinese market. Using the Revealed Comparative Advantage (RCA) method and the Linear Approximation-Almost Ideal Demand System (LA/AIDS) model, this research analyzes annual time series data covering the period 2003-2022, focusing on the quantity and export value of chemical pulp (HS 470329). The results show that Indonesian pulp has a comparative advantage in the Chinese market, as indicated by Indonesia's RCA index greater than one. However, this comparative advantage is declining over time. At the same time, China's sustained increase in pulp consumption underscores the intensified competition among pulp-exporting countries for market share in China. Using the LA/AIDS model, the estimation results highlight a different dynamic in the Chinese pulp market: Japanese pulp emerges as a complementary product to Indonesian pulp, while Thailand and Brazilian pulp act as substitutes. These findings have valuable strategic implications for Indonesian policymakers and industry stakeholders in managing the complexities of global pulp trade dynamics.

Keywords: almost ideal demand system; pulp export; revealed comparative advantage

INTRODUCTION

Indonesia's Gross Domestic Product (GDP) is heavily influenced by the performance of the non-oil and gas processing industry. The non-oil and gas processing industry contributes 16.3% to Indonesia's GDP, as reported by the Ministry of Industry (2023). The pulp and paper industry, which is part of the non-oil and gas processing industry, also contributes positively to Indonesia's GDP. The export value of the pulp and paper industry until July 2023 was approximately USD 646.28 million, which places it at the eighth largest export value after the industries of food, basic metals, chemicals, automobiles, garments, and electrical equipment. The pulp industry has experienced rapid growth since the 1990s and is expected to continue to grow positively until 2023.

The installed capacity of the pulp industry increased from 8.25 million tons in 2014 to 11.255 million tons in 2017 (APKI 2019). This growth in installed capacity was driven by growth in Indonesia's domestic consumption, which increased from 7.05 million tons in 2014 to 7.54 million tons in 2019. Meanwhile, Indonesia's total pulp exports also experienced growth, from 3.5 million tons in 2014 to 4.7 million tons in 2019. This indicates an increase in world consumption of Indonesian pulp products.

Indonesia has exported two types of pulp: chemical pulp, including dissolving grades (HS 4702), and chemical pulp resulting from soda or sulfate processes, but excluding dissolving grades (HS 4703). Pulp with HS code 4702 is not exported continuously every year, whereas HS 4703 pulp is exported quite regularly with sufficient quantities and value. Therefore, this study will focus on HS 4703 pulp.

Indonesia is one of the largest exporters of HS470329 pulp in the world and is the second largest exporting country after Brazil. The Indonesian pulp industry has a strong structure considering that the Indonesian pulp industry is not dependent on importing raw materials. The primary raw materials for pulp production in Indonesia are wood chips and pulpwood, which can be sustainably produced in Indonesia. Indonesia's equatorial location allows industrial forest plantations to maximize photosynthesis, which in turn, gives Indonesia a comparative advantage

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

over pulp producing countries from four-season countries (Wulandari 2007).

The main consumer of Indonesian pulp exports (HS 470329) is China, which accounts for over 50% of Indonesia's total exports. Approximately 20-30% of Indonesia's total exports are consumed by the Korean and Indian markets (Figure 1). The value of pulp imports from Indonesia to the Chinese market has fluctuated, with a tendency to increase between 2003 and 2022. The value of pulp imports from Brazil, the main competing country in the Chinese market, has also been fluctuating, with a tendency to rise during the same period (Fig. 2), this indicates a strong competition between the two countries in the Chinese market.

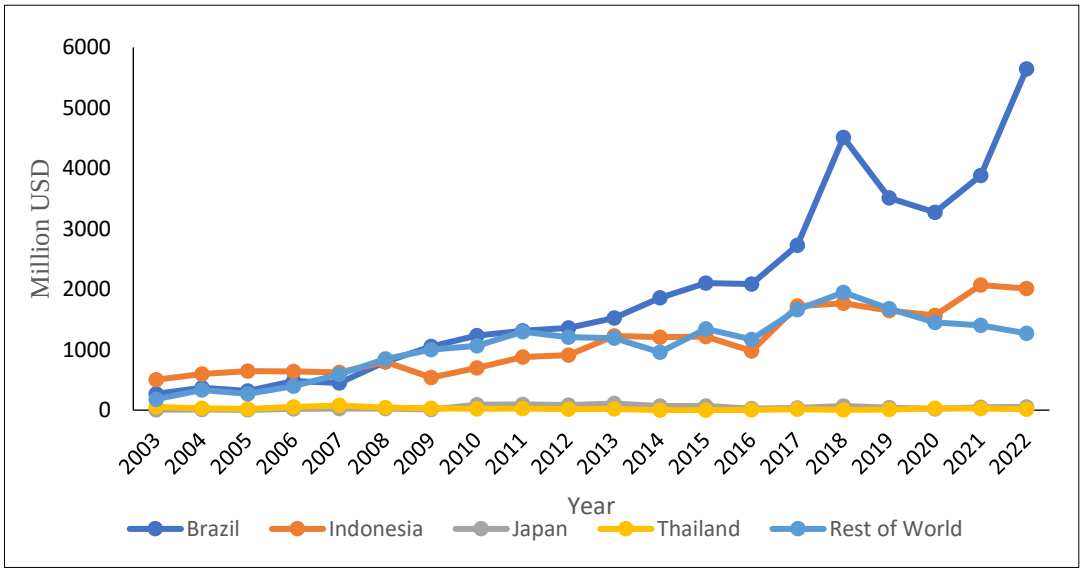

Figure 1. The value of China's pulp imports from Indonesia, Japan, Thailand and Brazil in the period 2003-2022 (Trade Map 2023)

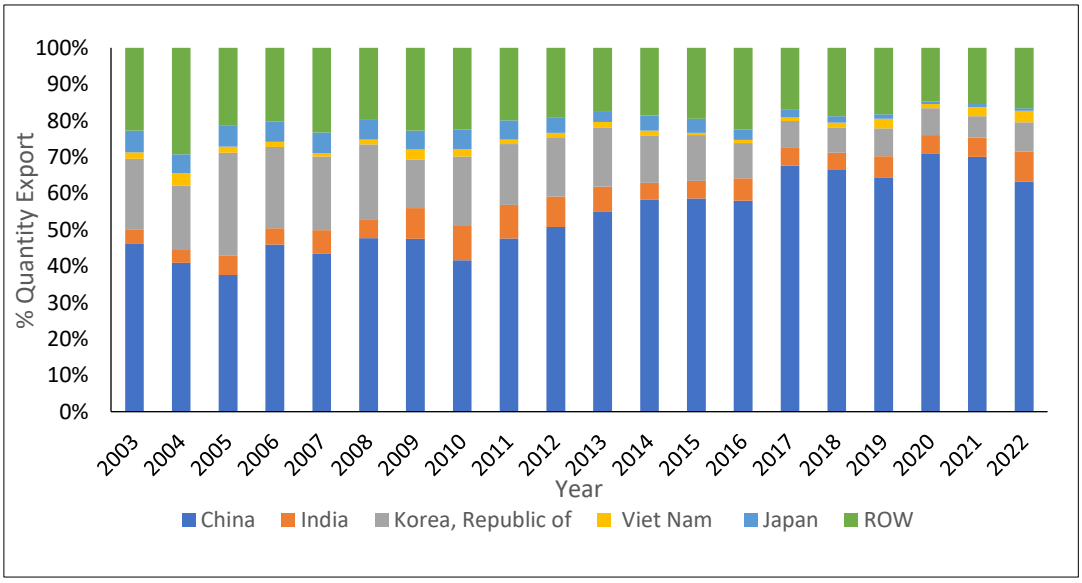

Figure 2. Percentage of Indonesia's Export Volume to the World (Trademap 2023)

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

The largest Chinese absorption of pulp from Indonesia occurred in 2020-2021. This period was characterized by the COVID-19 pandemic and high demand for packaging paper in China. Indonesia has become an important supplier in meeting China's needs (Huiying *et al.* 2023). The China-US trade war has also led China to limit the US as a pulp supplier to China (Christopher *et al.* 2004). Brazil and Indonesia are two countries that have the big potential to supply pulp to China (Gunawan *et al.* 2017 and Yishan *et al.* 2016) but the competition between these two countries in meeting China's needs is strongly influenced by their comparative advantages and the elasticity of their goods and services.

The relationship between a country's comparative advantage and elasticity is influenced by various economic factors that impact market responsiveness to price changes, cross-demand, and spending on the country's products. The concept of comparative advantage explains how a country can efficiently allocate its resources in an open economy (Ramadhan and Yasin 2023). Elasticity, on the other hand, measures the responsiveness of demand and expenditure to price changes. The elasticity of exported products can be affected by a country's comparative advantages in a specific industry, leading to different consequences in demand and expenditure (Daniele *et al.* 2022). Understanding these dynamics is crucial for policymakers and entrepreneurs in making informed decisions about market structure, pricing strategies, and policy interventions (Marabuci A 2023).

China is the main export destination for Indonesian pulp. Therefore, it is crucial to study the comparative advantage of Indonesian pulp in the Chinese market. This study aims to assess the comparative advantage of Indonesian pulp exports and determine the price, cross-price, and expenditure elasticities of pulp demand in the Chinese market.

METHODS

The methods used in this study consists of the Revealed Comparative Advantage (RCA) method, which analyzed export comparative advantage; and the Almost Ideal Demand System (AIDS) model, which determined price, cross-price, and expenditure elasticities of pulp demand in the Chinese market.

Comparative and Competitiveness Analysis

The theory of comparative advantage, first proposed by David Ricardo, suggests that countries should focus on producing goods and services in which they have a comparative advantage relative to other countries. In 1989, Bela Balassa introduced the RCA method to compare comparative advantages between countries producing similar commodities. A country has a comparative advantage if its RCA index value is greater than 1, and a competitiveness below the world average if its RCA index value is less than 1 (Laursen, 2015). The RCA index value is calculated using the following equation:

$$RCA = \frac{X_{ad}/X_a}{X_{wd}/X_w} \quad \ldots. 1)$$

Remarks:
Xad = Total exports of Indonesian pulp commodity to the Chinese market
Xa = Total exports of Indonesia to the Chinese market
Xwd = Total world exports of pulp commodities to China
Xw = Total world exports to the Chinese market

Demand Analysis

The AIDS method is an econometric approach to the modeling of consumer behavior with respect to goods and services. The method was first introduced in 1980 by Canadian economists Angus Deaton and John Muellbauer. It is considered the most flexible model for this purpose. The advantage of the model lies in its ability to explain the nature of complementarities and substitutions between goods and services. It enables us to

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

understand how changes in the price of a commodity can affect the demand for that commodity and other commodities. This model has been widely used in various studies to understand consumer behavior, estimate price elasticity, and plan economic policies. Studies that have utilized this method include research by Alexander *et al.* (2023), Izzatin *et al.* (2023), Mahdi and Suprehatin (2021), Purnamasari *et al.* (2014) and Rifin (2013) for agricultural goods.

A preference known as the price-independent generalized logarithmic (PIGLOG) was used by Deaton and Muellbauer (1980). This preference allows for exact aggregation over consumers and can represent market demand as if it were the outcome of decisions by rational representative consumers. The cost or expenditure function required to achieve a certain level of utility (u) at a certain price (p), which is denoted by c(u,p), is then formulated as formula 2.

$$\log c(u,p) = (1-u)\log\{a(p)\} + u\log\{b(p)\} \quad (2)$$

To obtain a flexible form of the cost function, it is necessary to add sufficient parameters as shown in equations (3) and (4) so that at each point the derivative value of the function can be equated to any cost function.

$$\log a(p) = a_0 + \sum_k a_k \log p_k + \tfrac{1}{2}\sum_k \sum_k y_{kj} log\ p_k\ log_{p_j} \quad (3)$$

$$\log b(p) = \log a(p) + \log a\,(p) + \beta_0 \Pi_k p_k^{\beta_k} \quad (4)$$

Equations (3) and (4) are then substituted into equation (2) so that they obtain:

$$\log c(u,p) = a_0 \sum_k a_k \log p_k + \tfrac{1}{2}\sum_k \sum_k y_{kj} log\ p_k\ log_{p_j} + \text{u}\ \beta_0 \Pi_k p_k^{\beta_k} \quad (5)$$

Where αi,βi and yij are parameters.

The demand function can be directly obtained from equation (5). This is a property characteristic of the cost function (Mokleiv and Nygård, 2012). The demand function can be obtained from the derivative of the cost function with respect to price: $\partial c(u,p)/\partial p_i = q_i$. The left and the right-hand sides of this demand function equation (q_i) are then multiplied by $p_i/c(u,p)$ so that equation (6) is obtained:

$$\frac{\partial \log c(u,p)}{\partial \log p_i} = \frac{p_i q_i}{c(u,p)} = w_i \quad (6)$$

Where w_i is the *budget share* of the i-th commodity. Logarithmic differentiation of equation (5) yields equation (6) budget share as a function of price and utility (7):

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i u \beta_0 \prod_k p_k^{\beta_k} \quad (7)$$

Where. $\gamma_{ij} = \frac{1}{2}\left(\gamma_{ij}^* + \gamma_{ji}^*\right)$

For consumers who maximize their utility, then total expenditure (x) will be equal to $c(u,p)$. Indirect utility functions are then obtained by inverting this equality. If the inverse is done to equation (5) and the result is then substituted into equation (6) then the budget shares are obtained as a function of p and x (equation 7), known as the AIDS demand function in the form of budget share.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log\left(\frac{x}{P}\right) \quad (8)$$

Where P is the price index, which is defined as in equation (9). For linear approximation AIDS (LA/AIDS), P^* is formulated as in equation (10). This P^* is known as Stone's geometric price index.

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k \sum_j \gamma^*_{kj} \log p_k \log p_j \quad (9)$$

$$\log P^* = \sum_k w_i \log p_i$$

Three groups of restrictions must be met as required for LA/AIDS demand function to be a homogenous of degree 0 in price and total expenditure according to *Slutsky's symmetry*, namely adding-up (equation 10), homogeneity (equation 11), and symmetry (equation 12) as follows:

$$\sum_{i=1}^{n} \alpha_i = 1, \sum_{i=1}^{n} \gamma_{ij} = 0, \sum_{i=1}^{n} \beta_i = 0 \quad (10)$$

$$\sum_{j=1}^{n} \gamma_{ij} = 0 \quad (11)$$

$$\gamma_{ij} = \gamma_{ji} \quad (12)$$

Besides Indonesia, Brazil, Japan and Thailand are the pulp exporters in the Chinese market. Therefore, four demand functions were estimated in this study that represent the demand functions of Indonesia, Japan, Thailand and Brazil in the Chinese market. To satisfy the restrictions stated above which implying total budget share equals to 1 ($\sum_i w_i = 1$), a rest of the world import price was included in the equation system, as formulated in equations (13-16) below:

$$w_1 = \alpha_1 + \gamma_{11} \log p_1 + \gamma_{12} \log p_2 + \gamma_{13} \log p_3 + \gamma_{14} \log p_4 + \gamma_{15} \log p_r + \beta_1 \log\left(\frac{x}{P^*}\right) + \varepsilon_1 \quad (13)$$

$$w_2 = \alpha_2 + \gamma_{21} \log p_1 + \gamma_{22} \log p_2 + \gamma_{23} \log p_3 + \gamma_{24} \log p_4 + \gamma_{25} \log p_r + \beta_2 \log\left(\frac{x}{P^*}\right) + \varepsilon_2 \quad (14)$$

$$w_3 = \alpha_3 + \gamma_{31} \log p_1 + \gamma_{32} \log p_2 + \gamma_{33} \log p_3 + \gamma_{34} \log p_4 + \gamma_{35} \log p_r + \beta_3 \log\left(\frac{x}{P^*}\right) + \varepsilon_3 \quad (15)$$

$$w_4 = \alpha_4 + \gamma_{41} \log p_1 + \gamma_{42} \log p_2 + \gamma_{43} \log p_3 + \gamma_{44} \log p_4 + \gamma_{45} \log p_r + \beta_4 \log\left(\frac{x}{P^*}\right) + \varepsilon_4 \quad (16)$$

Where $\alpha_i, \beta_i, \gamma_{ij}$ are parameters and,

w_1 = Indonesia's share of pulp export value in the Chinese market.
w_2 = Japanese's share of pulp export value in the Chinese market
w_3 = Thailand's share of pulp export value in the Chinese market.
w_4 = Brazilian's share of pulp export value in the Chinese market.
p_1 = Price of pulp exports from Indonesia in the Chinese market (US$/ton)
p_2 = Price of pulp exports from Japan in the Chinese market (US$/ton)
p_3 = Price of pulp exports from Thailand in the Chinese market (US$/ton)
p_4 = Price of pulp exports from Brazil on the Chinese market (US$/ton)
p_5 = Price of pulp from *a rest of the world* (*ROW*) in the Chinese market (US$/ton)
x = Total value of pulp imports by China (US$)
P^* = *Stone's geometric price index*

In this study three groups of parameter restrictions are presented in detail in Table 1. Based on the parameters that have been estimated, the own-price elasticity, cross-price elasticity, and expenditure elasticity are then obtained using formulas as expressed in equations (17), (18), and (19), respectively.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

1. Adding up:

$$\sum_{i=1}^{n} \alpha_i = 1, \sum_{i=1}^{n} \gamma_{ij} = 0, \sum_{i=1}^{n} \beta_i = 0 \quad (17)$$

2. Homogeneity:

$$\sum_{i=1}^{n} \gamma_{ij} = 0 \quad (18)$$

3. Symmetry:

$$\gamma_{ij} = \gamma_{ji} \quad (19)$$

The restrictions on this model can be seen in Table 1. After that, elasticity calculations were carried out consisting of uncompensated (own price), compensated (cross price), and expenditure (expenditure). The formula used is as follows.

1. Uncompensated elasticity

$$e_{ij} = -\delta_{ij} + \frac{\hat{\gamma}_{ij}}{\bar{w}_i} - \hat{\beta}_i \frac{\bar{w}_j}{\bar{w}_i} \quad (20)$$

2. Compensated elasticity

$$e_{ij}^{*} = -\delta_{ij} + \frac{\hat{\gamma}_{ij}}{\bar{w}_i} + \bar{w}_j \quad (21)$$

3. Expenditure elasticity

$$\eta_i = 1 + \frac{\hat{\beta}_{ij}}{\bar{w}_i} \quad (22)$$

Table 1. The restrictions on various version of the processed tuna product AIDS Model

Adding up	Homogeneity	Symmetry
$\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 = 1$	$\gamma_{11} + \gamma_{12} + \gamma_{13} + \gamma_{14} = 0$	$\gamma_{12} = \gamma_{21}$
$\beta_1 + \beta_2 + \beta_3 + \beta_4 = 0$	$\gamma_{21} + \gamma_{22} + \gamma_{23} + \gamma_{24} = 0$	$\gamma_{13} = \gamma_{31}$
$\gamma_{11} + \gamma_{21} + \gamma_{31} + \gamma_{41} = 0$	$\gamma_{31} + \gamma_{32} + \gamma_{33} + \gamma_{34} = 0$	$\gamma_{14} = \gamma_{41}$
$\gamma_{12} + \gamma_{22} + \gamma_{32} + \gamma_{42} = 0$	$\gamma_{41} + \gamma_{42} + \gamma_{43} + \gamma_{44} = 0$	$\gamma_{23} = \gamma_{32}$
$\gamma_{13} + \gamma_{23} + \gamma_{33} + \gamma_{43} = 0$		$\gamma_{24} = \gamma_{42}$
$\gamma_{14} + \gamma_{24} + \gamma_{34} + \gamma_{44} = 0$		$\gamma_{34} = \gamma_{43}$
		$\gamma_{34} = \gamma_{43}$

Data

The data used in this study are annual data on quantity (in Kg) and export value of chemical pulp (HS 470329; in 1000 US$) for the period 2003-2022. Data on *exchange rates* and *GDP deflators* from pulp exporting countries to China are also used. Those data were obtained from Trademap, World Bank and Biro Pusat Statistik (BPS).

The nominal price of pulp exports was obtained by dividing the total export value by the total export quantity and expressed in USD per ton. The obtained nominal price is then expressed in real value at the base year 2010. To do this, GDP deflator of pulp exporting countries to China, including Indonesia; should have the same base year. The base year chosen in the study was 2010. The real price is then obtained in the following way: ((nominal price x exchange rate)/*GDP deflator*)/exchange rate in 2010). Data was processed using Microsoft Excel 2016 and the demand function was estimated using *the Seemingly Unrelated Regression* (SUR) technique using STATA.

RESULTS AND DISCUSSION

Indonesia's pulp and paper industry has been part of industry statistics since 1990. It has experienced a significant growth after the government initiated the Industrial Plantation Forest (HTI) program. From 2003 to 2022, Indonesia exported between 2.37 - 4.37 million tons of pulp (HS 470329) per year to the world. This accounted for about 14-16%

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

of the world's total pulp exports (Trademap 2023). The pulp exports of Indonesia suffered a substantial decline in 2004 due to environmental concerns raised by the World Wildlife Fund (WWF) (Simangunsong *et al.*, 2016). The decline in export quantity persisted from 2005 to 2008 due to the global financial crisis.

Comparative Advantage Analysis

The results of the RCA analysis showed that pulp raw materials (HS 470329) have an excellent comparative advantage in the Chinese market. Throughout the period from 2003 to 2022, the value of the RCA index was greater than one (Figure 3). This indicates that the share of Indonesian pulp commodities in China's total imports was significantly high. This comparative advantage resulted from a relatively low production cost, which was due to material costs and labour wages in Indonesia being relatively low compared to raw material costs and labour wages in other pulp exporting countries (Simangunsong *et al.,* 2016). However, this competitiveness has been gradually declining, as indicated by the lowest RCA index value in 2022. Several factors have contributed to the weakening of the RCA index of Indonesian pulp exports to China. First, the global financial crisis in 2008 had a significant impact on trade, including Indonesia's exports. The crisis caused a decline in Indonesia's total export value, which may have affected the competitiveness of Indonesian pulp exports in China Prasetyo A *et al.*(2018). Second, the implementation of the ASEAN-China Free Trade Agreement in 2010 has led to changes in the competitive landscape, affecting Indonesia's export competitiveness in the Chinese market (Tampubolon 2019).

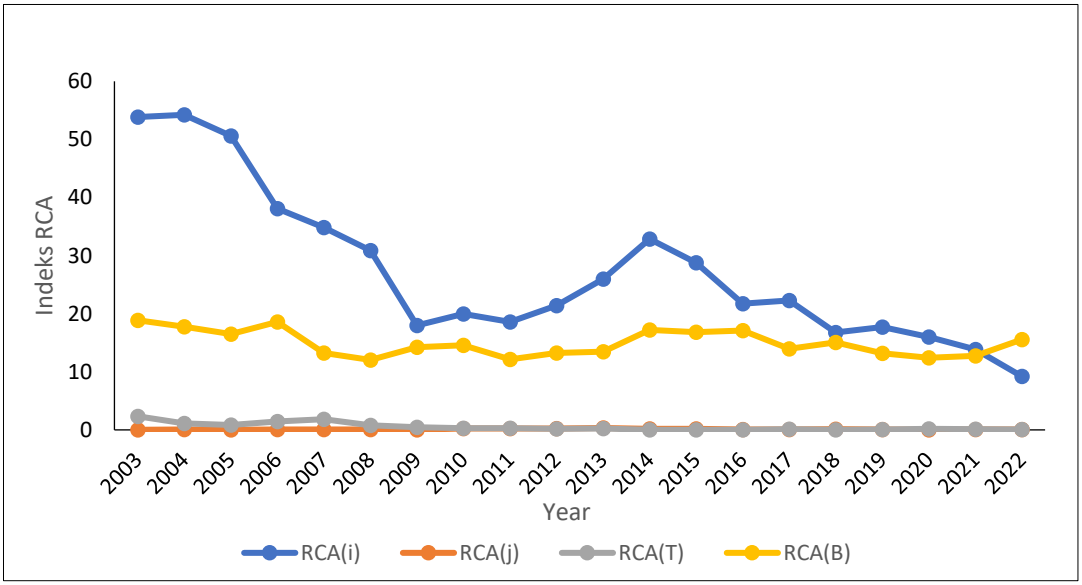

Figure 3. RCA index values from Indonesia, Japan, Thailand and Brazil in the Chinese market during the period 2003-2022.

Figure 3 also shows that Japanese and Thai exports to the Chinese market have relatively low RCA Index values. Brazil's RCA Index shows a consistent value over time, which is due to China's continued reliance on Brazil as a supplier of pulp: Brazil has become the main global supplier of wood pulp, making it a reliable source for China's wood pulp imports (Philip et al 2015). Brazil is one of the main importers of wood pulp, a

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

type of pulp with advantages such as low production costs, high opacity and good paper formation (Huiying et al 2023). The booming Chinese economy has created a high demand for market pulp, leading South America to build large modern pulp mills to supply China (Perry and Greenbaum 2006); on the other hand, the China-US trade war has also led China to restrict the US as a pulp supplier to China (Christopher et al 2004), and this causes Brazil with large production capacity to be a major supplier in China. The complementarities between Chinese exports and Brazilian imports cover a larger number of products than those observed in the opposite direction (Flavio *et al.* 2014). Finally, the bilateral benefits generated in the Brazil-China trade relationship, as measured by the interregional multiplier, show that the stimulus generated by Brazilian production in China is greater. These factors contribute to the fact that China imports more from Brazil than from Indonesia, despite the latter being geographically closer.

Demand Analysis

The LA/AIDS model used in this study analyzed consumer behavior towards Indonesian pulp commodities, including their relationship with pulp commodities originating from other exporting countries in the Chinese market. The resulting parameters of the LA/AIDS model in the Chinese market are presented in Table 2. Table 2 shows the diversity of the share of pulp export values from Indonesia, Japan, Thailand and Brazil in the Chinese market can be explained by export prices of 47%, 32%, 48% and 58%, respectively, as shown by the R-sq values of each country. Furthermore, the value of w_i showed that the largest share of pulp export value in the Chinese market was pulp from Brazil (42%), followed by pulp from Indonesia (28%), while pulp from Japan and Thailand each only about 1% of the total value of pulp imports made by China. The coefficients in table 2 will be used to determine compensated, uncompensated and also expenditure elasticities.

Table 2. Parameter estimates of *LA/AIDS* Model

Variable	Equation			
	Indonesia (1)	Japan (2)	Thailand (3)	Brazil (4)
Wi	28%	1%	1%	42%
Price of Ind	0.0195	-0.0532***	0.0060	0.0277
Price of Jpn	-0.0532***	0.0300***	0.0107***	0.0124***
Price of Thi	0.0060	0.0107***	-0.0123***	-0.0044
Price of Brz	0.0277	0.0124***	-0.0044	-0.0357
Price of ROW	-1.E-16***	-8.E-17***	7.E-18***	-8.E-18***
X	-0.1060***	-0.0102***	-0.0170***	0.1332***
R-sq	47%	32%	48%	58%

Note: *** significant at 1%, ** significant at 5%, * significant at 10%

Widarjono (2016) explains that uncompensated elasticities (Marshallian elasticity) measure the uncompensated change in the quantity of a good demanded due to a change in the price of that good. Indonesia, Thailand, and Brazil have negative compensated elasticity. This is according to the law of demand explains that Indonesia, Thailand, and Brazil will experience a decrease in demand for pulp if there is an increase in price. Indonesia will experience a decrease in demand of -0.64752 percent for

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

every 1% increase in the price of Indonesian pulp in the Chinese market, as well as Thailand and Brazil will experience decreases of -2.3530 and -0.6663 percent respectively. This shows that conditions in Indonesia, Thailand, and Brazil are in accordance with the law of demand, which reads that when prices increase, the demand for these goods will decrease.

Table 3. Estimates of price, cross-price and expenditure elasticities derived from LA/AIDS model

Equation	Countries			
	Indonesia(1)	Japan (2)	Thailand (3)	Brazil (4)
Price				
Compensated				
Price Indonesia	-0.647520	-0.174700	0.030237	0.516319
Price Japan	-3.925220	1.390568	1.195896	0.042306
Price Thailand	0.949221	1.183266	-2.352950	-0.007330
Price Brazil	0.349789	0.083118	-0.001460	-0.666300
Uncompensated				
Price Indonesia	-	-0.221140	0.017820	-0.059050
Price Japan	-4.438160	-	0.839573	0.645934
Price Thailand	0.131968	1.159523	-	-1.274180
Price Brazil	0.070027	0.033692	-0.007630	-
Expenditure	0.626418	0.192469	-0.879890	1.318007

Price is an important factor that affects demand. If prices rise, demand tends to fall, and if prices fall, demand tends to rise. A different condition was found in the pulp of Japanese origin, which showed a positive elasticity coefficient of 1.3906. The same condition is also found in Pinto *et al.* (2022) research. They found that cloves from Comoros have a positive compensated elasticity value. Theoretically, this condition can be described as if there is an increase in price, it also will cause an increase of Japanese pulp in the Chinese market, which is not suitable with demand theory. This probably happens because Japan is able to produce pulp with high quality. Izzatin et al (2023) in her publication found that the significant value of price variable is bigger than probability 0.05, which means that the price variable is not significant. On the other hand, Wibowo & Surbakti (2023) found that the domestic price has a positive effect on demand. It is necessary to be careful in drawing conclusions in this research.

The value of cross-price elasticity (compensated) shows a negative relationship between Indonesia and Japan, which means pulp from Indonesia was a complement of pulp from Japan in the Chinese market. The same thing was also found by Rifin (2013), Rifin (2014) and Purnamasari *et al.* (2014) who states that if the value of cross-elasticity (*uncompensated) is* positive, it shows that there is a substitution relationship, while if the value of cross-elasticity is marked negative, it indicates a complementary relationship between related country export products.

In the Indonesian AIDS model, the cross-elasticity of Japanese pulp is negative, which means that for Indonesia, Japanese pulp is a complements of Indonesian pulp. This is also found in Japanese AIDS models that show pulp from Thailand and Brazil as a substitute for Japanese pulp, but pulp from Indonesia complements it. For Thailand, pulp from Indonesia and Japan is a substitute, but pulp from Brazil complements it. For Brazil, pulp

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1628

from Indonesia and Thailand is complementary, but pulp from Japan is a substitute. Mahdi and Suprehatin (2021) also found that in different equations is possible to result different complement or substitution conditions.

The value of expenditure elasticity for pulp from Indonesia, Japan and Brazil was positive, which indicated that pulp from these three countries was a normal good. This shows that if there is an increase in the total value of pulp commodity imports in China, it will increase the demand for pulp from the three pulp exporting countries in accordance with the value of the elasticity of expenditure obtained. This was also in line with what Pinto *et al.* (2022) found in his research. The value of expenditure elasticity shows that if there is an increase in imports in the Chinese market by 1% *cateris paribus*, it would increase demand for pulp originating from Indonesia and Japan by 0.626 and 0.192 percent, respectively. The obtained value of Brazil's expenditure elasticity of more than 1 indicated that pulp from Brazil was a luxury item. This implies if there is an increase in pulp demand in China market it would cause an increase in demand for pulp from Brazil, which is greater than the demand for pulp from Indonesia and Japan.

CONCLUSION

This research was conducted to analyze the performance of Indonesian pulp exports in the Chinese market. The results of RCA's analysis show that Indonesian pulp has a fairly strong competitiveness in the Chinese market, but the competitiveness has decreased as indicated by the smallest RCA index value that occurred in 2022. The right policy is urgently needed so that Indonesia will not lose one of the largest pulp export destinations. Although pulp exports from Japan and Thailand were not as large as pulp exports from Indonesia and Brazil, these two countries were included to study the cross-price elasticity that occurs in the Chinese market. The results of the LA/AIDS model showed that pulp from Japan was a complement of pulp from Indonesia, while pulp from Thailand and Brazil was a substitute for pulp from Indonesia.

This study solely considers cost as a factor that affects the comparative advantage of Indonesian pulp. Variations in demand, product competitiveness, and non-economic factors that affect Indonesian pulp export performance cannot be fully explained.

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