

DEMAND FOR INDONESIAN PLYWOOD IN THE SOUTH KOREAN MARKET

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Abstract

Background: Indonesia is a tropical country with abundant forest resources, and plywood is a key value-added product. Among the globally traded plywood products, HS 441231 accounts for the largest share and is a strategic component of Indonesia's exports. South Korea is one of Indonesia's main export destinations, as imports largely satisfy its plywood demand. Although Indonesia maintains a dominant position, its exports to South Korea have declined in recent years amid competition from Malaysia and Vietnam. Given the high supplier concentration, understanding South Korea's import demand structure is increasingly important.

Purpose: This study analyzes the demand for Indonesian plywood (HS 441231) in the South Korean market using the LA/AIDS and QUAIDS models to assess price and expenditure responses and evaluate Indonesia's position relative to major competitors.

Design/methodology/approach: The analysis uses monthly South Korean import data for HS 441231 from 2010 to 2024. LA/AIDS and QUAIDS models are estimated using SUR and NLSUR with adding-up, homogeneity, and symmetry restrictions.

Findings/Result: Indonesian plywood holds the largest import share, shows elastic demand, and functions as a normal good. The quadratic component of the QUAIDS is significant, indicating a nonlinear consumption pattern. Indonesia has a substitution relationship with Malaysia and a complementary relationship with Vietnam.

Conclusion: Indonesia's competitiveness in the South Korean market is primarily price-based, indicating the need for greater cost efficiency, enhanced quality, and compliance with certification requirements to achieve a more sustainable position.

Originality/value (State of the art): This study contributes to the literature by combining LA/AIDS and QUAIDS to analyze South Korea's plywood demand, providing empirical insights into cross-country substitution dynamics.

Keywords: elasticity, expenditure share, import competition, LA/AIDS, QUAIDS

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INTRODUCTION

Indonesia is a tropical country with abundant forest resources, and one of the forest products that creates added value and plays a crucial role in economic growth is plywood production. This product is widely used in the furniture and construction industries because of its excellent physical and mechanical properties (Cakiroglu et al. 2019). The plywood industry has played an important role in the Indonesian economy by contributing significantly to the gross domestic product, foreign exchange earnings, government revenue, and employment. Indonesia's plywood exports dominate the tropical hardwood market (Malau et al. 2022), reflecting its strong position in international trade. According to Trademap (2025), among the 14 types of plywood classified under the 6-digit Harmonized System (HS) code in global trade, only four types, HS 441210, 441231, 441239, and 441299, have complete data for the period 2010-2024. Among these products, HS 441231 was the most dominant. This type of plywood consists of wood sheets measuring ≤ 6 mm that have at least one outer layer of tropical wood and does not include compressed wood sheets, cellular wood panels, inlaid wood, or sheets identifiable as furniture components. The product accounts for nearly 43.0% of total global exports, followed by HS 441299 (13.1%), HS 441239 (4.0%), and HS 441210 (0.6%). These figures indicate the strategic importance of HS 441231 in Indonesia's plywood-export structure.

In 2017, the three largest importers of Indonesian plywood were the United States, Japan, and South Korea (Puruwita & Oktor, 2019). Among these markets, South Korea has significant potential for plywood trade, as imports supply nearly all plywood demand (Lee et al. 2021; Malau et al. 2022). Trademap (2025) shows that South Korea's plywood imports during 2010-2024 ranged from 0.74 to 1.12 million tons per year, indicating consistently high demand. This demand is associated with environmental considerations, technological advancements, and national policies that promote the use of sustainable building materials. In addition, plywood is considered a flexible material that can be used in various types of architectural structures (Kim et al. 2024). These conditions make South Korea an important and competitive market for plywood-exporting countries, including Indonesia. In the context of international trade, South Korea is the third-largest export destination for Indonesia's plywood under HS code 441231, where Indonesia competes with other

major suppliers, such as Malaysia and Vietnam. Imports from these three countries accounted for 82.0% of the total, reflecting the high concentration of suppliers and competition among the exporting countries. Although Indonesia has maintained a dominant position, its plywood exports to South Korea have declined by 5.0% annually during the period 2020-2024. This decline highlights the need to better understand South Korea's import demand structure and Indonesia's competitive position in this market.

Previous studies have examined Indonesian plywood demand in selected export markets, however research focusing on the South Korean market remains limited. Simanjuntak et al. (2017) examined demand for Indonesian plywood in the Japanese market using the AIDS model. They found that demand was inelastic and exhibited strong substitution effects with Malaysian and Chinese products. These findings provide important insights into the competitive dynamics of Japan. However, they do not explain demand behavior in other significant markets. Meanwhile, empirical studies specifically examining the demand structure of Indonesian plywood in the South Korean market remain scarce. Given that South Korea is one of Indonesia's main export destinations, this lack of comprehensive analysis represents a research gap. Moreover, the application of demand system models such as LA/AIDS and QUAIDS in this market remains largely unexplored. Such analysis is essential better to understand demand responsiveness and competition among major suppliers.

To address this gap, this study applies the Linear Approximate Almost Ideal Demand System (LA/AIDS) and Quadratic Almost Ideal Demand System (QUAIDS) models to analyze Indonesian plywood in the South Korean market. The LA/AIDS model estimates price and expenditure elasticities within a demand system framework and enables the analysis of substitution patterns across exporting countries. This approach allows us to systematically measure demand responsiveness to price changes and total expenditure. However, consumer responses to changes in expenditure do not always follow a strictly linear pattern. Therefore, this study employs the QUAIDS model to capture nonlinear expenditure effects by incorporating a quadratic term. Using both models, this study provides a more comprehensive analysis of demand behavior and compares linear and nonlinear specifications.

Based on the background and identified research gap, this study aims to analyze the Indonesian plywood demand in the South Korean market. Specifically, this study estimates the price and expenditure elasticities using the LA/AIDS and QUAIDS models. These elasticities measure the response of demand to changes in price and total expenditure. In addition, this study evaluates Indonesia's position relative to other major suppliers, particularly Malaysia and Vietnam, in the South Korean market. The findings provide empirical evidence to inform policy and market strategies aimed at enhancing the competitiveness of Indonesian plywood in the South Korean market.

METHODS

This study uses monthly time-series data from January 2010 to December 2024. The dataset includes South Korea's import values and quantities of plywood from Indonesia, Malaysia, and Vietnam, classified under Harmonized System (HS) code 441231. Import data were obtained from the Trade Map. It collects exchange rate data (LCU/US\$) from the central banks of each exporting country. Data on Gross Domestic Product (GDP) deflators were sourced from the International Monetary Fund (IMF).

This study compiled data by retrieving monthly import statistics from the Trade Map and macroeconomic indicators from official institutional sources. Nominal prices (US\$/tons) by dividing the import value (US\$) by the import quantity (tons). Subsequently, it converted nominal prices into real prices using the exchange rate (Local Currency Unit/US\$) and the GDP deflator of each exporting country, applying the same base year to ensure comparability. The expenditure (budget share) for each exporting country was calculated as the proportion of its import value relative to South Korea's total plywood imports from the three countries.

This study applies the Linear Approximate Almost Ideal Demand System (LA/AIDS) and Quadratic Almost Ideal Demand System (QUAIDS) models to analyze plywood demand in the South Korean market. The LA/AIDS model is estimated using the seemingly Unrelated Regression (SUR) method with theoretical restrictions. In contrast, the QUAIDS model is estimated using the Non-Linear Seemingly Unrelated Regression (NLSUR) method with restrictions. The estimated coefficients from both models were then used

to calculate the own-price, cross-price, and expenditure elasticities. All demand estimations were performed using STATA 18.

This study applies the AIDS model developed by Deaton and Muellbauer (1980). This model is based on the Price Independent Generalized Logarithmic (PIGLOG) preference function and assumes a linear relationship with expenditures. This function is expressed as $c(u,p)$, where u is the utility and p is the price vector.

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

Utility u is assumed to lie between 0 and 1, where $(1-u)$ (subsistence) represents the lowest utility level, reflecting the minimum-needs condition, and u (bliss) represents the maximum attainable satisfaction. The term $c(u,p)$ describes the minimum cost function, consisting of the linear and quadratic interaction components of log prices. Meanwhile, $b(p)$ introduces a nonlinear component by multiplying prices raised to parameters, allowing the model to capture the joint influence of all prices on cost more flexibly. Accordingly, the AIDS cost function can be written as follows:

$$\log c(u,p) = a_0 + \sum_k a_k \log p_k + 1/2 \sum_k \sum_j \gamma_{kj}^* \log p_k \log p_j + u \beta_0 \prod_k p_k^{\beta_k} \quad (2)$$

The AIDS model employs a translog price index. However, because the translog price index is nonlinear and contains many unknown parameters, it is commonly approximated by the Stone price index to obtain the Linear Approximate AIDS (LA/AIDS) specification. Formally, the translog price index is defined as:

$$\ln a(p) = \alpha_0 + \sum_k \alpha_k \ln p_k + 1/2 \sum_j \sum_k \gamma_{kj} \ln p_k \ln p_j \quad (3)$$

By replacing the translog price index with the Stone price index (P^*), the LA/AIDS model is obtained and expressed as follows:

$$w_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \ln p_j + \beta_i \ln (x/P^*) \quad (4)$$

where: i,j (exporting country); w_i (expenditure share of plywood exports country i in the South Korean market); $\ln p_j$ (natural log plywood prices from exporting country in the South Korean market); x (total value of South Korean plywood imports); $\alpha_i, \gamma_{ij}, \beta_i$ (parameters to be estimated); P^* (Stone price index = $\sum_i w_i \ln p_i$).

The LA/AIDS model applies several constraints derived from demand theory to ensure model consistency, including the zero-degree homogeneity of price and total expenditure, as well as the fulfilment of Slutsky symmetry requirements. The three restrictions are adding up (5), homogeneity (6), and symmetry (7):

$$\sum \alpha_i = 1, \sum \beta_i = 0, \sum \gamma_{ij} = 0 \quad (5)$$

$$\sum_j \gamma_{ij} = 0 \quad (6)$$

$$\gamma_{ij} = \gamma_{ji} \quad (7)$$

Four expenditure share functions representing the demand for plywood from Indonesia, Malaysia, Vietnam, and the rest of the world (ROW) in the South Korean market were then modelled as shown in equations:

$$w_i = \alpha_1 + \gamma_{ii} \ln p_i + \gamma_{im} \ln p_m + \gamma_{iv} \ln p_v + \gamma_{ir} \ln p_r + \beta_1 \ln(x/P^*) \quad (8)$$

$$w_m = \alpha_2 + \gamma_{mi} \ln p_i + \gamma_{mm} \ln p_m + \gamma_{mv} \ln p_v + \gamma_{mr} \ln p_r + \beta_2 \ln(x/P^*) \quad (9)$$

$$w_v = \alpha_3 + \gamma_{vi} \ln p_i + \gamma_{vm} \ln p_m + \gamma_{vv} \ln p_v + \gamma_{vr} \ln p_r + \beta_3 \ln(x/P^*) \quad (10)$$

$$w_r = \alpha_4 + \gamma_{ri} \ln p_i + \gamma_{rm} \ln p_m + \gamma_{rv} \ln p_v + \gamma_{rr} \ln p_r + \beta_4 \ln(x/P^*) \quad (11)$$

where: w_i , w_m , w_v , and w_r are, respectively, the expenditure shares for Indonesia, Malaysia, Vietnam, and ROW's plywood in the South Korean market; p_i , p_m , p_v and p_r are, respectively, the plywood prices of Indonesia, Malaysia, Vietnam, and ROW in the South Korean market.

Estimated coefficients from equations 8-11 are used to determine elasticities using formulas as follows:

1. Expenditure elasticity

$$\eta_i = 1 + (\hat{\beta}_i / \bar{w}_i) \quad (12)$$

2. Own price elasticity (uncompensated)

$$e_{ij} = -\delta_{ij} + (\hat{\gamma}_{ij} / \bar{w}_i) - \hat{\beta}_i (\bar{w}_j / \bar{w}_i) \quad (13)$$

3. Cross price elasticity (compensated)

$$e_{ij}^* = -\delta_{ij} + (\hat{\gamma}_{ij} / \bar{w}_i) + \bar{w}_j \quad (14)$$

Where: $\hat{\gamma}_{ij}$ and $\hat{\beta}_i$ are estimated parameters; δ_{ij} = Kronecker delta (1 for $i=j$, 0 for $i \neq j$).

Since the LA/AIDS has limitations in representing consumer behaviour, Banks et al. (1997) developed the QUAIDS model as an extension of the AIDS model. This model incorporates the translog function for $\ln a(p)$, the Cobb–Douglas price aggregator for $b(p)$, and a quadratic component through $\lambda(p)$. Thus, the QUAIDS demand function takes the following form:

$$w_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \ln p_j + \beta_i \ln \{x/(a(p))\} + \lambda_i / (b(p)) [\ln \{x/(a(p))\}]^2 \quad (15)$$

where: $a(P)$ (translog price index (price index level 1); $b(P)$ (Cobb–Douglas price aggregator); λ_i (curvature parameters for commodities i).

To calculate elasticity in the QUAIDS model, equation (15) can be partially derived with respect to x and to obtain equations (16) and (17):

$$\mu_i = (\partial w_i) / (\partial \ln x) = \beta_i + ((2\lambda_i) / b(p)) \ln (x/a(p)) \quad (16)$$

$$\mu_i = (\partial w_i) / (\partial \ln p_j) = \gamma_{ij} - \mu_i (\alpha_i + \sum_j \gamma_{ij} \ln p_j) - (\lambda_i \beta_i) / b(p) [\ln(x/a(p))]^2 \quad (17)$$

Similar to the LA/AIDS model, the QUAIDS model of four expenditure share functions representing the demand for plywood from Indonesia, Malaysia, Vietnam, and other countries (ROW) in the South Korean market (Equations 18–21) were estimated:

$$w_i = \alpha_i + \gamma_{ii} \ln p_i + \gamma_{im} \ln p_m + \gamma_{iv} \ln p_v + \gamma_{ir} \ln p_r + \beta_1 \ln \{x/(a(p))\} + \lambda_1 / (b(p)) [\ln \{x/(a(p))\}]^2 \quad (18)$$

$$w_m = \alpha_2 + \gamma_{mi} \ln p_i + \gamma_{mm} \ln p_m + \gamma_{mv} \ln p_v + \gamma_{mr} \ln p_r + \beta_2 \ln \{x/(a(p))\} + \lambda_2 / (b(p)) [\ln \{x/(a(p))\}]^2 \quad (19)$$

$$w_v = \alpha_3 + \gamma_{vi} \ln p_i + \gamma_{vm} \ln p_m + \gamma_{vv} \ln p_v + \gamma_{vr} \ln p_r + \beta_3 \ln \{x/(a(p))\} + \lambda_3 / (b(p)) [\ln \{x/(a(p))\}]^2 \quad (20)$$

$$w_r = \alpha_4 + \gamma_{ri} \ln p_i + \gamma_{rm} \ln p_m + \gamma_{rv} \ln p_v + \gamma_{rr} \ln p_r + \beta_4 \ln \{x/(a(p))\} + \lambda_4 / (b(p)) [\ln \{x/(a(p))\}]^2 \quad (21)$$

Using the estimated parameters of the QUAIDS model, expenditure, uncompensated price, and compensated price elasticities were determined, with the compensated elasticity derived from the Slutsky equation (equations 22-24). The consistency of demand theory is evaluated based on the symmetry and negativity conditions of the Slutsky matrix, which must be symmetric and negative semi-definite. This implies that the parameter δ_{ij} has the same sign as the compensated cross-price elasticity. Moreover, the QUAIDS model applies the same restrictions as the LA/AIDS model and adds a quadratic component to satisfy the adding-up condition. The model computes the elasticity values using the following formulation:

1. Expenditure elasticity

$$e_i = (\mu_i/w_i) + 1 \quad (22)$$

2. Own price elasticity (uncompensated)

$$e_{ij}^u = (\mu_{ij}/w_i) - \delta_{ij} \quad (23)$$

3. Cross price elasticity (compensated)

$$e_{ij}^c = e_{ij}^u + e_i w_j \quad (24)$$

The research framework in Figure 1 summarizes the analysis of Indonesia's plywood exports to South Korea using the LA/AIDS and QUAIDS models to estimate demand elasticity. This study utilizes the estimation results to evaluate the competitive position

of Indonesian plywood and formulate an effective export market development strategy.

RESULTS

The estimated parameters of the LA/AIDS and QUAIDS models are shown in Table 1. As indicated by values, Indonesia dominates the plywood import share at 37.0%, followed by Malaysia at 25.0%, Vietnam at 20.0%, and the rest of the world (ROW) at 18.0%. However, a significant market share is a point-in-time indicator and does not necessarily imply sustained competitiveness, particularly when export performance weakens. In fact, Indonesia's plywood exports to the South Korean market have shown a downward trend over the past four years, suggesting increasing competitive pressure in both price and non-price dimensions. Evidence from international forest products trade indicates that product quality is positively associated with global competitiveness and, in some settings, may exert a larger effect than price, although the magnitude and significance vary across product categories and exporting countries (Jiang et al. 2023). This perspective is consistent with the argument that the recent decline is linked to market demand for cost efficiency, innovation, and improvements in product quality (Keelson et al. 2024). Therefore, Rustiadini and Novianti, (2025) emphasize the importance of quality improvement, technological innovation, and certification to maintain the competitiveness of Indonesian plywood exports in the global market.

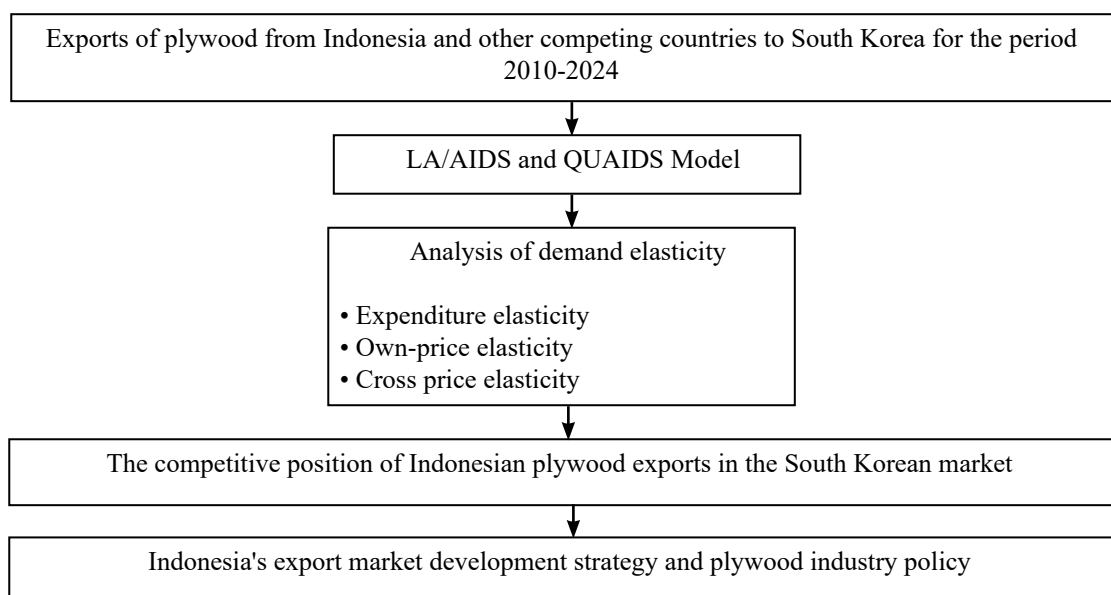


Figure 1. Research framework for analyzing Indonesian plywood demand in the South Korean market

Table 1. Estimated coefficients of the LA/AIDS and QUAIDS demand models for plywood imports in the South Korean market, 2010-2024.

Variable	Countries			
	Indonesia	Malaysia	Vietnam	ROW
LA/AIDS model				
w_i	0.37	0.25	0.20	0.18
α	0.35***	0.34***	0.48***	-0.17***
β	-0.05	0.12***	0.29***	-0.37***
R-sq	0.80	0.53	0.80	0.47
QUAIDS model				
w_i	0.37	0.25	0.20	0.18
α	-0.39**	0.79***	0.37***	0.24
β	-1.31***	0.88**	0.12	0.31
λ	-0.48***	0.29*	-0.07	0.25
R-sq	0.81	0.56	0.80	0.46

Notes: *** (significant 1%); ** (significant 5%); * (significant 10%)

In the budget-share equation, α_i enters as the constant term, whereas β_i loads on the real-expenditure term $\log(x/a(p))$; thus, β_i captures how the exporter's expenditure share changes with real total expenditure (Gostkowski, 2018). The estimation results presented in Table 1 show that all α coefficients in the LA/AIDS model are statistically significant, indicating differences in basic expenditure shares among exporting countries. All β coefficients for all countries are also statistically significant, except for Indonesia, suggesting no statistical evidence that changes in real total expenditure systematically affect Indonesia's plywood expenditure share in the South Korean market. On the other hand, the statistical significance of the QUAIDS curvature parameter (λ) supports the presence of a nonlinear Engel-curve relationship between real expenditure and import budget shares. Because the QUAIDS specification nests the AIDS model when $\lambda=0$, a significant λ suggests that a purely linear expenditure effect may be inadequate in this context (Poi, 2012; Gostkowski, 2018). Consistent with this, Figure 2 shows nonlinearity in Indonesia's plywood expenditure share in the South Korean market. The budget share increases at low-to-medium expenditure levels but decreases at higher expenditure levels.

Atasha et al. (2025) also document a nonlinear relationship in Indonesia's paper expenditure share in Japan's market, albeit in the opposite direction. This divergence is plausible, given the distinct demand bases of paper and plywood. Paper imports in Japan

are supported by broad and recurring end-use demand (hygiene and printing/writing). In contrast, plywood imports in South Korea are more closely linked to industrial procurement and specification requirements, rendering expenditure shares more sensitive to quality upgrades at higher expenditure levels. In addition, (Atasha et al. 2025) used the period 2010-2023 and highlighted major shocks, such as the trade war in 2018 and the pandemic in 2020. These shocks have the potential to shape market share dynamics differently than in the 2010-2024 plywood sample in this study, which also includes an adjustment period after 2023.

Consistent with the higher R-squared values across most countries, the QUAIDS model is better at describing plywood consumption patterns in the South Korean market than the LA/AIDS model. Atasha et al. (2025) also show that the QUAIDS model better captures changes in preferences and variation in consumption responses across expenditure levels than the linear model. In line with the nonlinear characteristics of the Engel curve, (Kutortse et al. 2022) applied QUAIDS to model the budget share of wood-based fuels, particularly firewood and charcoal, which are grouped as FCO, and confirmed that the quadratic expenditure component allows the budget share to respond to changes in expenditure in a nonlinear manner. Hence, estimates of own-price, cross-price, and expenditure elasticities based on the QUAIDS model are shown in Table 2.

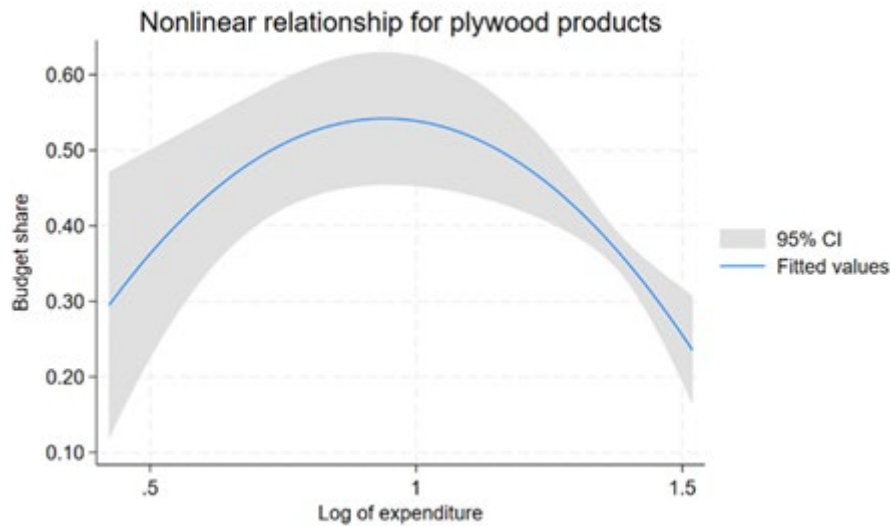


Figure 2. Nonlinear relationship between real total expenditure and Indonesia's plywood budget share in the South Korean market

As shown in Table 2, the significant own-price elasticity (uncompensated) values for plywood products from Indonesia (-6.81), Malaysia (-2.01), and Vietnam (-8.17) indicate elastic demand, reflecting the high sensitivity of South Korean consumers to changes in plywood prices from these three countries. These results differ from the own-price elasticity found by Simanjuntak et al. (2017), which stated that Indonesia's plywood demand in the Japanese market was inelastic. Niquidet and Tang (2013) also reported a similar pattern of destination market differences for other wood products. They show that own-price elasticities vary across importing countries and relate these differences to market-specific end-use and quality considerations. The differences in the results arise from variations in export destination countries, research periods, and the model approach employed. The price elasticity for the ROW group is positive at 29.04 and significant, which is inconsistent with the theory of demand. This condition may have arisen due to aggregation bias, as the ROW group includes countries with highly varied product and market characteristics, making the elasticity results unrepresentative. Consistent with this explanation, Niquidet and Tang (2013) note that a positive own-price elasticity for the residual ROW category can arise from aggregation issues rather than representing actual demand behavior.

The cross-price elasticity (compensated) between Indonesian and Malaysian plywood in Table 2 is positive (1.01) and statistically significant, indicating a substitution relationship. This implies that a 1.0% increase in the price of Malaysian plywood increases

the demand for Indonesian plywood by approximately 1.01%, holding utility constant. This interpretation is consistent with forest product import demand studies that use cross-price elasticities to identify substitution and complementarity across supply sources (Sun, 2014). Conversely, the negative cross-price elasticities between Indonesia and Vietnam (-4.26) and the ROW group (-5.27) indicate a complementary relationship, as industries such as construction and furniture combine plywood products with different technical specifications. These findings reflect product differentiation that prevents plywood from different origins from being close substitutes. (Sun, 2014) also emphasizes that Marshallian cross-price elasticities incorporate both income and substitution effects, whereas Hicksian elasticities isolate the substitution effect. Accordingly, a relationship that appears complementary in Marshallian terms may partly reflect an income-effect component, especially when the expenditure elasticities are large. Hence, the compensated (Hicksian) estimates provide a cleaner basis for interpreting the substitution patterns in this study.

The expenditure elasticity for Indonesian plywood products in Table 2 is very low (0.006) and not significantly different from zero (-0.4 to 0.4), indicating that Indonesian plywood falls into the category of normal goods. For comparison, Tajdini et al. (2011) report an income elasticity of 0.32 for particleboard (a wood-based panel product), indicating that it is a normal/necessary good and suggesting similarly limited responsiveness to income changes. In contrast, the significant expenditure elasticities for Malaysia

(2.341) and Vietnam (2.198) exceed 1, suggesting that South Korean buyers treat plywood from these sources as luxury goods and increase their purchases by more than a proportionate amount as total expenditure rises. This condition reflects that South Korean consumers with high purchasing power tend to allocate a larger proportion of their expenditures to Malaysian and Vietnamese plywood products. This underscores the importance of strategies to enhance value-added and strengthen the image and branding of Indonesian plywood products. Calvano et al. (2025) also emphasize that improving the competitiveness of wood products, such as plywood, is most effectively achieved through production innovation, sustainable practices, and the use of local and secondary materials. This approach not only increases the added value but also expands Indonesia's export market opportunities.

Managerial Implication

South Korea is the world's second-largest importer of plywood (HS 441231), with an import share of 12.1% in 2024. This condition reflects South Korea's high dependence on plywood imports due to limited domestic forest resources (Maryudi et al. 2021). The average geographical distance of suppliers is 4,204 km, which indicating South Korea's dependence on supplies from distant countries. For Indonesia, South Korea is the third-largest export market for Indonesian plywood during the 2010-2024 period, with a share of 13.3%, after Japan (38.6%) and the United States (17.4%). In the South Korean market, the three leading suppliers of plywood to the South Korean market are Indonesia (37.0%), Malaysia (24.6%), and Vietnam (20.2%), which together accounted for approximately 82.0% of South Korea's total plywood imports. This concentrated market structure was reflected in the Herfindahl Index (HI) value of 0.43 in 2024, which falls into the high-concentration category (Sleuwaegen et al. 1989), indicating intense competition among exporters (Meliany et al. 2021).

Table 2. Estimates of own price, cross-price, and expenditure elasticities of Indonesian plywood imports in the South Korean market (QUAIDS model), 2010-2024.

Variable	Countries			
	Indonesia	Malaysia	Vietnam	ROW
Price				
Uncompensated				
Indonesia	-6.81***	0.89***	-4.92***	-4.83**
Malaysia	11.66***	-2.01***	11.72***	-22.76***
Vietnam	-3.05***	0.67***	-8.17***	-0.53
ROW	-1.45**	-0.46***	-0.73	29.04***
Compensated				
Indonesia	-6.81***	1.01***	-4.26***	-5.27**
Malaysia	11.45***	-1.46***	12.33***	-22.98***
Vietnam	-3.08***	0.71***	-7.71***	-0.78
ROW	-1.56**	-0.27***	-0.36	29.03***
Expenditure				
	0.006 (-0.4-0.4)	2.341*** (1.3-3.4)	2.198*** (1.6-2.8)	-0.102 (-1.7-1.5)

Notes: *** (significant 1%); ** (significant 5%); * (significant 10%)

Although Indonesia still dominates the plywood market in South Korea, analysis of the 2020-2024 sub-period shows a downward trend of 5.0% per year on average, in line with declines in Vietnam (3.0%) and Malaysia (19.0%). South Korea's anti-dumping tariff policy contributed to the decrease from Malaysia, given the five-year tariffs of 4.73% to 38.1% imposed on Malaysian products since 2011 (Yoon-seung, 2020). In contrast, South Korea's import tariffs in 2024 were reduced to approximately 5.9% for products originating from Indonesia and Malaysia, and 5.1% for products originating from Vietnam. Although low, these ad valorem tariffs still have the potential to affect price competitiveness in markets sensitive to price changes. The findings of this study indicate that the South Korean market is sensitive to changes in price. Evidence from forest product demand modelling indicates that price elasticities may differ across countries. Therefore, a market-specific pricing approach, together with contract terms that reflect local demand responsiveness, may be more appropriate than applying a uniform strategy across destinations (Buongiorno, 2019). This condition requires the Indonesian plywood industry to increase productivity and quality, and maintain production stability (Saraswati et al. 2023). Strengthening cost efficiency is a very important factor in remaining competitive in the export market; however, efficiency alone is not enough. Price stability is crucial for establishing a cost structure that is more responsive to global market fluctuations (Purwawangsa et al. 2024). An important strategy to expand market penetration and maintain Indonesia's position amid competition with Malaysia and Vietnam is to improve quality through innovation, standardization, and certification. Legality assurance should be treated as a market access capability, as Indonesia's SVLK aims to secure better trade linkages and access foreign markets. However, mandatory licensing can impose significant technical and financial burdens on SMEs compared to large firms. Therefore, streamlining and cost-reduction mechanisms are essential to avoid weakening export potential (Maryudi et al. 2021).

Cha et al. (2009) found that high-income consumers in South Korea are willing to pay a 5-6% price premium for certified wood products. Consistent with this, a meta-analysis reported that consumers generally show a willingness to pay a premium for certified wood products. However, the estimated premiums vary widely across studies. Product characteristics, such as

base price and purchase frequency, as well as differences across countries and survey locations, shape the estimated premium (Cai & Aguilar, 2013). Given this variation, consistent product performance and reliable supply should support certification-based differentiation to sustain competitiveness, reinforce consumer trust, and support price stability in the export markets. The price stability of forest products, including plywood, is powerfully shaped by supply chain efficiency and the consistency of raw material supply, and international price volatility underscores the need for an integrated production and distribution system (Sushko, 2024). In addition, the implementation of sustainable production practices and product certification plays a crucial role in improving efficiency and maintaining price stability (Mena-reyes et al. 2024). Indonesia can capitalize on the opportunity to replace Malaysia by maintaining a consistent supply and quality and strengthening product differentiation to meet the needs of the South Korean furniture and construction industries, which utilize a variety of plywood specifications. These integrated efforts have the potential to increase competitiveness and expand Indonesia's export share.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The competitive position of Indonesian plywood in the South Korean market remains relatively weak, relying heavily on price advantages rather than on sustainable competitiveness. The results show that the demand for plywood from Indonesia, Malaysia, and Vietnam in South Korea is highly price-elastic, indicating that Indonesia's performance in this market is shaped more by destination-specific pricing conditions than by a uniform approach across export markets. Cross-price elasticities further indicate that Indonesian plywood substitutes Malaysian plywood but complements Vietnamese plywood, suggesting that product differentiation and end-use requirements limit direct substitutability across origins. In addition, the expenditure elasticity of Indonesian plywood is not significantly different from zero. Simultaneously, those for Malaysia and Vietnam exceed one, implying that Indonesian plywood captures weaker demand expansion as total plywood expenditure increases. Overall, these findings highlight that moving beyond price-based competition in South Korea is closely

associated with improvements in cost efficiency, consistent quality, and precise product differentiation, thereby supporting a more sustainable competitive position.

Recommendations

Based on these findings, Indonesia should strengthen the competitiveness of its plywood in the South Korean market by improving production efficiency, enhancing quality, and promoting product differentiation so that competitiveness is not based solely on low prices but also on distinctive product attributes. Government support is needed through technological modernization, faster certification processes, and strategic trade diplomacy to expand market access and strengthen bargaining power. To ensure that certification enhances competitiveness rather than increasing costs, especially for SMEs, compliance mechanisms should be streamlined and made more cost-efficient through group certification, shared auditing support, and digital documentation systems. Future research may broaden the analysis to other plywood categories and forestry products and incorporate non-tariff barriers, macroeconomic variables such as exchange rates, and industrial demand conditions in the destination market, as these factors can significantly influence plywood demand.

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