JEMSI: Jurnal Ekonomi Manajemen Sistem Informasi
E-ISSN: 2686-5238
P-ISSN: 2686-4916
https://dinastirev.org/JEMSI dinasti.info@gmail.com +62 811 7404 455
DOI: https://doi.org/10.38035/jemsi.v7i5
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Received: 23 April 2026 | **Revised:** 30 May 2026 | **Accepted:** 4 June 2026

The Impact of Shipping Costs, Market Competition, And Service Quality with Exchange Rate as a Moderating Variable on the Export Volume in Shipping Companies

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Abstract: This study examines the effects of shipping costs, market competition, and service quality on export volume, with the exchange rate as a moderating variable among Indonesian exporters and freight forwarders using maritime transport and shipping companies also entered into the population to calculate the increase in export volume. A descriptive quantitative method was applied, employing primary data from questionnaires and secondary data from company reports, shipping statistics, and relevant literature. Using purposive sampling and the 10-times rule for 32 indicators, a minimum of 320 respondents was obtained. Data were analyzed with Structural Equation Modeling Partial Least Square (SEM-PLS) using SmartPLS 4. Results reveal that exchange rate, shipping costs, and service quality have a positive and significant impact on export volume. Higher shipping costs accompany increased export activity, while superior service quality enhances efficiency and international trade partner confidence. Conversely, the number of competitors shows no significant effect, indicating that the presence of more shipping operators does not directly raise export shipments. The exchange rate strengthens the relationships between shipping costs and competition with export volume but does not moderate the effect of service quality. These findings highlight the importance of exchange rate stability and improved maritime logistics services to foster Indonesia's export growth, while expansion of shipping operators should be regulated to ensure competitive pricing and optimal service.

Keyword: Shipping Costs, Market Competition, Service Quality, Exchange Rate, Export Volume, SEM-PLS.

INTRODUCTION

Export performance is a critical indicator of national economic development, particularly for emerging economies such as Indonesia, where foreign exchange earnings from exports play a strategic role in sustaining economic growth and financing development. The government has

consistently promoted export-oriented policies by leveraging natural resources and manufactured goods to strengthen national competitiveness in global markets (Huda & Widodo, 2017). As international trade increasingly relies on maritime transport, the shipping industry becomes a fundamental backbone of export activities, determining the efficiency, reliability, and continuity of cargo flows across borders.

In the era of globalization and market openness, shipping companies no longer serve merely as transport providers but function as strategic facilitators of export performance. Their operational capabilities including capacity availability, schedule reliability, cost efficiency, and service quality directly influence the volume of export cargo that can be absorbed and transported. Fluctuations in export cargo volumes across shipping services indicate that export growth is not solely driven by external demand or exchange rate movements, but also by internal operational and competitive dynamics within the shipping industry.

Shipping costs represent one of the most sensitive components of logistics expenses and are highly exposed to market disruptions. Empirical evidence shows that container freight rates surged by more than 500% during the COVID-19 pandemic due to strong demand, capacity constraints, port congestion, and equipment shortages, and remain volatile amid ongoing geopolitical and operational disruptions (Carrière-Swallow et al., 2022). Given that container shipping accounts for approximately 50–60% of global trade value (UNCTAD, 2024), elevated and unstable freight rates reduce exporters' margins, increase planning uncertainty, and weaken price competitiveness, particularly in short-term contract markets such as intra-Asia trade.

Market competition within the shipping industry further shapes export performance through pricing strategies, capacity allocation, and service differentiation. The dissolution of traditional shipping conferences and the rise of alliances and consortia have intensified competition while simultaneously enhancing market power through economies of scale (Otani, 2024); Michis, (2025). These structural changes enable pricing discrimination based on route characteristics, shipment volume, and bargaining power, potentially disadvantaging exporters operating in less competitive or lower-volume trade lanes (Cariou et al., 2025).

Beyond costs and competition, service quality has become a decisive determinant of exporters' shipping choices. Delays in documentation, slow responsiveness, unreliable schedules, and inadequate supporting facilities can significantly disrupt export operations and reduce customer satisfaction. Empirical observations of customer complaints highlight persistent service inconsistencies, indicating that improvements in service quality are essential for shipping companies to enhance operational reliability and sustain export cargo volumes, especially in increasingly fragmented global supply chains (Zakia et al., 2024).

In addition to industry-specific factors, exchange rate fluctuations act as a critical external condition influencing export performance by moderating the effects of shipping costs, competition, and service quality. Volatile exchange rates increase uncertainty in logistics cost structures, particularly as most shipping-related expenses are denominated in foreign currencies, thereby compressing exporters' margins and complicating long-term planning. Previous studies confirm that exchange rate depreciation can negatively affect export performance and firm profitability, especially in economies dependent on imported inputs (Hussain et al., 2024). Despite extensive research on export determinants, studies integrating shipping costs, market competition, and service quality with exchange rate fluctuations as a moderating variable remain limited in the Indonesian shipping context, underscoring the relevance and contribution of this study.

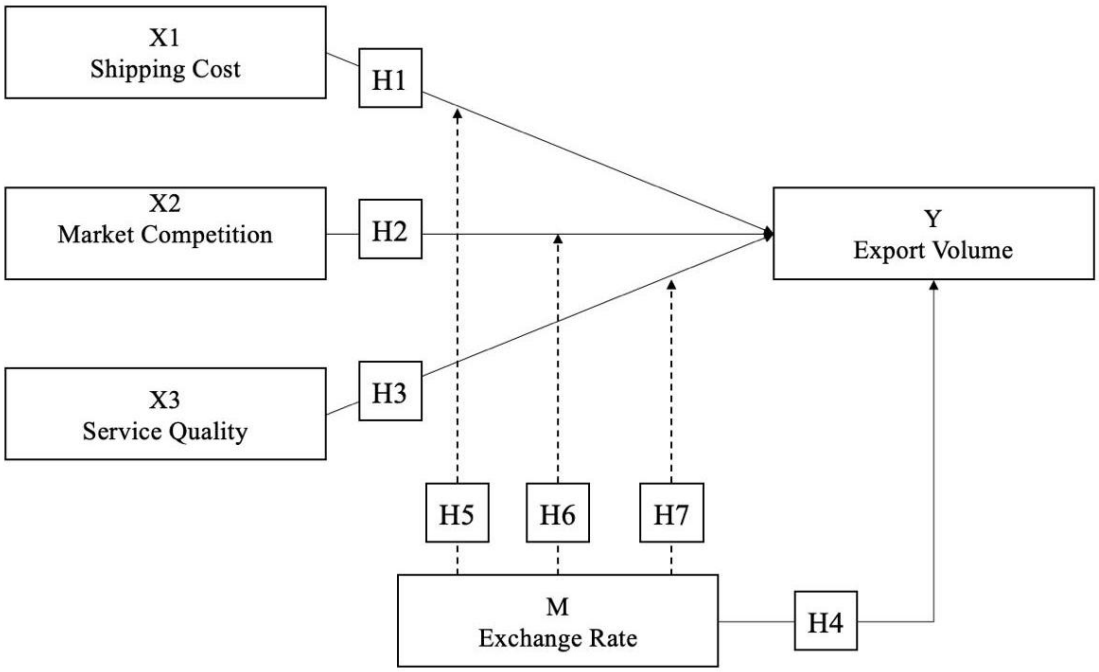
METHOD

This study employs a quantitative research approach that utilizes statistical analysis to objectively and empirically answer the research questions. This approach is selected because it enables the testing of causal relationships between shipping costs, market competition, service quality, export cargo volume, and exchange rate fluctuations through numerical measurement,

thereby producing findings that are generalizable across different contexts and periods. According to Sugiyono, (2020), population refers to the entire group of objects or subjects that possess specific characteristics determined by the researcher. In line with this definition, the population of this study consists of export-oriented companies (cargo owners), freight forwarders, and shipping companies involved in maritime export activities. These entities are included because they collectively represent the complete export decision-making chain, from trade decisions and operational booking processes to the provision of vessel capacity and logistics services that directly influence export cargo volume.

The sampling technique applied in this study is non-probability sampling using a purposive sampling method, whereby respondents are selected based on specific criteria relevant to the research objectives. The criteria include individuals who work in companies that have actively conducted maritime export activities for at least the past two years, are directly involved in decisions related to shipping costs, selection of shipping lines, or evaluation of service quality, and have experience interacting with more than one shipping company. The determination of sample size follows the 10-times rule proposed by Joseph F. Hair et al. (2014) for Partial Least Squares–Structural Equation Modeling (PLS-SEM). With a total of 32 measurement indicators, the minimum required sample size is 320 respondents, ensuring sufficient analytical power for hypothesis testing.

The data used in this study comprise primary and secondary data. Primary data are collected through the distribution of structured, closed-ended questionnaires to selected respondents, while secondary data are obtained from academic journals, official publications, industry reports, and other relevant sources that support the theoretical framework and analysis. Data analysis is conducted using Structural Equation Modeling (SEM) with the Partial Least Squares (PLS) approach, assisted by SmartPLS 4 software. SEM-PLS is chosen due to its ability to simultaneously analyze complex causal relationships among latent variables and to accommodate models with moderating effects. The analysis is carried out in two main stages: evaluation of the measurement model (outer model) to assess validity and reliability, and evaluation of the structural model (inner model) to examine direct and moderating relationships among constructs. Model evaluation includes the assessment of R-square values and hypothesis testing based on T-statistics and P-values, using a significance level of 5%.

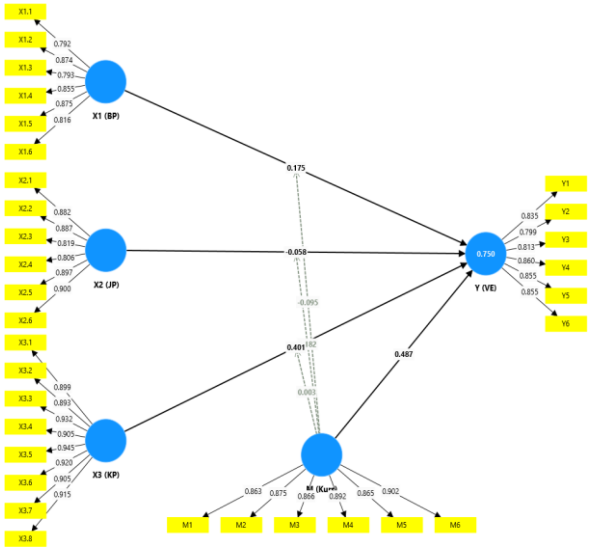


Source: Research Results

Figure 2. Research Model

RESULTS AND DISCUSSION

The evaluation of convergent validity constitutes a fundamental stage in both exploratory and confirmatory factor analysis within multivariate statistical frameworks. This assessment aims to determine the extent to which individual indicators or constructs accurately represent the theoretical concepts they are designed to measure. Specifically, convergent validity examines whether multiple observed variables consistently converge to reflect the same latent dimension. In practice, an indicator is generally considered valid when its loading value exceeds the threshold of 0.70, indicating a strong association between the indicator and its corresponding latent construct. The results of the PLS model estimation employed to evaluate these validity criteria are presented in the following section:



Source: Research Results

Figure 3. Outer Model

Based on the findings of the validity analysis, the loading factor values illustrating the relationship between each variable and its corresponding indicators are presented as follows:

Table 2. Outer Loading

Variabel	*Loading Factor*	Keterangan
Exchange Rate (M)		
M1	0.863	VALID
M2	0.875	VALID
M3	0.866	VALID
M4	0.892	VALID
M5	0.865	VALID
M6	0.902	VALID
Shipping Costs (X1)		
X1.1	0.792	VALID
X1.2	0.874	VALID
X1.3	0.793	VALID
X1.4	0.855	VALID
X1.5	0.875	VALID
X1.6	0.816	VALID
Market Competiton (X2)		
X2.1	0.882	VALID
X2.2	0.887	VALID

X2.3	0.819	VALID
X2.4	0.806	VALID
X2.5	0.897	VALID
X2.6	0.900	VALID
Service Quality (X3)		
X3.1	0.899	VALID
X3.2	0.893	VALID
X3.3	0.932	VALID
X3.4	0.905	VALID
X3.5	0.945	VALID
X3.6	0.920	VALID
X3.7	0.905	VALID
X3.8	0.915	VALID
Export Volume (Y)		
Y1	0.835	VALID
Y2	0.799	VALID
Y3	0.813	VALID
Y4	0.860	VALID
Y5	0.855	VALID
Y6	0.855	VALID
Exchange Rate (M) Memoderasi Shipping Costs (X1)		
M x X1	1	VALID
Exchange Rate (M) Memoderasi Market Competiton (X2)		
M x X2	1	VALID
Exchange Rate (M) Memoderasi Service Quality (X3)		
M x X3	1	VALID

Source: Research data

The table above presents the factor loading values for each construct indicator, which show varying magnitudes across the variables. Since all loading factor values exceed 0.7 (> 0.7), the indicators can be considered valid. In addition to loading factors, the assessment of convergent validity also employs the Average Variance Extracted (AVE) as an additional measure. AVE reflects the proportion of variance captured by a construct in relation to the variance attributed to measurement error. A construct is regarded as valid when its AVE value is greater than 0.50 (> 0.50). The results of the AVE values for each variable are shown as follows:

Table 3. AVE (Average Variance Extracted)

Research Variable	Average variance extracted (AVE)	Indication
Exchange Rate (M)	0.770	VALID
Shipping Costs (X1)	0.697	VALID
Market Competiton (X2)	0.750	VALID
Service Quality (X3)	0.836	VALID
Export Volume (Y)	0.700	VALID

Source: Research data

According to Ghozali and Latan (2015), the Average Variance Extracted (AVE) is employed to measure the convergent validity of a construct composed of reflective indicators. An AVE value of 0.50 or higher indicates that the construct is capable of explaining at least 50% of the variance in its observed indicators.

Furthermore, the reliability of each variable is evaluated using the Cronbach's Alpha and Composite Reliability (CR) values. A construct is considered to possess strong internal

consistency when both its Cronbach's Alpha and Composite Reliability values exceed 0.70 (> 0.70), signifying that the indicators consistently measure the same underlying concept.
Tabel 4. 1. Hasil Cronbach Alpha dan Composite Reliability

Table 4. Cronbach Alpha and Composite Reliability

	Cronbach's alpha	Composite reliability (rho_c)	Indication
Exchange Rate (M)	0.940	0.952	Reliable
Shipping Costs (X1)	0.913	0.932	
Market Competiton (X2)	0.933	0.947	
Service Quality (X3)	0.972	0.976	
Export Volume (Y)	0.914	0.933	

Source: Research data

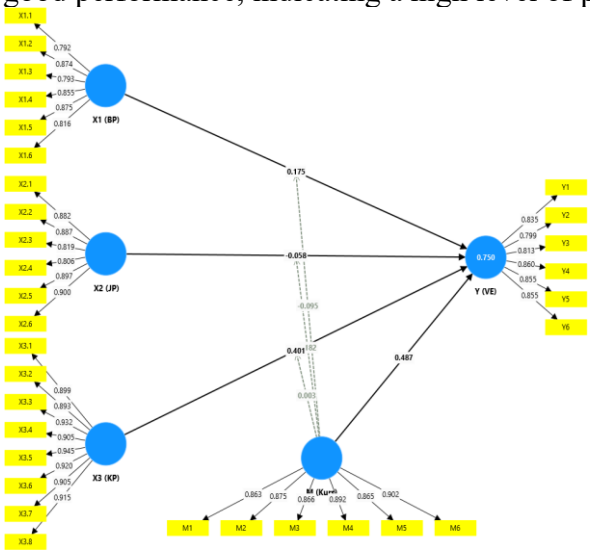
Based on the test results, all constructs have Cronbach's Alpha values above the minimum threshold (≥0.6 for exploratory and ≥0.7 for confirmatory), and Composite Reliability values >0.7. This indicates that the research instrument demonstrates good internal consistency, is reliable, and suitable for use, so the collected data can be considered consistent and trustworthy for further analysis.

Table 5. The Coefficient of Determination (R^2)

	R-square	R-square adjusted
Y (Export Volume)	0.750	0.744

Source: Research data

Export Cargo Volume model yields an R-square value of 0.750, or 75%, which falls within the strong category. The adjusted R-square value for the Export Cargo Volume variable is 0.744, or 74.4%, which is also categorized as strong. Accordingly, it can be concluded that the model demonstrates good performance, indicating a high level of predictive accuracy.



Source: Research Results

Figure 4. Bootstraping Model

This stage involves hypothesis testing to evaluate the significance of the relationships among the variables in the proposed model, including the independent variables of Shipping Costs, Market Competition, and Service Quality, the moderating variable of Exchange Rate Fluctuations, and the dependent variable of Export Cargo Volume. The hypothesis testing was conducted using the bootstrapping procedure in PLS-SEM with SmartPLS 4, employing the original sample estimates, T-statistics, and P-values. A hypothesis is considered supported when the T-statistic exceeds the critical t-value and the P-value is below the significance threshold of 0.05; otherwise, the hypothesis is not supported.

Table 6. Bootstrapping Result

Hypothesis	Path	Original sample (O)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
H1	The Effect of Shipping Costs on Export Cargo Volume	0.175	0.041	4,307	0.000
H2	The Effect of Market Competition on Export Cargo Volume	-0.058	0.050	1,147	0.251
H3	The Effect of Service Quality on Export Cargo Volume	0.401	0.060	6,648	0.000
H4	The Effect of Exchange Rate Fluctuations on Export Cargo Volume	0.487	0.051	9,587	0.000
H5	The Moderation Effect of Exchange Rate Fluctuations on the Relationship between Shipping Costs and Export Cargo Volume	-0.095	0.041	2,326	0.020
H6	The Moderation Effect of Exchange Rate Fluctuations on the Relationship between Market Competition and Export Cargo Volume	0.182	0.051	3,559	0.000
H7	The Moderation Effect of Exchange Rate Fluctuations on the Relationship between Service Quality and Export Cargo Volume	0.003	0.032	0,047	0.962

Source: Research data

1. Hypothesis 1

The results of the hypothesis testing indicate that shipping costs have a positive and significant effect on Export Cargo Volume, with a significance value of 0.000 (< 0.05). This finding suggests that an increase in shipping costs—within the context of this study—is associated with an increase in Export Cargo Volume. This positive relationship can be interpreted as an indication of intensified international trade activity, where rising export demand leads to higher demand for shipping space, thereby driving freight rates upward due to capacity constraints. In this sense, shipping costs reflect heightened export activity rather than functioning solely as a cost barrier. This finding is consistent with the study by Carrière-Swallow et al. (2022), who observed that the post-pandemic surge in global shipping costs coincided with the recovery of global trade volumes, noting that container freight rate increases often follow rising export demand, particularly under limited fleet capacity conditions.

2. Hypothesis 2

Berdasarkan hasil uji PLS, diperoleh koefisien sebesar –0,058, T-statistics 1,147, dan p-value 0,251 (>0,05). Hal ini menunjukkan bahwa jumlah pesaing tidak berpengaruh positif Based on the PLS analysis, the estimated coefficient is –0.058, with a T-statistic of 1.147 and a p-value of 0.251 (> 0.05). These results indicate that the number of competitors does not have a positive or significant effect on Export Cargo Volume, leading to the rejection of the second hypothesis. The negative coefficient suggests that as the number of competitors in the shipping market increases (indicating higher market concentration), Export Cargo Volume tends to increase. This phenomenon is consistent with the oligopolistic structure of the global shipping industry, where three major alliances 2M, Ocean Alliance, and THE Alliance—control more than 80% of global container shipping capacity (UNCTAD, 2024).

Furthermore, the lack of significance in Hypothesis 2 may be explained by the fact that an increase in the number of competitors does not necessarily represent "healthy" competition at the export route level. Instead, it may result in market fragmentation, which does not automatically lead to higher export cargo volumes handled by shipping companies. In fragmented markets, exporters tend to prefer shipping lines that offer reliable container allocation and fixed schedules rather than new entrants with unstable and unguaranteed capacity allotments. Empirical data from the Drewry Shipping Index (2024) support this interpretation, showing that following post-pandemic consolidation among major operators, global shipping capacity increased by 12% in 2024 compared to 2023, while ocean logistics costs declined by 48% from their 2021 peak, reflecting improved market efficiency under high concentration. At the national level, the Indonesian Ministry of Transportation (2024) reported that major shipping companies affiliated with international consortia handled more than 65% of Indonesia's containerized Export Cargo Volume, with throughput efficiency at major ports such as Tanjung Priok and Tanjung Perak increasing by 9.3% throughout 2024.

3. Hypothesis 3

The test results indicate that service quality has a positive and significant effect on Export Cargo Volume, with a significance value of 0.000 (< 0.05). This finding implies that improvements in service quality such as schedule reliability, faster document processing, cargo security, and port facility availability enhance exporters' ability to increase shipment volumes to international markets. This positive relationship underscores the critical role of efficiency and reliability in maritime logistics. High-quality services reduce the risk of delays, minimize additional costs such as demurrage and detention, and strengthen the confidence of international buyers in Indonesian exporters. Consequently, superior service quality not only improves customer satisfaction but also facilitates smoother cargo flows and enhances export competitiveness (Sijabat & Hutahayan 2023) ; (Damanik et al., 2024).

4. Hypothesis 4

The results of hypothesis test H4 show that accessibility (X4) has a positive but not Hasil The statistical test results demonstrate that exchange rate fluctuations have a positive and significant effect on Export Cargo Volume, with a significance value of 0.000 (< 0.05). This finding indicates that currency depreciation specifically the weakening of the Indonesian rupiah against the US dollar enhances the price competitiveness of Indonesian products in international markets. When the rupiah depreciates, Indonesian export goods become relatively cheaper for foreign buyers transacting in US dollars, thereby stimulating demand and increasing Export Cargo Volume. This result is consistent with previous studies. Hena (2020) found that rupiah depreciation significantly increased Indonesia's non-oil and gas exports by lowering the relative prices of export goods in global markets, which subsequently boosted international demand and export volumes.

5. Hypothesis 5

The statistical analysis yields an interaction coefficient of –0.095, with a T-statistic of 2.326 and a p-value of 0.020 (< 0.05). These results confirm that exchange rate fluctuations significantly moderate the relationship between shipping costs and Export Cargo Volume, with a negative moderating effect. This implies that exchange rate movements weaken the influence of shipping costs on increases in Export Cargo Volume. This finding aligns with by Carrière-Swallow et al. (2022), who explain that rising global logistics costs exert a heavier burden on countries with depreciating currencies, as dollar-denominated cost components increase simultaneously. Thus, exchange rates do not strengthen the positive effect of shipping costs on export volumes but instead act as an external factor that weakens this relationship, particularly during periods of high currency volatility and sharply rising dollar-based logistics costs.

6. Hypothesis 6

The PLS analysis indicates an interaction coefficient of 0.182, with a T-statistic of 3.559 and a p-value of 0.000 (< 0.05). These results confirm that exchange rate fluctuations positively

and significantly moderate the relationship between the number of competitors and Export Cargo Volume, leading to the acceptance of Hypothesis 6. The positive coefficient suggests that exchange rate movements strengthen the influence of market competition on Export Cargo Volume. This finding is consistent with Bahmani-Oskooee & Gelan (2017), who demonstrated that domestic currency depreciation stimulates export growth through increased international demand, particularly when supported by adequate logistics infrastructure and transportation capacity.

7. Hypothesis 7

Berdasarkan hasil analisis SEM-PLS, diperoleh koefisien interaksi antara kualitas Based on the SEM-PLS analysis, the interaction coefficient between service quality and exchange rate fluctuations is 0.364, with a T-statistic of 0.047 and a p-value of 0.962, which is well above the 0.05 significance threshold. These results indicate that exchange rate fluctuations do not moderate the relationship between service quality and Export Cargo Volume, leading to the rejection of the seventh hypothesis. This finding suggests that exchange rate movements neither strengthen nor weaken the effect of service quality on Export Cargo Volume. The result is consistent with Gani, (2017) , who argue that maritime logistics service quality enhances international trade performance through supply chain efficiency and reliability rather than through exchange rate mechanisms. Similarly, Umeaduma & Dugbartey, (2023) found that port service reliability consistently increases exporter confidence regardless of macroeconomic conditions such as exchange rate volatility. This confirms that service quality is a structurally stable variable that is relatively unaffected by external factors such as exchange rate fluctuations.

CONCLUSION

This study analyzes the effects of shipping costs, market competition, and service quality on Export Cargo Volume in shipping companies, with exchange rate fluctuations serving as a moderating variable. The findings confirm that export performance in the maritime shipping sector is influenced by the interaction of operational efficiency, market structure, and macroeconomic conditions.

The results indicate that shipping costs have a positive and significant effect on Export Cargo Volume, suggesting that higher freight rates in this context reflect increased export demand and intensified utilization of shipping capacity rather than acting purely as a cost barrier. Market competition, measured by the number of competitors, does not show a significant direct effect on Export Cargo Volume, implying that exporters prioritize reliability and capacity certainty over the mere presence of multiple shipping operators. In contrast, service quality demonstrates a positive and significant impact, highlighting its critical role in supporting smooth logistics flows, reducing operational risks, and strengthening export competitiveness.

Exchange rate fluctuations also exert a positive direct effect on Export Cargo Volume by enhancing price competitiveness through currency depreciation. However, the moderating analysis reveals differentiated effects. Exchange rate fluctuations weaken the relationship between shipping costs and Export Cargo Volume, as rising dollar-denominated logistics costs impose greater financial pressure under volatile currency conditions. Conversely, exchange rate movements strengthen the relationship between market competition and Export Cargo Volume, while no moderating effect is found on the relationship between service quality and Export Cargo Volume, indicating that service quality remains a stable determinant regardless of exchange rate conditions.

Overall, this study contributes empirical evidence that export cargo performance is shaped not only by internal shipping and service factors but also by external macroeconomic dynamics. These findings provide valuable insights for shipping companies, exporters, and

policymakers in designing strategies to enhance export competitiveness under conditions of cost volatility and exchange rate uncertainty.

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