

Impact of Exchange Rate Volatility on Shipping Industry Financial Performance in Nigeria

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Abstract: *This study examined the effect of exchange rate volatility on the financial performance of the Nigerian shipping industry from 1990 to 2024. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH 1,1) method was used to estimate the exchange rate volatility effect, while the ARDL method is used to evaluate the short-run and long-run effects on the financial performance of the shipping industry. Within the context of this study, the exchange rate volatility does not significantly affect the financial performance of the shipping industry. In this study, the dynamics of the labor force and the freedom of trade significantly affect the financial performance of the shipping industry. Therefore, the research concludes that the shipping industry operating in Nigeria has developed mechanisms that help the shipping industry operate efficiently despite the exchange rate risks. This study contributes to existing literature by examining how exchange rate volatility affects the financial performance of Nigeria's shipping industry. Although the maritime sector plays a vital role in the country's economy and international trade, limited empirical research has specifically explored the effect of exchange rate fluctuations on the financial performance of shipping firms in Nigeria. By addressing this gap, the study provides new evidence to enhance understanding of exchange rate risk within the Nigerian maritime industry.*

Keywords: Exchange Rate Volatility, Shipping Industry, Financial Performance, ARDL Model, GARCH Model, Nigeria

1. Introduction

Exchange Rate Volatility is an important part of the International Trading System and Financial Markets in the world, and it has significant impacts on various sectors, especially those that heavily depend on international trade, such as the shipping industry (Michael et.al, 2024; Ikpe, et.al, 2024). Shipping industry is an important part of a developing country that helps in international trade and boosts economic growth in the country (Adenigbo, et.al, 2023; Poi & Ihunwo, 2021). It is an important contributor to the country's GDP, foreign exchange earnings, employment opportunities, and regional trade integration, especially in considering the geographical location of the country in the Gulf of Guinea (Nwolozi, et.al, 2025). The Nigerian shipping industry faces high operating costs, especially in considering the foreign exchange spent on chartering vessels, maintaining vessels, ensuring vessels, purchasing fuel, and paying port charges. However, the revenue is largely earned in Naira. When the Naira depreciates in value, the value of foreign denominated obligations increases, hence reducing profitability, capital investment, and discouraging participation in the industry (Chukwudi, 2025; Esomnofu & Okpalanwabude, 2025). These risks are further complicated by other factors like inflation, which affects the operations of the industry; the labour force, which affects the cost of acquiring skilled manpower in the maritime industry; and the country's trade policies, which affect the ease of doing business in the shipping industry (Olabisi & Akeju, 2024; Oladeji, Soyinka, & Akinola, 2024). Therefore, the financial performance of the shipping industry becomes very vulnerable to macro-economic shocks (Ifegha, et.al, 2022). The financial performance of the shipping industry, therefore, becomes very vulnerable to exchange rate fluctuations. Instability in exchange rates will, therefore, affect freight rates, insurance rates, equipment hire rates, and trade volumes. This will, in turn, affect the cost structure and revenue generation in the industry (Gold & Yusuf, 2025; Gelle, et.al, 2025).

Volatility in exchange rates, which is a persistent and unpredictable change in exchange rates, has the potential to affect the competitive advantage between exports and imports. This will lead to a decline in profitability. For Nigeria, the factors that affect exchange rate instability are external factors such as changes in oil prices, a decline in foreign exchange reserves, capital flight, and changes in inflationary trends. All these factors lead to instability in the exchange rate. This will lead to uncertainty in revenue generation, thus affecting the ability to compete in a global market (Musa et al., 2023; Ikpe, Ubom, & Johnson, 2024).

Instability in exchange rates will lead to an increase in debt servicing costs of debts incurred to purchase vessels and build port infrastructure. This will, therefore, affect financial planning in the industry because it will be difficult to estimate cash flows in an unstable exchange rate environment. This will lead to a decline in investors' confidence in this industry because it is a capital-intensive industry (Michael, et.al, 2024; Nwolozi, et.al, 2025). The unpredictability that could be associated with the movement of

exchange rates could, in turn, lead to reduced expansion, modernization plans, and access to international funding sources (Adenigbo, et.al, 2023; Poi & Ihunwo, 2021).

Therefore, the need to understand the effect of exchange rate volatility on the financial performance of Nigeria's shipping industry is essential. While previous studies have been conducted on the macroeconomic effects of exchange rate movements in Nigeria, little research has been conducted on the direct effects of exchange rate movements on the financial performance of Nigeria's shipping industry (Chukwudi, 2025; Esomnofu & Okpalanwabude, 2025). It is in this regard that this study aims to examine the relationship between exchange rate volatility and the financial performance of Nigeria's shipping industry.

1.2 Statement of the Research Problem

Nigeria's shipping industry has been very instrumental in promoting global trade, providing employment opportunities in the maritime sector, and contributing to the country's revenue generation (Adenigbo, et.al, 2023; Poi & Ihunwo, 2021). Nevertheless, the country's shipping industry has continued to face numerous internal and external shocks, especially with exchange rate fluctuations. In the recent past, the depreciation of the Naira has continued to affect the operations of the shipping industry in Nigeria (Chukwudi, 2025; Esomnofu & Okpalanwabude, 2025). Despite the efforts put in place to stabilize the Naira, the shipping industry has continued to experience the effects of high import duty charges levied on marine equipment, lack of access to foreign exchange for vessel maintenance, and persistent inflation (Nwolozi, et.al, 2025). Recently, the global trade environment has continued to experience several shocks, including protectionist policies, which affected global trade (Michael, Ubom, & Glory, 2024; Ikpe, et.al, 2024). Domestic policy interventions have recorded limited achievements. In addition, the slow processing of concession agreements at the ports, as well as institutional challenges, have affected the efforts to attract investments into the sector and improve the sector's competitiveness (Dere, et.al, 2025; Enyinda, Abang, et.al, 2024).

Exchange rate risks remain one of the keys but unresolved challenges. For instance, the consistent depreciation of the Naira has resulted in the high cost of importing vessels, spare parts, fuel, and maritime technologies (Gold & Yusuf, 2025; Gelle, et.al, 2025). In addition, the exchange rate risks have made denominated debt burdens unbearable for local shipping companies (Musa et al., 2023). Moreover, the exchange rate risks have affected the predictability of exchange rates, which is essential for decision-making, particularly for companies that operate long-term Naira contracts with increasing foreign exchange costs (Ikpe, et.al, 2024; Michael, et.al, 2024).

While the role of the shipping industry in the performance of Nigeria's trade is well acknowledged, a gap exists between the macro-economic policy objectives and financial performance at the firm level. The existing literature mainly discusses the relationship between exchange rate volatility and the performance of the macro-economy, with limited research on the impact of exchange rate volatility on the financial performance of shipping firms (Chukwudi, 2025; Esomnofu & Okpalanwabude, 2025). Secondly, the majority of the research on the impact of exchange rate volatility in the global body of literature is based on developed nations without taking into consideration the challenges of currency instability, foreign exchange scarcity, and trade deficits that Nigerian shipping firms face (Nwolozi, et.al, 2025).

The absence of literature on the impact of exchange rate volatility necessitates in-depth research on the topic. The aim of this research, therefore, is to investigate the impact of exchange rate volatility on the financial performance of shipping firms in Nigeria in terms of operational costs, profitability, and revenue generated (Adenigbo, et.al, 2023; Poi & Ihunwo, 2021).

1.3 Research Questions

The research questions are as follows, and they are intended to assist in the achievement of the objectives of the study;

1. How does exchange rate volatility impact the financial performance of the shipping industry in Nigeria?

1.4 Objectives of the Study

The main aim of the study is to examine the effect of exchange rate volatility on the financial performance of the shipping industry in Nigeria. The specific objectives are:

1. To ascertain the effect of exchange rate volatility on the financial performance of the shipping industry in Nigeria.

1.5 Hypotheses of the Study

The null hypothesis that was tested in the study is as follows;

- H01: Exchange rate volatility does not have an impact on the financial performance of the shipping industry in Nigeria.

2. Literature Review

2.1. Conceptual Review

2.1.1 Financial Performance of the Shipping Industry

These include the ability to generate revenue, manage costs, service debt, and maintain profitability. Thus, financial performance reflects the viability and competitiveness of the shipping companies in the context of a constantly evolving world trading system (Adenigbo, et.al, 2023; Poi & Ihunwo, 2021). In the context of the financial performance of the shipping industry of a developing country like Nigeria, where more than 90 percent of the country's foreign trade is done by sea (Nwolozi, et.al, 2025; Ikpe, et.al, 2024), financial performance of the shipping industry of Nigeria reflects a very important issue for strategic consideration for the country's economic well-being.

Shipping companies of Nigeria operate in a system where the costs of operations of the companies are fixed by the prices of foreign-denominated goods, e.g., the purchase of vessels, chartering, fuel, insurance, spare parts, and port charges. Therefore, changes in the value of the exchange rate between the local currency, the Naira, and other currencies, e.g., the United States Dollar, have significant impacts on the financial performance of the shipping companies of Nigeria (Gold & Yusuf, 2025; Gelle, et.al, 2025). When the value of the local currency, the Naira, falls, the prices of imported goods rise, and customs duty and inflation consequently rise (Esomnofu & Okpalanwabude, 2025).

However, apart from the profitability of the business, financial performance also includes the strength of the business's liquidity, its ability to service debt, and its capacity to withstand macro-economic shocks. Therefore, the financial performance of the Nigerian shipping industry is closely related to the exchange rate, as the value of the currency impacts the sustainability of the business (Michael, et.al, 2024; Musa et al., 2023).

2.1.2 Indicators of Financial Performance of the Shipping Industry

2.1.2.1 Container Throughput Revenue

Revenue earned from container throughput refers to the money earned from containerized cargo movement, usually measured in twenty-foot equivalent units. This variable is an important measure of port performance and the viability of the shipping industry (Dere, et.al, 2025; Enyinda, et.al 2024). Since the movement of containerized cargo dominates the shipping industry, the volume of containers will certainly influence the revenue earned by port authorities and service providers (Mbachu, et.al, 2025). In the case of Nigeria, the movement of containers plays a critical role in the performance of the shipping industry. Since the country's economy relies on maritime trade, the movement of containers will certainly influence the revenue earned by port authorities. Data from the Nigerian Ports Authority revealed that container traffic volume recorded by the country's port reached approximately 1.8 million TEUs by the end of 2021, with Apapa Port recording the highest volume (Dere, et.al, 2025; Poi & Ihunwo, 2021).

Volatility in exchange rate has a major influence on container throughput revenue. Since the depreciation of the local currency, the Naira, increases the prices of imported goods, this may reduce the volume of imported containers. Exchange rate fluctuations will certainly influence the prices charged on exported containers. In addition, since many port-related costs, equipment procurement, and capital investment are denominated in foreign exchange, depreciation can also affect the cost of operations, which can subsequently affect the firm's profitability (Gold & Yusuf, 2025; Gelle, Orshio, et.al, 2025). As container throughput volume sustains its growth, it can improve the stability of revenue generation, which can result in economies of scale (Mbachu, et.al, 2025; Nwolozi, et.al, 2025).

2.1.2.2 Port Revenue

On the other hand, port revenue refers to income earned from port dues, cargo handling, berthing, storage, pilotage, and lease of infrastructure. It is an immediate measure of port efficiency and sustainability (Dere, et.al, 2025; Enyinda, et.al, 2024). The main ports in Nigeria, such as Lagos ports Apapa and Tin Can, Port Harcourt, and Calabar, play an essential role in facilitating trade, and their revenue performance is directly related to trade movements (Mbachu, et.al, 2025; Poi & Ihunwo, 2021).

Volatility in the exchange rate affects port revenue in Nigeria. The depreciation of the Naira makes the local currency equivalent of import duties and port charges higher, hence reducing trade and cargo movements (Gold & Yusuf, 2025; Gelle, et.al, 2025). The instability of the currency also affects pricing, and budgeting becomes difficult, thus affecting trade (Esomnofu & Okpalanwabude,

2025). The depreciation of the exchange rate affects the maintenance and purchase of port equipment, as they are often priced in foreign currency, and thus necessitates an upward review of tariffs, hence discouraging trade (Nwolozi, et.al, 2025; Michael, et.al, 2024).

2.1.2.3 Shipping Costs

The shipping cost is the overall cost of shipping, which entails the cost of freight, fuel, port dues, handling, insurance, crew, maintenance, and administrative expenses (Adenigbo, et.al, 2023; Poi & Ihunwo, 2021; Mbachu, et.al, 2025). The cost is an essential factor in trade competitiveness and the profitability of shipping firms. The high cost of shipping leads to a decrease in the profitability of firms and the efficiency of operations. On the contrary, the management of the shipping cost is an essential factor in the profitability and sustainability of firms (Mbachu, et.al, 2025; Nwolozi, et.al, 2025). The shipping cost is high in developing countries compared to developed economies (Gold & Yusuf, 2025; Gelle, et.al, 2025). The Nigerian economy mainly operates in foreign currency, and the depreciation of the Naira increases the cost of fuel, spare parts, maintenance of vessels, and other imported materials (Esomnofu & Okpalanwabude, 2025; Michael, et.al, 2024). The increase in the cost of shipping leads to an increase in the cost of freight, which is mainly in local currency. The instability of the currency leads to a decrease in the profitability of firms (Ikpe, et.al, 2024; Musa, et al., 2023).

2.1.3 Exchange Rate Volatility and Shipping Industry Financial Performance

On the other hand, exchange rate volatility refers to unpredictable changes in the value of the currency of a particular country with respect to another. The Nigerian currency is highly sensitive to changes in oil prices, capital flow, and macroeconomic variables under a managed floating system, which affects shipping companies that pay in foreign currency and receive local currency (Gold & Yusuf, 2025; Gelle, et.al, 2025). Since 1986, when the Structural Adjustment Programme started in Nigeria, there has been a depreciation in the value of the Naira (Esomnofu & Okpalanwabude, 2025; Michael, et.al, 2024). The stability or instability in the value of the Nigerian currency has contributed to overall currency instability, which affects shipping operations (Ikpe, et.al, 2024; Musa et al., 2023). The changes in the value of the Nigerian currency are a threat to shipping companies because it makes foreign payments more expensive, thus affecting profitability (Chukwudi, 2025; Gold & Yusuf, 2025). Empirical evidence shows that instability in the value of the Nigerian currency affects the pricing of logistics services and consequently the competitiveness of the logistics sector in an emerging economy (Ikpe, et.al, 2024; Adenigbo, et.al, 2023).

2.2 Measure of Exchange Rate Volatility

Volatility of exchange rates is defined and measured in this research using the GARCH model. GARCH models have been found to be appropriate for analyzing exchange rates in economies that experience macroeconomic instability, as such economies often experience frequently fluctuating exchange rates (Esomnofu & Okpalanwabude, 2025; Michael, et.al, 2024). Other researchers have also used GARCH models to analyze exchange rates in Nigeria, demonstrating their suitability for examining the effects of currency instability on economic sectors (Ikpe, et.al, 2024; Ikpe, et.al, 2024).

In this study, the GARCH (1,1) model is used to define the exchange rates of Nigeria. The exchange rates are then employed as a variable to evaluate their impact on the financial performance indicators of Nigeria's shipping industry (Gold & Yusuf, 2025; Gelle, et.al, 2025).

2.2.2 Exchange Rate

This refers to the price of one currency relative to another. Exchange rate changes are known to influence the performance of open economies such as Nigeria, where businesses such as shipping companies heavily rely on international trade. The shipping industry is highly affected by exchange rate changes since it relies on imported inputs and debt incurred in a foreign currency (Esomnofu & Okpalanwabude, 2025; Ikpe, et.al, 2024). Exchange rate changes are known to influence the performance of shipping companies. They affect transaction costs, pricing predictability, and risk exposure for cross-border operating businesses (Gold & Yusuf, 2025; Gelle, et.al, 2025). These changes compel shipping companies to invest heavily in managing exchange rate risks, which affects their performance. Exchange rate changes influence key cost items such as spare parts, fuel, maintenance, insurance, and port charges, which are usually incurred in foreign currency (Michael, et.al, 2024; Musa et al., 2023).

At the international level, developing countries are more affected by the costs of exchange rate volatility due to underdeveloped hedging markets, which limits their ability to respond to exchange rate uncertainty (Chukwudi, 2025; Ikpe, et.al, 2024). In the case of Nigeria, the lack of access to forward contracts or futures markets means that the shipping sector has to rely on the internal financial capacities of firms, affecting their profitability (Gold & Yusuf, 2025; Esomnofu & Okpalanwabude, 2025).

2.2.3 Exchange Rate Volatility

This is the measure of the constant changes in the value of the exchange rate, which is subject to influence by market forces, macroeconomic forces, and changes in government policies. In the case of the Naira in Nigeria, the managed float exchange rate system has exposed the currency to constant changes due to the export of oil products and the influence of other macroeconomic forces in the global economy (Gold & Yusuf, 2025; Gelle, et.al, 2025). The appreciation of the U.S. dollar and the outflow of capital have put immense pressure on the value of the Naira, which has resulted in the increased cost of imports and inflation in the country (Esomnofu & Okpalanwabude, 2025; Michael, et.al, 2024).

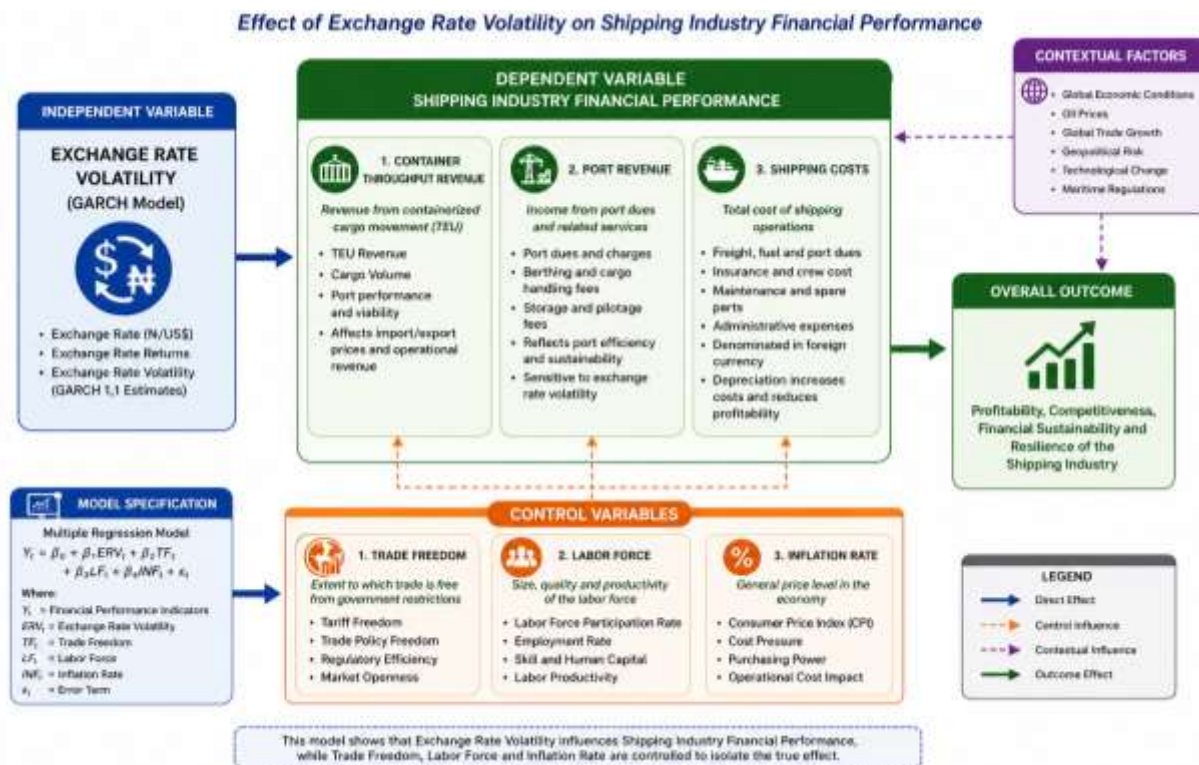
The constant changes in the value of the exchange rate are attributed to various factors such as differences in trade balances, capital flight, and the influence of speculation in the international capital market. The phenomenon of the overshooting of the currency market compared to the goods and services market has resulted in the constant short-term changes in the value of the exchange rate, which has led to macroeconomic instability in the country (Ikpe, et.al, 2024; Musa et al., 2023).

2.3 Maritime Trade and Exchange Rate Volatility

Transporting products and commodities by sea is known as maritime trade. Exchange rate volatility has a direct and indirect impact on maritime trade through investment, output, and the framework of a nation's economic policies (Esomnofu & Okpalanwabude, 2025; Michael, et.al, 2024). Nigeria's exchange rate fluctuated significantly between 1986 and 2022. The Structural Adjustment Program (SAP), which was put into place in 1986, is the main factor influencing Nigeria's exchange rate. The two main tactics used by SAP to diversify output and increase international and agricultural export trades were the liberalization of the foreign exchange market and the devaluation of the Naira (Gold & Yusuf, 2025; Gelle, et.al, 2025).

Nigeria's exchange rate volatility is causing uncertainty, an increase in the country's import bill, and an imbalance in its macroeconomic factors, all of which impact international and maritime trade. Exchange rate volatility continues to influence the nation's economic policies and its maritime and international trade sector despite government interventions to stabilize the exchange rate (Ikpe, et.al, 2024; Musa et al., 2023; Adenigbo, et.al, 2023).

Fig.1 Conceptual Model of Exchange Rate Volatility on Shipping Industry Financial Performance in Nigeria



Source: Researcher's Conceptualization (2026), adapted from the reviewed literature.

The conceptual model explains the relationship between exchange rate volatility and the financial performance of Nigeria's shipping industry. Exchange rate volatility, measured using the GARCH (1,1) model, is the independent variable, while financial performance is measured by container throughput revenue, port revenue, and shipping costs. Trade freedom, labor force, and inflation rate are included as control variables to isolate the effect of exchange rate volatility. The framework provides the basis for the study's empirical analysis and hypothesis testing.

2.2. Theoretical Review

1. Purchasing Power Parity (PPP) Theory

This is predicated on the idea that the two currencies' exchange rates will fluctuate until the price of comparable goods and services is equal when stated in terms of the same currency. The exchange rates between the Naira and other currencies affect the cost of imported ships, shipping equipment, fuel, replacement parts, and other operating expenses in the Nigerian maritime sector. If the Naira depreciates beyond what is predicted by the Purchasing Power Parity theory, shipping companies may face increased operating costs, which could reduce profitability. Conversely, an appreciation of the Naira could lower import costs and improve profitability. The theory of purchasing power parity helps shipping companies understand how exchange rate fluctuations can influence their cost structure (Gold & Yusuf, 2025; Esomnofu & Okpalanwabude, 2025).

2. Interest Rate Parity (IRP) Theory

The theory states that any difference in interest rates between two countries is represented in the forward exchange rate to prevent arbitrage. This is particularly relevant to Nigerian shipping companies, as many rely on foreign currency loans to finance vessels and operations. Exchange rate changes due to interest rate differentials directly affect profitability; if the Naira depreciates against the loan currency, debt repayment costs increase, reducing profits. Understanding the Interest Rate Parity (IRP) theory helps shipping companies manage these currency risks (Michael, et.al, 2024; Ikpe, Ubom, & Johnson, 2024).

3. Agency Theory

Agency theory centers on the conflicts that arise between managers and shareholders, particularly under conditions of information asymmetry. In the Nigerian shipping industry, exchange rate volatility may create uncertainty in decision-making and financial reporting. Managers may act opportunistically, such as delaying foreign currency exchanges or selectively hedging against exchange rate risks, which can reduce organizational value and financial performance. Agency theory suggests that implementing strong corporate governance practices can help mitigate these conflicts and manage associated financial risks (Adenigbo, et.al, 2023; Dere, et.al, 2025).

4. Real Options Theory

Real Options Theory views investment opportunities as options, allowing firms to delay, expand, reduce, or abandon investments in response to market uncertainties. For Nigerian shipping companies, exchange rate volatility poses significant challenges to business decisions, including fleet expansion, port facility investments, and long-term international contracts. Applying Real Options Theory enables shipping firms to strategically manage investments under currency fluctuations, thereby supporting the sustainability of their financial performance (Ifegha, et.al, 2022; Mbachu, et.al, 2025).

5. International Fisher Effect (IFE) Theory

According to the International Fisher Effect, currencies of countries with high nominal interest rates tend to depreciate relative to those with lower rates. Nigeria's relatively high nominal rates compared to its trading partners suggest that the Naira is likely to decline against other currencies. This affects repayment of foreign debt and the cost of imported goods and services. For shipping companies engaged in international contracts, the International Fisher Effect highlights the exchange rate risks impacting revenue, operating costs, and debt servicing. Accounting for this effect enables shipping firms to better anticipate currency risk and make informed pricing decisions for international contracts (Nwoloziri, et.al, 2025; Michael, et.al, 2024).

2.3 Empirical Review

Gold & Yusuf (2025) explored the effect of exchange rate and macroeconomic indicators on Nigeria's non-oil export performance using annual data spanning the 2000s to early 2020s. The study found that exchange rate movements and volatility were significant factors affecting non-oil export outcomes, showing that currency instability affects broader trade sectors beyond oil.

Chinweuba (2025) investigated the relationship between exchange rate dynamics and the balance of payments performance in Nigeria from 1975 to 2024. Employing an ARDL modeling approach, the study indicated that exchange rate movements significantly influence balance of payments dynamics in both the short and long run, emphasizing the broader macroeconomic impact of currency volatility.

Esomnofu & Okpalanwabude (2025) examined the impact of EXRTV on Nigeria's trade balance over the period 1981 to 2016. The study employed ARDL model and the findings revealed that EXRTV had a significant negative impact on the country's trade balance, suggesting that currency instability reduces competitiveness and trade flows.

Olabisi & Akeju (2024) examined the impact of EXRTV on economic growth, inflation, and output in Nigeria between 1985 and 2022 using ARDL analysis. Findings showed that exchange rate volatility interacted significantly with inflation and growth outcomes, suggesting that unstable currency conditions can amplify macroeconomic instability.

Gelle, et.al, (2024) investigated the impact of EXRTV on non-oil exports and economic growth prospects from 1990 to 2024 using ARCH-GARCH models. The study found that exchange rate volatility significantly influenced non-oil export performance, reinforcing the view that unstable currency conditions impair trade competitiveness.

Michael et.al (2024) investigated the effect of EXRTV on international trade in Nigeria using monthly data from 2013 to 2023. The study employed a GARCH model alongside VAR analysis, finding that exchange rate volatility significantly depressed imports but stimulated exports, highlighting the complex influence of currency fluctuations on trade dynamics.

Musa et al. (2023) assessed the impact of exchange rate volatility on Nigeria's export performance over the period 2008 to 2021. Using an ARDL-ECM with secondary data, the study found that real effective EXRTV negatively influenced export performance in the long run, indicating that currency instability undermines export competitiveness.

2.4. Gap in Literature

Most studies on exchange rate volatility in Nigeria focus on macroeconomic and trade outcomes, leaving a gap in understanding its impact on the shipping industry. There is limited research using firm-level financial data to examine how currency fluctuations affect shipping companies' performance, despite their high exposure to foreign-denominated costs and debts.

3. Methodology

3.1 Research Design

This study opted to use the longitudinal research design. The rationalization for the adoption of this research design is assessed from the fact that it enables a researcher to determine the actual sequence of events and also enables a researcher to gain an insight into the cause-and-effect relationships that exist between two or more variables. More so, this research design enables a researcher to source for a number of variables over a long period of time without in any way influencing the outcome of the variables in the sense that the data already exist and thus are not manipulated.

3.2 Population and Sample Size of the Study

The study focused on the effect of exchange rate volatilities on financial performance of the shipping industry in Nigeria for the period 1990 to 2024. In this case, the study population was the Nigerian shipping industry. The rationale for selecting this study in Nigeria are not only because of the scarcity of research on the subject in Nigeria but also because of the fact that Nigeria is an oil-exporting nation and its main source of revenue is oil exports, which occur in the shipping industry. In addition to that, Nigeria is a nation that imports goods and services in huge quantities, which also occur in the shipping industry. The fact that the price of oil in the global market is very volatile and also the fact that import prices are very volatile (most especially in this case when there is a trade war that affects the prices of imports and exports due to the imposition of tariffs among the superpowers in the global marketplace), it became very essential to conduct this research in Nigeria. Moreover, the Nigeria economy is used as a sample size as the research focuses on using macroeconomic system-wide variables, particularly in terms of the impact of exchange rate volatility on the economy. The population of the study is also regarded as manageable, and hence it was decided that the entire population be used as a sample for the purpose of the research. The population of the study is used as a sample.

3.3 Sources of Data

The data used for the purpose of the research was sourced from secondary sources. In particular, the financial performance of the shipping industry, inflation rate, trade freedom, and labour force were sourced from both the World Bank Development Indicator and the Central Bank of Nigeria Statistical Bulletin for the year 1990 to 2024. Exchange rate volatility was derived using the GARCH (1,1) model. The financial performance of the shipping industry proxies whose data was sourced include container throughput revenue, shipping costs, and port revenue, which were controlled by the inflation rate, trade freedom, and labour force respectively.

3.4 Model Specification

Consistent with the findings of Kanu & Nwadiubu (2020), whose research focused on the topic: Exchange Rate Volatility and International Trade in Nigeria, the current research retains the basic framework of analysis whereby international trade components are regressed against exchange rate volatility and other relevant macroeconomic variables. Kanu & Nwadiubu's model specified the trade volume (TRADE VOL) as a function of the real effective exchange rate (REER), and further broken down into export and import trade components as follows:

$$EXPT = \alpha_0 + \alpha_1 REER + e_t \quad (3.1)$$

$$IMPT = \alpha_0 + \alpha_1 REER + e_t \quad (3.2)$$

Where:

EXPT = Growth rate of Export trade

IMPT = Growth rate of Import trade

REER = Real Effective Exchange Rate

et = Error term

Unlike Kanu and Nwadiubu's framework, however, the current research departs from the analysis of aggregate international trade components such as exports and imports to instead focus on the financial performance of the Nigerian shipping industry. The financial performance of the shipping industry is analyzed through three key dimensions:

1. Container Throughput Revenue (CTP)
2. Shipping Costs (SHPC)
3. Port Revenue (POR)

To better grasp the dynamic relationship between exchange rate variables and the shipping industry, these financial indicators are individually regressed against a set of exchange rate-related explanatory variables. This yields a total of three unique models, which are further categorized into four categories based on the type of exchange rate volatility under consideration.

3.5 Estimation Technique for Exchange Rate Volatility

To ascertain the volatility of the naira exchange rate during the research period, this study intends to utilize a Generalized Autoregressive Conditional Heteroscedasticity (GARCH) modeling technique. The GARCH model is an efficient technique to measure volatility, which is a key feature of financial series. The GARCH model is more applicable to financial series because exchange rate volatility is a well-known phenomenon that is described by a leptokurtic distribution.

The study utilizes a GARCH (1,1) model, which is a popular model used to measure exchange rate volatility. The GARCH model is a simple model that is widely used to measure volatility. The GARCH (1,1) model is characterized by the following equations:

$$r_t = \mu + \varepsilon_t \quad (3.3)$$

The equation shows that the rate of return on the value of the exchange rate at any given time t , denoted by r_t , is equal to the average rate of return denoted by μ and some random variation or shock denoted by ε_t .

$$\varepsilon_t \sim N(0, h_t) \quad (3.4)$$

The random variation or shock in the rate of return on the value of the exchange rate is normally distributed with zero mean and variance denoted by h_t .

The random variation or shock in the rate of return on the value of the exchange rate is normally distributed with zero mean and variance denoted by h_t . However, the variance or volatility is not constant over time and is denoted by h_t .

$$h_t = \alpha_0 + \alpha_1 + \beta_1 h_{t-1} \quad (3.5)$$

The variance or volatility denoted by h_t is a function of a constant term denoted by α_0 , the square of the previous period's error term denoted by $(\varepsilon_{t-1})^2$, and the previous period's volatility denoted by h_{t-1} . This implies that the volatility of the returns on the exchange rate at time t is not constant but rather a function of a constant, the shock experienced in the previous period, and the volatility experienced in the previous period.

Where:

r_t = return (or log difference) on the exchange rate at time t ,

μ = constant mean,

ε_t = error term,

h_t = conditional variance,

$\alpha_0 > 0$, $\alpha_1 \geq 0$, and $\beta_1 \geq 0$ are parameters to be estimated.

The model adequately captures the autoregressive volatility and the effect of past shocks, thus enabling an accurate estimation of the volatility of the exchange rate.

After obtaining the volatility series, the study evaluates the effect of EXRV on the financial performance of the shipping industry in Nigeria using the ARDL model. The approach is appropriate for analyzing the relationships between variables that are a mixture of I (0) and I (1) but not all of the variables are I(2).

Hence, the modified model is decomposed into three models. They are expressed as follows:

$$CTP = F(EXRV, IFR, TRF, LAB) \quad (3.6)$$

$$SHPC = F(EXRV, IFR, TRF, LAB) \quad (3.7)$$

$$POR = F(EXRV, IFR, TRF, LAB) \quad (3.8)$$

Econometrically, the models stated above will be re-modified in ARDL form and unit root form:

ARDL Form

Model One: Exchange Rate Volatility and CTP

$$\Delta CTP_t = \alpha_0 + \alpha_1 \Delta CTP_{t-1} + \sum_{i=0}^m \Delta EXRV_{t-1} + \sum_{k=0}^0 X_k \Delta IFR_{t-k} + \sum_{j=0}^P X_j \Delta TRF_{t-j} + \sum_{k=0}^Q X_k \Delta LAB_{t-k} + \mu t - \quad (3.18)$$

Model Two: Exchange rate Volatility and SHPC

$$\Delta SHPC_t = \alpha_0 + \alpha_1 \Delta SHPC_{t-1} + \sum_{i=0}^m \Delta EXRV_{t-1} + \sum_{k=0}^0 X_k \Delta IFR_{t-k} + \sum_{j=0}^P X_j \Delta TRF_{t-j} + \sum_{k=0}^Q X_k \Delta LAB_{t-k} + \mu t - \quad (3.19)$$

Model Three: Exchange rate Volatility and POR

$$\Delta POR_t = \alpha_0 + \alpha_1 \Delta POR_{t-1} + \sum_{i=0}^m \Delta EXRV_{t-1} + \sum_{k=0}^0 X_k \Delta IFR_{t-k} + \sum_{j=0}^P X_j \Delta TRF_{t-j} + \sum_{k=0}^Q X_k \Delta LAB_{t-k} + \mu t - \quad (3.20)$$

Where:

$EXRV_t$ = Exchange Rate Volatility

CTP_t = Container Throughput Revenue

$SHPC_t$ = Shipping Cost

POR_t = Port Revenue

IFR_t = Inflation Rate

LAB = Labour Force

TRF = Trade Freedom

t = stands for time.

α_0 = represent short run coefficients

α_i = represent the long-term coefficients

While, the short-term analysis relates to the adjustment process and immediate effect of the independent variables on the dependent variables, the long-term analysis discloses the speed of adjustment towards equilibrium in the long term.

3.6 Measurement of Variables

Table 3.1 highlights the variables, their measurement and various sources of data.

Table 3.1: Variables, Measurement and Source of Data

S/N / Study Variables	Description/Measurement	Sources of Data	Research Studies that have used the Measurement
Dependent Variables			
Financial Performance of Shipping Industry			

1	Container throughput revenue (CTP)	Total Throughput = Total Containers Handled.	World Bank Development Indicator.	Allen & McAleer, (2020)
2	Shipping Cost (SHP)	Total Shipping Cost/ Total Shipped.	Drewry Shipping Consultants (Drewry's World Container Index) Freights (digital freight forwarding platforms also provide this data) BIMCO (International Shipping Association)	Allen & McAleer, (2020)
3	Port revenue (POR)	Number of container ships calling at the ports.	UNCTAD	Kanu & Nwadiubu, (2020)
Independent Variables				
4	Exchange Rate Volatility (EXRV)	GARCH Model (1,1) $r_t = \mu + \varepsilon_t$ $\varepsilon_t \sim N(0, h_t)$ $h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1}$	GARCH Model 1(1)	Francq & Zakoian, (2019)
Control Variables				
5	Inflation Rate (IFR)	Consumer price Index.	CBN Statistical Bulletin (2023)	Ahmad & Wazir, (2017)
6	Trade Freedom (TRF)	Trade weighted average tariff rate.	Heritage foundation's index of Economic freedom, (2023).	Gwartney et.al. (2024)
7	Labour Force (LAB)	The total number of people employed or unemployed.	World Bank Development Index (2023)	Abodie et.al. (2023)

Source: Researcher's Compilation, (2026)

3.7 Method of Data Analysis

The technique used to estimate was based on the ARDL Model. Prior to using the econometric model to estimate the data, a series of preliminary tests was undertaken to understand the data. First, descriptive statistics were performed on all the data to obtain a summary of key features. Second, a correlation matrix was created to identify linear relationships between all the data. Finally, a series of diagnostic tests was performed on the regression model to ensure its adequacy. The Variance Inflation Factors were used to identify if there was any issue of multicollinearity between the explanatory data. This is because if there is a problem of multicollinearity, it can cause a distortion of coefficients. The econometric E-Views version 13 was used to run the second-order integrated technique.

4. Data Analysis

4.1 Descriptive Statistics

Table 4.1: Descriptive Statistics

Variable	Mean	Max.	Min.	Std. Dev.	Skew.	Kurt.	J-B	Prob.
CTPG	6.35	59.32	-17.63	13.79	1.91	8.55	2.41	0.30
PORG	30.20	218.63	-65.55	50.17	1.65	7.37	3.41	0.49
SHPCG	1.52	40.23	-37.24	13.97	0.33	5.28	3.96	0.14
EXRTV	43.42	1023.0	-55.00	175.92	5.30	30.02	1308.71	0.00
IFR	19.02	72.84	5.39	15.96	2.05	6.37	43.47	0.00
LABG	3.18	15.60	2.12	2.23	5.28	29.85	2.21	0.33
TRF	4.81	6.57	1.84	1.48	-0.76	2.23	3.93	0.14

Source: Author's computation, (2025), using Eview 13.

The descriptive statistics of the variables employed in the study are presented in Table 4.1. It can be observed that the mean of the container throughput growth (CTPG) is 6.35, whereas the mean of the port revenue growth (POR) and shipping cost growth (SHPCG) is 30.20 and 1.52, respectively. This means that the growth rate of the port revenue is relatively higher compared to the growth rates of other shipping performance indicators. In terms of the variation of the variables, it can be observed that the POR has relatively higher variation with a standard deviation of 50.17, whereas the CTPG and SHPCG have relatively moderate variation. The results also showed that the mean value of exchange rate volatility is 43.42, with a very high maximum value of 1023.0 and a high standard deviation of 175.92. This shows the variability of exchange rate movement in Nigeria. The inflation rate has a mean value of 19.02, which implies that the inflation rate is high in the Nigerian economy. Labour force growth and trade freedom have a mean value of 3.18 and 4.81, respectively, which implies that the growth is moderate in the Nigerian economy. The results of the Jarque-Bera normality test showed that CTPG, POR, SHPCG, LABG, and TRF are normally distributed, since their probability values are greater than 0.05. EXRTV and IFR are not normally distributed.

Table 4.2: Correlation Matrix

Variable	CTP	POR	SHPC	EXRTF	IFR	LAB	TRF
CTP	1						
POR	0.68	1					
	0.00						
SHPC	-0.25	0.43	1				
	(0.15)	(0.01)					
	0.21	0.68	0.41	1			
EXRTV	0.23	0.00	0.01				
	0.00	0.00	0.87	0.18			
IFR	-0.41	-0.05	0.46	0.14	1		
	0.02	0.79	0.01	0.43			
LAB	0.87	0.93	0.16	0.49	-0.23	1	
	0.00	0.00	0.35	0.00	0.19		
TRF	0.78	0.31	-0.62	0.10	-0.66	0.55	1
	0.00	0.07	0.00	0.55	0.00	0.00	

Source: Author's computation, (2025), using Eview 13.

Table 4.2 above shows the correlation matrix that defines the inter-relationships between the variables employed in the study. The correlation matrix shows that container throughput (CTP) has strong positive correlations with port revenue (POR), labour force (LAB), and trade freedom (TRF), which means that as these variables increase, the container throughput also increases. The port revenue is also strongly positively correlated with the labour force and exchange rate volatility (EXRTV). The shipping cost (SHPC) is positively correlated with exchange rate volatility and inflation rate (IFR), but negatively correlated with trade freedom. The inflation rate is generally negatively correlated with some of the variables, particularly the container throughput and trade freedom. The correlation coefficients are all below the critical level, which means that there are no serious multicollinearity problems among the variables.

Table 4.3: Results for Multicollinearity Test

Variable	Centred VIF
EXRTV	0.214
LAB	8.078
TRF	4.114
IFR	2.151

Source: Author's computation, 2025, using Eview 13.

The VIF results show all variables are within acceptable limits, indicating no multicollinearity problem.

Table: 4.4 Unit root Test

Variable	ADF Test		KPSS		Order of Integration
	Levels	First Difference	Levels	First Difference	
CTP	-1.649	-4.792	0.656	0.291	I(1)
SHPC	0.02	-3.429	0.654	0.205	I(1)
POR	-3.189	-6.487	0.758	0.334	I(1)
EXRTV	2.573	-3.162	0.394	0.305	I(0)
IFR	-2.137	-4.668	0.591	0.187	I(1)
LAB	-1.269	2.986	0.582	0.229	I(0)
TRF	-1.543	-7.031	0.6182	0.272	I(1)

Source: Author's computation, (2025), using Eview 13.

Most variables are non-stationary at level but become stationary after first differencing (I(1)), while EXRTV and LAB are stationary at level (I(0)), supporting the use of the ARDL model.

Table 4.5: Bounds Cointegration Test

Test Statistic	Value	Significance	I(0)	I(1)
<i>Eqn: with EXRTV</i>				
F-statistic	3.805	10%	2.08	3
K	5	5%	2.39	3.38
		1%	3.06	4.15

Source: Author's computation, (2025), using Eview 13.

F-statistic (3.805) exceeds critical bounds, indicating a long-run relationship (cointegration).

Table 4.6: EGARCH Results for Exchange Rate Volatility

Variable	Coeff	t-stat	Prob.
Constant	0.498	3.324	0.001
exrt _{t-1}	0.906	30.769	0.000
Variance Equation			
ω	-1.784	-2.123	0.038
α	1.437	2.150	0.030
γ	-0.685	-1.134	0.257
β	0.668	2.366	0.018
Adj. R-sq.		0.967	
D-W stat		1.838	

Source: Eview 13. (2026)

The GARCH results show that EXRTV (-1), ARCH (α), and GARCH (β) are all positive and statistically significant at 1%. The model has high explanatory power (Adj. R² = 0.967) and no autocorrelation (DW = 1.838).

Table 4.7: Results for Exchange Rate Volatility and Shipping Industry Financial Performance

Variable	Container thruptut		Shipping cost		Port revenue	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.

Short Run						
ARDL Result						
$\Delta EXRTV$			-0.001	0.000		
ΔLAB			10.572	0.000		
ΔIFR					-0.003	0.532
ΔTRF	0.080	0.001			0.030	0.733
ΔTRF_{t-1}	0.059	0.012			0.229	0.017
ECM_{t-1}	-0.490	0.000	-0.286	0.000	-0.410	0.000
Long Run ARDL						
Result						
EXRTV	-0.643	0.074	-0.099	0.057	-0.849	0.503
IFR	0.001	0.818	0.004	0.589	0.015	0.476
LAB	1.582	0.000	2.059	0.029	4.961	0.003
TRF	0.138	0.003	-0.170	0.096	-0.061	0.790
Constant	-3.363	0.344	-6.393	0.494	-46.525	0.005
Adj. R-sq.	0.494		0.490		0.474	
D-W stat	2.006		2.128		2.566	

Source: Eview 13 (2025)

The results imply that the constant term of container throughput and shipping cost models, -3.363 and -6.393, respectively, is not statistically significant since the probability value is greater than 0.05, implying that the constant term is not significant. However, it is clear that the constant term of the port revenue model is statistically significant since the probability value is less than 0.05, implying that there is a significant baseline effect in the model. The implications of the result that the models of container throughput, shipping cost, and port revenue have an adjusted R-squared value of 0.494, 0.490, and 0.474, respectively, is that 49%, 49%, and 47%, respectively, of the variance in the dependent variable is explained by the explanatory variables in each of the three models. The implications of the result that the Durbin-Watson statistic of the models is 2.006, 2.128, and 2.566 for container throughput, shipping cost, and port revenue models, respectively, is that there is no significant autocorrelation in each of these three models, implying that the regression estimates are reliable.

4.2 Test of hypothesis

The null hypothesis is that the volatility of the exchange rate does not have a significant effect on the financial performance of the shipping industry in Nigeria. The results of the ARDL long-run estimates indicate that the coefficient of the EXRTV is -0.643 ($p = 0.074$) for container handling, -0.099 ($p = 0.057$) for the shipping cost, and -0.849 ($p = 0.503$) for port revenue. Since the probability values are greater than the 5% significance level, the volatility of the exchange rate does not have a statistically significant effect on the financial performance indicators of the shipping industry.

The study is unable to reject the null hypothesis (H_0) and concludes that the volatility of the exchange rate does not have a significant effect on the financial performance of the shipping industry in Nigeria.

4.3 Discussion of Results

The results of this study showed that the EXRTV does not have a statistically significant impact on the financial performance of the Nigerian shipping industry, as measured by container volume, shipping cost, and port revenue. The long-run ARDL outcome reveals that the coefficients of EXRTV are all negative for the three financial performance indicators (container volume: -0.643, shipping cost: -0.099, port revenue: -0.849), but all are statistically insignificant at the 5% significance level. This outcome implies that, during the study period, changes in the value of the naira did not have any significant impact on the financial performance of the shipping industry in Nigeria.

This outcome is consistent with the finding of the study by Okene et al. (2024), which found that exchange rate volatility did not have any significant impact on the maritime trade volume in Nigeria. Similarly, the result partially aligns with Oyekunle et al. (2021), who observed that while exchange rate depreciation may be harmful in the short term, it could enhance international competitiveness for Nigerian shipping services, suggesting a complex and context-dependent relationship.

However, the finding contrasts with several studies that reported a negative impact of exchange rate volatility on the financial performance of shipping firms. For example, Adeyemo et al. (2020), Eze & Uchenna (2021), and Ijjo & Olaoluwa (2019) found that

fluctuations in the exchange rate increased operational costs and reduced profitability for transport and shipping firms in Nigeria. The discrepancy may be due to differences in the financial indicators used, the specific firms studied, or the time periods analyzed. While those studies focused on firm-level profitability and dollar-denominated costs, the present study used broader macroeconomic proxies for financial performance, such as container throughput, shipping cost, and port revenue, which may be less sensitive to exchange rate movements.

Additionally, the descriptive statistics reveal substantial variability in exchange rate volatility (EXRTV), with a highly leptokurtic distribution. This suggests occasional extreme fluctuations that may affect firms unevenly, further explaining why the aggregate financial indicators of the shipping industry did not reflect a statistically significant relationship. The strong significance of labour force (LAB) in both the short-run and long-run ARDL models highlights that human capital and operational capacity may play a more crucial role in shaping financial performance than exchange rate movements. This aligns with studies emphasizing internal operational efficiency as a buffer against macroeconomic shocks (Adewuyi & Adefolami, 2021; Okonkwo & Ugochukwu, 2021).

In conclusion, the results indicate that while exchange rate volatility is a theoretically important determinant of financial performance, its practical impact on Nigeria's shipping industry during the study period was limited. The study's findings reinforce the notion that macroeconomic and operational factors such as labour force dynamics, trade freedom, and port activity levels may be more immediate drivers of shipping sector performance. The results therefore partly support empirical findings that show minimal impact of exchange rate volatility (Okene et al., 2024; Oyekunle et al., 2021) while contradicting studies that emphasize a strong negative effect on firm-level profitability (Adeyemo et al., 2020; Eze & Uchenna, 2021; Ijjo & Olaoluwa, 2019).

5.1 Conclusion

The study examined the effect of exchange rate volatility on the financial performance of the Nigerian shipping industry over the period 1990–2024. Using GARCH (1,1) to estimate exchange rate volatility and the ARDL model to analyze both short-run and long-run relationships, the findings reveal that exchange rate volatility does not have a statistically significant effect on container throughput, shipping costs, or port revenue. This suggests that, at the industry level, the shipping sector in Nigeria has mechanisms such as operational adjustments, trade policies, or strategic pricing that mitigate the financial impact of exchange rate fluctuations. In contrast, labour force dynamics and trade freedom appear to have more pronounced effects on shipping sector performance, indicating that internal operational factors and policy environments are critical determinants of financial outcomes.

Overall, the results align with some empirical studies, such as Okene et al. (2024) and Oyekunle et al. (2021), which found limited or context-dependent effects of exchange rate volatility, while partially contradicting firm-level studies (Adeyemo et al., 2020; Eze & Uchenna, 2021; Ijjo & Olaoluwa, 2019) that reported significant negative impacts on profitability. The findings highlight the importance of distinguishing between firm-level and industry-level analyses when assessing macroeconomic shocks.

5.2 Recommendations

Based on the study's findings, the following recommendations are proposed:

1. **Strengthen Operational Resilience:** Shipping companies should continue to improve operational efficiency and labour management, as labour force dynamics significantly influence financial performance. Investment in workforce training and technology adoption can enhance productivity and mitigate operational risks.
2. **Diversify Revenue Streams:** Firms should explore new shipping routes, services, and logistics solutions to reduce reliance on foreign exchange-sensitive costs, thereby insulating themselves from potential currency fluctuations.
3. **Government Policy Support:** Policymakers should maintain stable trade and port policies, and support initiatives that enhance trade freedom and infrastructure development, as these factors positively affect industry performance.
4. **Exchange Rate Risk Management:** While the study finds limited industry-level effects, firms with dollar-denominated obligations should implement hedging strategies and financial instruments to manage exposure to exchange rate fluctuations.
5. **Promote Domestic Production:** To reduce vulnerability to import costs, the government should encourage domestic production of goods and raw materials used in shipping operations.

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