

Analysis of the Impact of Shipping Tariffs on the Marginal Efficiency of Freight Forwarders Based on Cost Optimization and Supply Chain Resilience

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Abstract: In contemporary society, globalized trade continues to develop and become the mainstream of economic trade. As an important role in the shipping industry connecting all parts of the shipping industry, the operational efficiency and cost control ability of freight forwarding enterprises are directly related to the competitiveness of foreign trade enterprises. This thesis aims to analyze the role of shipping rate fluctuation and supply chain resilience on the marginal efficiency of freight forwarding enterprises, which is assessed by collecting shipping rate indices and analyzing past literature. It is found that the marginal cost of freight forwarders is more sensitive to the fluctuation of shipping tariffs and fuel costs, and that firms with higher supply chain resilience can effectively mitigate the shock during the period of rising tariffs. While improving efficiency, shipping companies still need to balance the relationship between cost control and environmental sustainability and form closer collaborative relationships with partners to cope with the wave of digitization.

Keywords: supply chain resilience, shipping tariffs, freight forwarders

1. Introduction

In the globalized economic system, the shipping industry plays a crucial role, which connects markets around the world and supports the flow of international trade. Shipping tariffs as a key factor affecting the cost of international trade, its fluctuations on the impact of freight forwarding enterprises cannot be ignored in recent years, the global shipping market has experienced several fluctuations, and these fluctuations are often closely related to the price of fuel, supply and demand, geopolitical events, as well as environmental policies and other factors. The uncertainty of these factors has brought great challenges to freight forwarders, especially in cost control and risk management. Fluctuations in shipping rates not only affect the direct costs of freight forwarders, but may also be transmitted to the entire economy through various links in the supply chain. This study aims to investigate the impact of shipping rate volatility on the marginal efficiency of freight forwarding firms and how firms can cope with these challenges through cost optimization and supply chain resilience. By analyzing the dynamics of the shipping market and the operational practices of freight forwarders, this paper will reveal the economic logic behind shipping rate volatility and provide strategic recommendations for freight forwarders.

2. Background to developments in the global shipping industry

With the changes in the global economic landscape, emerging market countries, such as India and the member countries of the Association of Southeast Asian Nations, are experiencing rapid economic growth and a gradual increase in demand for international trade. The Asian region's share of global trade continues to rise, while the European and American markets are growing relatively slowly. In addition, geopolitics such as the Russia-Ukraine conflict has had a profound impact on energy transportation. Europe's reduced reliance on Russian natural gas in favor of liquefied natural gas (LNG) from the Middle East, the US and Africa has led to a significant increase in demand for LNG shipments. At the same time, several important international transportation routes have become complex and uncertain. Shipowners are not giving up on market expansion, instead, they are still optimistic about ordering new ships, especially container ships and bulk carriers, to meet capacity demand in China. As of September 2024, the total size of China's maritime fleet has reached 430 million deadweight tons, accounting for 18.7% of the world fleet. The shipping cargo volume reached 9.37 billion tons in 2023, exceeding the 9 billion tons mark for the first time, with a year-on-year growth of 9.5%. In addition, China has also vigorously promoted the construction of smart ports and smart waterways, and the country has built 49 automated terminals, which continues to be a global leader [1]. Not only in China, but many ports around the world, such as the Port of Singapore, are accelerating the construction of automated terminals to reduce labor costs and improve operational efficiency by means of driverless loading and unloading equipment and digital management systems to reduce waiting times. This marks technology and digital transformation. Blockchain technology has been widely used for cargo documentation and tracking, which can significantly reduce the cumbersome processes in traditional manual operations and shorten cargo clearance and settlement time. The application of automated systems such as AI navigation optimization further improves the efficiency of route planning and fuel usage.

3. Changes in maritime freight rates

Ocean freight rates are a complex movement, influenced by many factors. Container liner rates are affected by supply and demand factors, governmental factors, the world economy and other factors. For a shipping company, the increased cost per additional voyage, per additional unit of cargo transported, is the marginal cost. Fuel and port charges are two important expenditures in the variable costs of shipping companies, and analyses of marginal benefits play a key role in controlling these expenditures. For example, optimizing sailing speeds and planning routes can effectively reduce fuel consumption and thus increase the marginal benefits of fuel [2]. In addition, green transport is not a bad idea. Adopting energy-efficient and environmentally friendly modes of transport, such as electric trucks and solar-powered boats, not only reduces dependence on fuel prices, but also lowers costs through carbon emission tax breaks. Shipping companies can also gain consumer recognition of green products and increase brand value.

For the demand side, fluctuations in global trade volumes are a direct factor affecting freight rates. For example, the annual surge in demand for consumer goods in Europe and the United States before the holiday shopping season leads to higher containerized freight rates. While during economic recession or global events such as epidemics and wars, a decrease in trade demand can lead to a drop in freight rates. Changes on the supply side such as excess or insufficient vessel capacity can significantly affect freight rates. If many new vessels are delivered but demand growth is insufficient, this can lead to excess capacity that reduces market rates; whereas a shortage of capacity can lead to higher rates when old vessels are centrally phased out and the supply of new vessels is insufficient.

The process of fluctuation of shipping prices is complex and varied, and may show extremely different trends of movement from cycle to cycle, which is not possible to conclude if the overall

perspective is taken alone. In general, the long-term trend of shipping prices is upward, which is related to the development of the world economy and inflation. Some scholars divide it into ten nodes, with shipping rates falling sharply after the 2008 subprime crisis in the United States and gradually recovering and showing a more stable steady movement by 2010 [3]. Shipping rates are also characterized by seasonality. There are differences in the seaworthiness and deadweight capacity of ships in different seasons. Taking one year as the analysis interval, the China Containerized Freight Index (CCFI) shows a roughly wave-like movement every year. Excluding accidental factors, CCFI tends to show a slow downward trend in the first quarter, which may continue into the second quarter until the middle of the second quarter, when the CCFI will begin to pick up again and continue until September-October, and then drop back down until the end of the year [4].

Due to the ever-changing development context, freight forwarding enterprises face the risk of freight rate fluctuations, which poses a major challenge to their profitability and market competitiveness. In order to effectively avoid this risk, enterprises can adopt various strategies. First, by participating in the shipping derivatives market, such as Forward Freight Agreements (FFA), enterprises are able to lock in future freight costs, thus reducing the uncertainty of market fluctuations [5]. Secondly, hedging with financial instruments such as the Container Transportation Index Futures can help enterprises hedge the risk of the spot market and realize price risk management. In addition, the establishment of a diversified supply chain can reduce the dependence on a single supplier, which in turn reduces the impact of freight rate fluctuations. Through the implementation of these strategies, freight forwarders can maintain stable operations in a volatile market and enhance their ability to adapt to market changes.

4. Application of supply chain resilience in freight forwarders

In maritime transport markets, the price elasticity of demand directly affects marginal benefits. If the price elasticity of demand for goods transport is high, the volume of demand may increase significantly even with a slight decrease in price, thus increasing marginal benefits. Thus, maritime transport companies can dilute fixed costs and reduce marginal costs by scaling up operations, such as increasing the number of voyages and expanding the fleet. However, overexpansion may lead to diminishing marginal benefits, especially if there is no corresponding increase in demand. Therefore, if all links in the supply chain, such as shipping lines, freight forwarders, ports, logistics companies, etc., can improve their efficiency through information sharing and coordinated operations, then marginal benefits can be improved even when the unit volume of transport increases. The following will analyze how freight forwarders can expand marginal costs or cope with the challenges posed by high costs from the perspective of supply chain resilience.

Freight forwarders can begin through many parts of the supply chain, such as transportation modes, warehouses, and digital development. At first, forwarders can optimize transport costs and transit times by combining different modes of transport when freight rates rise. For example, when ocean freight rates are high, more rail or road transport may be chosen, which avoids relying on a single mode of transport and reduces the risks associated with freight rate fluctuations. By adopting such multi-modal transport, enterprises can reduce their dependence on a single mode with high freight rates, thereby reducing the volatility of transport costs and increasing marginal efficiency. Then, forwarders can optimize transport costs and transit times by combining different modes of transport when freight rates rise. For example, when ocean freight rates are high, more rail or road transport may be chosen, which avoids relying on a single mode of transport and reduces the risks associated with freight rate fluctuations. By adopting such multi-modal transport, enterprises can reduce their dependence on a single mode with high freight rates, thereby reducing the volatility of transport costs and increasing marginal efficiency. Last but not least, Digital new business has also gradually become an important means for freight forwarders to develop business. Some enterprises have adopted

various methods, such as cooperation, self-built or equity investment, to try different business models. For example, Maersk Group has invested in the digital forwarding platform of a startup to simplify the booking process, aiming to bring customers a new forwarding service experience. In addition, Maersk and IBM have also jointly built the TradeLens platform, which connects the information chains of terminals, shipping companies, freight forwarders, logistics companies and cargo owners upstream and downstream of the shipping value chain, forming a large ecological platform covering the whole world [6].

As the global supply chain continues to transform towards digitalization and intelligence, the shipping and logistics industry will face more complex challenges and opportunities in the future. How to balance cost control and environmental sustainability while improving efficiency will be a pressing issue for companies to address, for example, green transportation and energy optimization. In the future, with the in-depth application of AI, big data, blockchain and other technologies, the entire shipping supply chain will become more transparent, efficient and intelligent. In the long run, the popularization of digital platforms and multi-party collaboration will drive the industry in the direction of greater flexibility and innovation, and push the global shipping market into a new competitive landscape. At the same time, shipping companies and freight forwarders need to pay constant attention to changes in market demand, diversification of transportation modes, and dynamic adjustments in policies and regulations to cope with the ever-changing global economic environment. For enterprises in all segments of the supply chain, how to enhance their core competitiveness in the wave of digitization and form closer collaborative relationships with partners will become the key to success. The future of the shipping industry will depend on the continuous upgrading of technological innovation and business models. Only by exploring and adapting to the fierce competition in the market can we maintain our leading position and drive the industry in a more sustainable and efficient direction.

5. Conclusion

This paper provides an in-depth analysis of the impact of shipping tariff volatility and supply chain resilience on the marginal efficiency of freight forwarding firms, revealing the central role of the shipping industry in global trade as well as the challenges that freight forwarding firms face in it. The study finds that the volatility of shipping rates has a significant impact on the marginal costs of freight forwarders, while firms with higher supply chain resilience are able to effectively mitigate the shocks during rate increases. While pursuing efficiency gains, shipping companies also need to form closer partnerships with their partners to cope with the wave of digitization. Some of the literature is selected to study the trends in the shipping industry, and the future direction can also be analyzed by using the past transactions of a specific company's case. With the development of Euroline, shipping finance will come into the public eye in the future.

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