

The Effects of Exogenous Shocks on the Baltic Dry Index

Doğanay Yıldırım ^{1*}, Sercan Erol ²

¹ Samsun University, Türkiye

² Karadeniz Technical University, Türkiye

* Corresponding author: doganay.yildirim@samsun.edu.tr.

Abstract. This study examines the movements of the Baltic Dry Index (BDI) during periods of major exogenous shocks of different origins in the dry bulk shipping market. The research is framed within the context of the fragility of international supply chains, the sensitivity of freight markets to supply-demand imbalances, and the critical role of maritime transport in global trade. The study focuses on four major exogenous shocks that coincided with periods of significant volatility in freight market conditions: the COVID-19 pandemic, the grounding of the Ever Given in the Suez Canal, the Russia-Ukraine War, and attacks on commercial vessels in the Red Sea. The COVID-19 pandemic disrupted port operations, reduced vessel availability, slowed logistics processes, and increased volatility in freight rates. The Ever-Given incident caused a six-day blockage in the Suez Canal, disrupting global maritime traffic, extending delivery times, and increasing costs on certain routes. The Russia-Ukraine War has heightened uncertainty in global supply chains, particularly regarding grain and energy transportation, and has been associated with higher volatility in the freight market. Similarly, attacks on commercial vessels in the Red Sea have highlighted maritime security risks and led to route changes. These events provide a comparative framework for explaining how different exogenous shocks were reflected in dry bulk freight market conditions. The study evaluates BDI movements through graphical comparisons and descriptive statistics centered around the selected shock dates. The findings are interpreted as evidence of the temporal relationship between exogenous shocks and BDI movements rather than definitive causal effects.

Key Words: Baltic Dry Index, Exogenous Shocks, COVID-19, Red Sea, Russia–Ukraine War

1. Introduction

Maritime transport is one of the cornerstones of global trade and plays a critical role in the functioning of the world economy. A large share of global trade by volume is carried by maritime transport, making it an indispensable component of international supply chains. According to UNCTAD, maritime transport accounts for more than 80% of global trade by volume, with the global volume of maritime trade reaching 12,720 million tons in 2024 (UNCTAD, 2025).

Freight rates in maritime transport are determined by a highly dynamic market structure shaped by the interplay of supply and demand. Fleet capacity, vessel supply, fuel costs, commodity demand, industrial production, and macroeconomic developments are among the key factors that decisively shape

the freight market (Stopford, 2009; Notteboom & Vernimmen, 2009; Gu & Liu, 2022). One of the most widely used indicators for tracking these changes in the dry bulk shipping market is the Baltic Dry Index. The Baltic Dry Index is recognised as a key indicator for both maritime markets and global trade activities because it reflects spot freight conditions in the dry bulk shipping sector (Lin & Sim, 2013; Lin et al., 2019; Bai et al., 2021; Bandyopadhyay & Rajib, 2023). However, in recent years, maritime transport markets have been confronted not only with traditional supply-and-demand dynamics but also with exogenous shocks emerging on a global scale. The COVID-19 pandemic, the Russia-Ukraine War, the grounding of the Ever Given in the Suez Canal, and attacks on commercial vessels in the Red Sea have demonstrated that maritime transport networks are vulnerable to various types of disruptions. These developments have become closely linked to freight market conditions through numerous operational and economic factors, including port operations, route safety, vessel accessibility, insurance costs, fuel consumption, and delivery times (Cui et al., 2023; Sun et al., 2024; UNCTAD, 2024b).

In this context, the Baltic Dry Index provides a useful indicator of how freight markets respond during periods of global economic slowdown, geopolitical uncertainty, and security-related disruptions. However, rather than establishing a direct and definitive causal relationship between external shocks and BDI movements, evaluating such market movements by examining how these developments coincided with freight market fluctuations during the same periods provides a more cautious approach. Therefore, rather than measuring the precise causal effects of the selected external shocks on the BDI, this study evaluates how BDI movements changed during these periods within a descriptive and comparative framework. This study examines movements in the Baltic Dry Index during major exogenous shocks of different origins in the 2019 to 2025 period, thereby describing how the dry bulk freight market responded under different shock conditions. In this context, the study examines the COVID-19 pandemic, the six-day blockage of the Suez Canal caused by the Ever Given, the Russia-Ukraine War, and attacks on commercial vessels in the Red Sea. The study evaluates BDI movements through graphical comparisons and descriptive statistics; it interprets the findings not as definitive causal conclusions, but as descriptive evidence of the temporal relationship between periods of exogenous shocks and freight market conditions.

2. Literature Review

Freight rates in maritime transport are among the market indicators that exhibit high volatility due to their sensitivity to changes in supply-demand conditions, operational costs, and global economic developments (Lim et al., 2019). One of the indicators widely used to track these changes in the dry bulk shipping market is the Baltic Dry Index. The Baltic Dry Index is recognised as a key indicator, particularly for reflecting market conditions related to major dry bulk cargo shipments (Stopford, 2009). During periods of economic growth, increased demand for raw materials can boost cargo volumes, creating upward pressure on BDI levels. Conversely, during periods of economic slowdown, a decline

in demand for raw materials weakens global trade volumes and can create downward pressure on dry bulk freight rates (Papailias et al., 2017; Lin et al., 2019).

Recent studies indicate that the maritime transport sector has become increasingly vulnerable to exogenous shocks such as the pandemic, geopolitical conflicts, trade restrictions, and security-related disruptions in strategic sea lanes (Rothengatter, 2011; UNCTAD, 2023). Such developments are associated with fluctuations in freight markets, driven by route changes, longer voyage durations, increased fuel consumption, operational uncertainties, and changes in vessel availability (Dagestani, 2022; Cong et al., 2024). Xu et al. (2022) examined the relationship between new case counts and BDI volatility during the COVID-19 pandemic using a GARCH-MIDAS model with data from 2020 to 2022. The study's findings indicate that case counts remain significantly associated with BDI volatility even after controlling for other freight and operational variables. Similarly, Chang et al. (2023), in their study covering the 2019 to 2021 period, compared pre- and post-pandemic periods; they found that the factors determining the BDI changed after the pandemic, with port calls, iron ore and scrap steel prices, and confirmed COVID-19 case counts becoming more decisive.

The literature also highlights the importance of route disruptions and geopolitical risks for maritime freight markets. Tran et al. (2025) demonstrate that the blockage caused by the Ever Given vessel in the Suez Canal in 2021 was associated with high economic and environmental costs for maritime transport, including route deviations and delays, and increased the fragility of supply chains. According to UNCTAD, the Russia-Ukraine War has impacted maritime trade logistics by disrupting cargo flows, particularly those originating in Europe, and by causing fluctuations in freight markets (UNCTAD, 2022). Erol (2024) examined the early-stage impacts of the Russia-Ukraine War on maritime trade and transportation in the Black Sea, noting that during the conflict, vessel operating and logistics costs increased, congestion and supply chain disruptions emerged in major logistics corridors, and alternative trade routes gained greater importance.

Monge et al. (2023), who examined the relationship between geopolitical risks and freight markets, analysed the behaviour of the Baltic Dry Index and West Texas Intermediate oil prices using monthly data from 1985 to 2021. The study's findings indicate that following geopolitical shocks, BDI returns tend to revert to their long-term trend, whereas oil prices exhibit more persistent responses. Furthermore, structural break and wavelet analyses reveal that geopolitical risks are associated with significant breaks in both freight rates and oil prices. More recently, UNCTAD (2024a) noted that security-related disruptions in the Red Sea have increased global maritime transport costs and exerted upward pressure on freight markets.

3. Materials and Methods

This study uses the Baltic Dry Index (BDI) as a key indicator to assess changes observed in the dry bulk freight market during periods of exogenous shocks. The BDI was selected as the empirical indicator for this study because it reflects freight conditions in the dry bulk shipping market. The

research is based on BDI data from 2019 to 2025. This period provides a suitable timeframe for analysis, as it encompasses a time span during which global maritime transport markets faced exogenous shocks of different origins.

The study examines four major exogenous shocks: the COVID-19 pandemic, the six-day blockage in the Suez Canal caused by the *Ever Given*, the Russia-Ukraine War, and attacks on commercial vessels in the Red Sea. These events were included in the comparative analysis because they occurred during the same time period in which significant fluctuations were observed in the dry bulk freight market. Thus, the study examined how external developments of different natures coincided with movements in the BDI.

Methodologically, the study is based on a descriptive and comparative research design rather than a causal econometric modelling approach. Therefore, the findings are interpreted not as definitive causal effects of exogenous shocks on the BDI, but rather as descriptive evidence of the temporal relationship between the selected shock periods and BDI movements. This approach aims to reveal how changes in the BDI are shaped around the dates of the shocks; however, it does not make a definitive claim of causality that these changes stem solely from these events.

The movements of the Baltic Dry Index (BDI) from 2019 to 2025 were visualised using annual and overall period charts. Selected shock periods were marked on the time series charts, and changes in index values were evaluated by considering pre- and post-shock trends. Additionally, the direction and magnitude of fluctuations in the freight market were presented in a comparative manner using descriptive statistics, annual averages, and time-series comparisons. In this context, the analysis focuses on describing how the BDI responded during different periods of exogenous shocks and explaining the relationship between these movements and freight market conditions.

4. Results

Time series charts show that the Baltic Dry Index experienced significant fluctuations during the 2019–2025 period and that these fluctuations closely coincided with periods of exogenous shocks of different origins. The findings present the movements observed in the dry bulk freight market during these periods within a descriptive framework, rather than measuring the precise causal effects of the selected shocks on the BDI. As shown in Figure 1, the Baltic Dry Index remained at low levels during the first months of 2020. This period coincided with the COVID-19 pandemic, which reduced global trade volumes, disrupted port operations, and created uncertainty in logistics processes. In the early stages of the pandemic, the index fell to 461 points amid a contraction in global demand and a slowdown in shipping activities. However, starting in the middle of the year, a rapid recovery in BDI values was observed due to supply chain imbalances, limited shipping capacity, and, particularly, the resurgence of economic activity in China. Nevertheless, the index remained volatile for the remainder of the year and generally remained below pre-pandemic levels. This pattern indicates that BDI movements during the

COVID-19 period were linked to both the contraction in demand and the subsequent supply chain pressures.

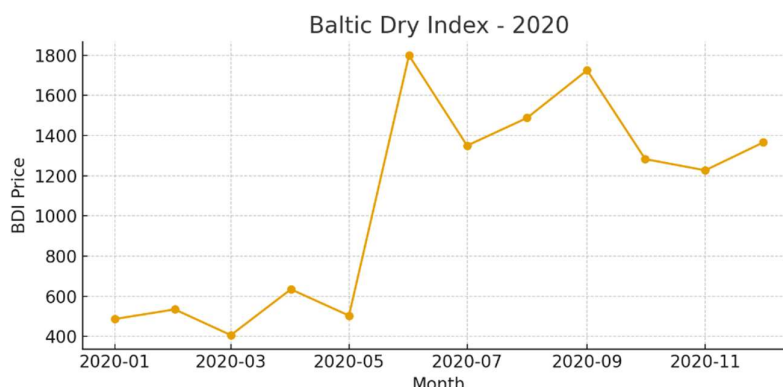


Figure 1. Baltic Dry Index – 2020

As shown in Figure 2, the Baltic Dry Index rose sharply in 2021. The six-day blockage caused by the Ever Given vessel in the Suez Canal led to disruptions in global maritime traffic, longer delivery times, and cost pressures on certain routes. This period coincided with the post-pandemic recovery in global trade, the persistence of logistics bottlenecks, and limited vessel supply. Under these conditions, the BDI rose above 2,000 points and reached very high levels in the third quarter of the year. Although a downward trend was observed in the index during the final months of the year, the fact that BDI values remained high throughout 2021 indicates that supply chain bottlenecks and capacity constraints were strongly reflected in freight market conditions.

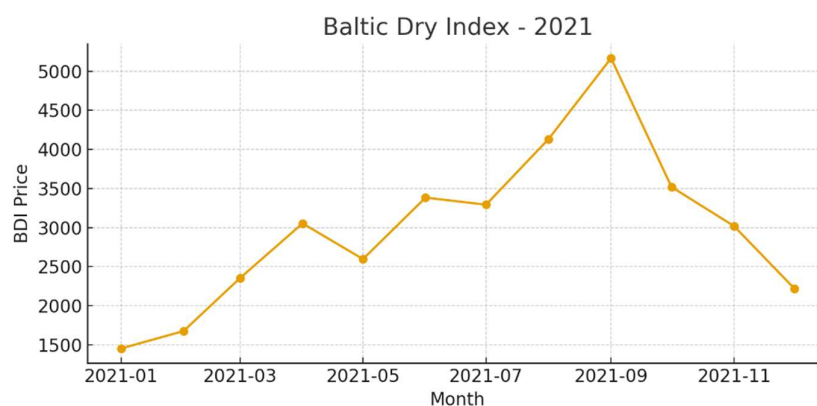


Figure 2. Baltic Dry Index – 2021

As shown in Figure 3, BDI values in 2022 followed a volatile trend during the same period marked by rising geopolitical uncertainty following the outbreak of the Russia-Ukraine War, route security issues, and risks related specifically to grain and energy transportation. The index remained at relatively high levels in the first month of the year, but a clear downward trend emerged starting in the middle of the year, driven by a slowdown in global demand and shifts in market expectations. Sharp declines were observed in the second half of the year, followed by a limited recovery in subsequent

months. This trend suggests that during the war, the BDI was sensitive not only to geopolitical developments but also to global demand conditions and market expectations.

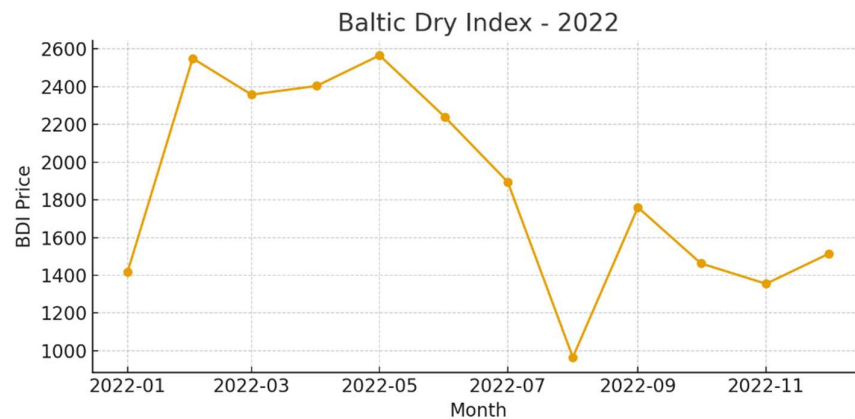


Figure 3. Baltic Dry Index – 2022

As shown in Figure 4, BDI values remained relatively low and flat during the first half of 2023. Increasing security risks in the Red Sea region and concerns about route safety led some vessels to opt for alternative routes, resulting in longer voyage durations and higher fuel costs. However, weak global demand during the same period limited the rise in freight rates to the expected extent. This situation suggests that cost increases alone are insufficient to drive up freight rates and that demand conditions play a significant role in BDI movements. In the second half of the year, the index rose amid uncertainties about global trade flows and geopolitical risks, with more pronounced increases in the final quarter. Although a limited decline was observed in the final month of the year, the index exhibited an upward trend heading into the end of 2023.

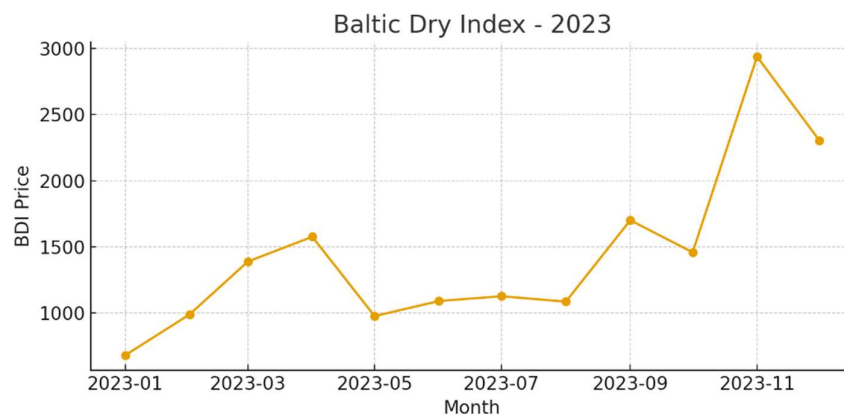


Figure 4. Baltic Dry Index – 2023

As shown in Figure 5, the Baltic Dry Index was volatile throughout 2024. While index values saw limited fluctuations in the first half of the year, a more pronounced rise emerged, particularly in the third quarter. In contrast, the fourth quarter saw a renewed downward trend in the freight market, and index values declined toward the end of the year. This period should be evaluated alongside changes in global trade volumes, fluctuations in dry bulk cargo demand, and uncertainties regarding maritime

shipping routes, particularly security risks in the Red Sea. Consequently, 2024 suggests that the BDI followed a trajectory sensitive to both demand conditions and route security and geopolitical uncertainties.

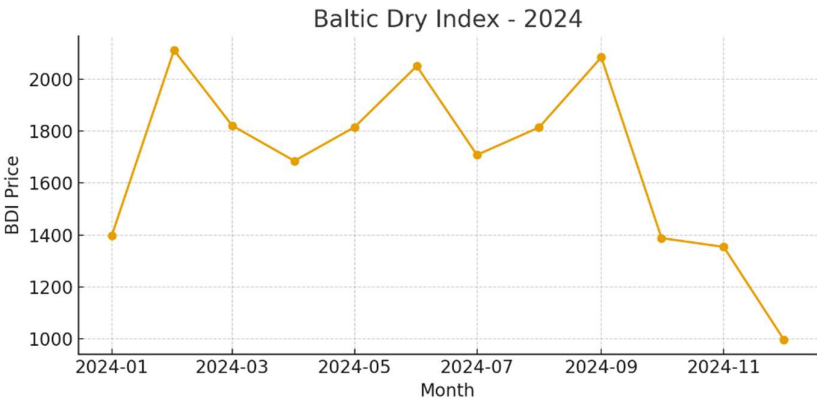


Figure 5. Baltic Dry Index – 2024

As shown in Figure 6, the Baltic Dry Index generally rose in 2025. The index, which was at relatively low levels in the first months of the year, rose gradually from the middle of the year onward and showed a more pronounced increase in the final quarter. This trend indicates a period in which demand conditions and cost pressures in the global dry bulk shipping market have regained strength. However, this increase should be evaluated in the context of broader market conditions, demand developments, and freight market expectations, rather than attributed solely to a single exogenous shock.

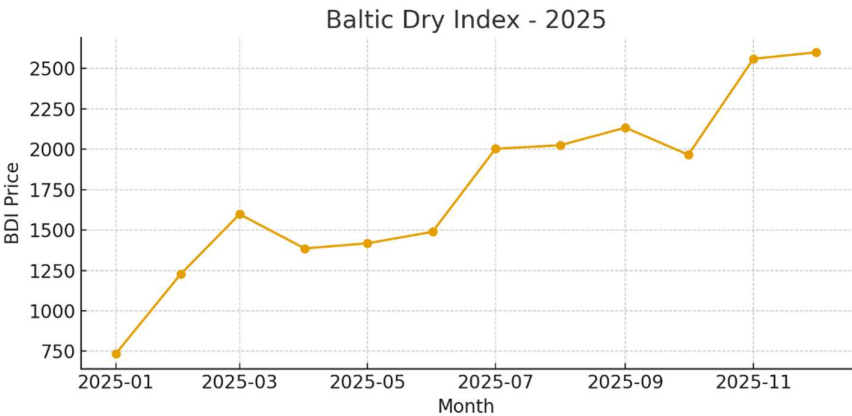


Figure 6. Baltic Dry Index – 2025

As shown in Figure 7, the overall BDI trend for the 2019 to 2025 period indicates that the dry bulk freight market is highly sensitive to global economic and geopolitical developments. In 2020, a significant decline in index values was observed during the COVID-19 pandemic, while in 2021, BDI values rose rapidly amid supply chain disruptions, post-pandemic recovery, and logistical bottlenecks. In 2022, market volatility increased with the outbreak of the Russia-Ukraine War, and the index entered a downward trend in the latter part of the year. In 2023 and 2024, the market followed a volatile yet

relatively more balanced trajectory; security risks in the Red Sea region and uncertainties in global trade flows were assessed alongside periodic increases. In 2025, a gradual recovery trend in BDI values was observed. Overall, the findings indicate that the BDI exhibits significant fluctuations during periods marked by global crises, geopolitical uncertainties, route safety issues, and changes in demand conditions. However, these results should be interpreted not as definitive evidence of the causal effects of exogenous shocks on the BDI, but rather as descriptive evidence of the temporal relationship between the selected shock periods and movements in the dry bulk freight market.

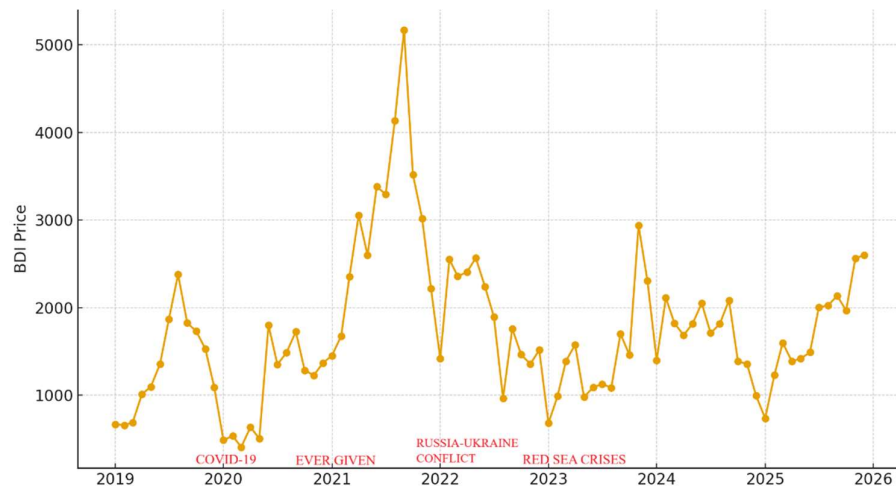


Figure 7. Baltic Dry Index 2019–2025 Period

5. Conclusion

This study examines how the dry bulk freight market behaves during periods of various types of global exogenous shocks, using Baltic Dry Index data for the 2019 to 2025 period. The findings indicate that the BDI exhibited significant fluctuations during these periods and that the dry bulk freight market is structurally sensitive to external developments. However, these findings should be interpreted not as definitive causal effects of exogenous shocks on the BDI but rather as descriptive evidence revealing the temporal relationship between the selected shock periods and BDI movements.

The four exogenous shocks examined in the study are linked to freight market conditions through various channels. During the early stages of the COVID-19 pandemic, the contraction in global demand, disruptions in port operations, and uncertainties in logistics processes coincided with the downward trend in the BDI. Following the pandemic, supply chain bottlenecks, constraints on transport capacity, and the recovery process in global trade were observed alongside an upward trend in the BDI. This indicates that BDI movements during the pandemic period must be evaluated in conjunction with both the contraction in demand and the subsequent supply and capacity pressures that emerged.

The six-day blockage caused by the Ever Given in the Suez Canal has emerged as a significant external event that led to disruptions in global maritime traffic, longer delivery times, and cost pressures on certain routes. However, the reflection of this event in the BDI should be assessed not only in light

of the canal blockage but also in conjunction with market conditions such as the post-pandemic recovery in global trade, logistics bottlenecks, and limited vessel supply. Consequently, the high BDI levels observed in 2021 present a picture that can be explained by the convergence of multiple market factors during that period.

The Russia-Ukraine War is viewed as a significant geopolitical development that has created uncertainty in the freight market, particularly regarding grain and energy transportation, route security, insurance costs, and regional trade flows. The findings indicate that volatility in the BDI increased when the war began; however, the index subsequently moved in a manner sensitive to changes in global demand conditions and market expectations. This suggests that freight market responses to geopolitical shocks are not one-sided but are shaped by demand, supply, route security, and the overall economic outlook.

Attacks on commercial vessels in the Red Sea and rising security risks have created a significant area of risk for maritime transport markets, leading to route changes, longer voyage durations, and pressure for higher fuel costs. However, the findings indicate that the extent to which these cost pressures are reflected in freight rates can vary depending on global demand conditions. In particular, the limited reflection of cost increases in the BDI during periods of weak demand highlights the decisive role of demand conditions in freight markets.

Overall, the study indicates that the BDI is a key indicator that reflects not only global economic activity but also developments related to supply chain disruptions, geopolitical uncertainties, route security issues, and market expectations. However, it is incorrect to attribute BDI movements to a single factor. Freight markets are shaped by the simultaneous interaction of numerous factors, including supply-demand balance, fleet capacity, fuel costs, route security, commodity demand, and the macroeconomic outlook. Therefore, movements observed in the BDI during periods of exogenous shocks should be evaluated within the broader context of market conditions.

From a practical perspective, the findings underscore the importance of maritime sector stakeholders closely monitoring freight market indicators during periods of exogenous shocks. For shipowners, charterers, cargo owners, logistics companies, and policymakers, evaluating BDI movements in conjunction with indicators such as route safety, port congestion, fuel costs, commodity demand, and geopolitical risks can contribute to more sound decision-making processes. Especially during periods of uncertainty, flexible route planning, evaluating alternative trade corridors, utilizing freight risk management tools, and strengthening early warning systems can enhance the sector's resilience to shocks.

The main limitation of this study is that it relies on a descriptive and comparative approach rather than a causal econometric model. Therefore, the results highlight the temporal relationship between shock periods and BDI movements rather than measuring the exact magnitude or persistence of shock-related changes in the BDI. Future studies could examine the magnitude, duration, and persistence of exogenous shocks on freight markets in greater detail using econometric methods such as

VAR, VECM, ARDL, or event studies. Furthermore, analyzing BDI data in conjunction with AIS-based vessel movements, port congestion indicators, commodity trade data, and geopolitical risk indices could contribute to a more comprehensive explanation of how exogenous shocks manifest in maritime transport markets.

References

- Bai, X., Lam, J. S. L., & Jakher, A. (2021). Shipping sentiment and the dry bulk shipping freight market: New evidence from newspaper coverage. *Transportation Research Part E: Logistics and Transportation Review*, 155, 102490.
- Bandyopadhyay, A., & Rajib, P. (2023). The asymmetric relationship between Baltic Dry Index and commodity spot prices: Evidence from nonparametric Causality-inQuantiles test. *Mineral Economics*, 36, 217-237, <https://doi.org/10.1007/s13563-021-00287-y>
- Chang, C. W., Hsueh, M. H., Wang, C. N., & Huang, C. C. (2023). Exploring the factors influencing the impact of the COVID-19 pandemic on global shipping: A case study of the baltic dry index. *Sustainability*, 15(14), 11367.
- Cong, L., Zhang, H., Wang, P., Chu, C., & Wang, J. (2024). Impact of the Russia–Ukraine conflict on global marine network based on massive vessel trajectories. *Remote Sensing*, 16(8), 1329.
- Cui, L., Yue, S., Nghiem, X. H., & Duan, M. (2023). Exploring the risk and economic vulnerability of global energy supply chain interruption in the context of Russo-Ukrainian war. *Resources Policy*, 81, 103373.
- Dagestani, A. A. (2022). An analysis of the impacts of COVID-19 and freight cost on trade of the economic belt and the maritime silk road. *International Journal of Industrial Engineering & Production Research*, 33(3), 1-16.
- Erol, S. (2024). The early impact of the Russia-Ukraine war on seaborne trade and transportation in the Black Sea. *International Journal of Shipping and Transport Logistics*, 18(3), 305-323.
- Gu, B., & Liu, J. (2022). Determinants of dry bulk shipping freight rates: Considering Chinese manufacturing industry and economic policy uncertainty. *Transport Policy*, 129, 66-77.
- Lim, K. G., Nomikos, N. K., & Yap, N. (2019). Understanding the fundamentals of freight markets volatility. *Transportation Research Part E: Logistics and Transportation Review*, 130, 1-15.
- Lin, A. J., Chang, H. Y., & Hsiao, J. L. (2019). Does the Baltic Dry Index drive volatility spillovers in the commodities, currency, or stock markets?. *Transportation Research Part E: Logistics and Transportation Review*, 127, 265-283.
- Lin, F., & Sim, N. C. S. (2013). Trade, income and the Baltic Dry Index. *European Economic Review*, 59, 1-18. <https://doi.org/10.1016/j.euroecorev.2012.12.004>
- Monge, M., Rojo, M. F. R., & Gil-Alana, L. A. (2023). The impact of geopolitical risk on the behavior of oil prices and freight rates. *Energy*, 269, 126779.

- Notteboom, T. E., & Vernimmen, B. (2009). The effect of high fuel costs on liner service configuration in container shipping. *Journal of transport geography*, 17(5), 325-337.
- Notteboom, T., Pallis, A., & Rodrigue, J. P. (2022). Port economics, management and policy. Routledge.
- Papailias, F., Thomakos, D. D., & Liu, J. (2017). The Baltic Dry Index: cyclicalities, forecasting and hedging strategies. *Empirical Economics*, 52(1), 255-282.
- Rothengatter, W. (2011). Economic crisis and consequences for the transport sector. In *Transport Moving to Climate Intelligence: New Chances for Controlling Climate Impacts of Transport after the Economic Crisis* (pp. 9-28). New York, NY: Springer New York.
- Stopford, M. (2009). *Maritime economics* (3rd ed.). Routledge.
- Sun, M., Cao, X., Liu, X., Cao, T., & Zhu, Q. (2024). The Russia-Ukraine conflict, soaring international energy prices, and implications for global economic policies. *Heliyon*, 10(16).
- Tran, N. K., Haralambides, H., Notteboom, T., & Cullinane, K. (2025). The costs of maritime supply chain disruptions: The case of the Suez Canal blockage by the Ever Given megaship. *International Journal of Production Economics*, 279, 109464.
- UNCTAD. (2022). *Maritime trade disrupted: The war in Ukraine and its effects on maritime trade logistics*. https://unctad.org/system/files/official-document/osginf2022d2_en.pdf
- UNCTAD. (2023). Review of maritime transport. United Nations Conference on Trade and Development. https://digitallibrary.in.one.un.org/TempPdfFiles/8392_1.pdf
- UNCTAD. (2024a). High freight rates strain global supply chains, threaten vulnerable economies. <https://unctad.org/news/high-freight-rates-strain-global-supply-chains-threaten-vulnerable-economies>
- UNCTAD. (2024b). "Navigating Troubled Waters: The Impact to Global Trade of Disruption of Shipping Routes in the Red Sea, Black Sea and Panama Canal". UNCTAD Rapid Assessment.
- UNCTAD. (2025). Review of maritime transport 2025. United Nations Conference on Trade and Development. https://unctad.org/system/files/official-document/rmt2025_en.pdf
- Xu, L., Zou, Z., & Zhou, S. (2022). The influence of COVID-19 epidemic on BDI volatility: An evidence from GARCH-MIDAS model. *Ocean & Coastal Management*, 229, 106330.