



Research on the Correlation Between BDI Index and China's Major Dry Bulk Import Trade

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Abstract: In this paper, according to the existing literature, combining the BDI index and dry bulk trade related research content, the existing literature is mainly for the BDI index volatility, prediction and other economic indicators related research based on the preliminary analysis. At the same time, we have collated the overview of the BDI index and the trade status of China's three major dry bulk cargoes, and the quantitative analysis part of this paper mainly uses the vector autoregressive model to study the correlation between the BDI index and China's dry bulk trade in 2015-2023, and to analyze the impact size and the degree of impact between the BDI index and China's dry bulk trade. After that, the gray correlation method is applied to supplement the analysis results. The research conclusion of this paper is: BDI index for iron ore import trade are positive impact, for soybean impact has positive and negative, both of the impact period is relatively short, the impact of the magnitude of the magnitude of the impact is relatively large; but the coal import trade volume of the BDI index shows a smaller response. And for the BDI index, China's three major dry bulk import trade volume on its impact is very small, although China has become the world's largest trading country, but still can not largely affect the international dry bulk freight prices.

Keywords: BDI index, dry bulk trade, VAR, correlation research

1 Introduction

1.1 Background

The Baltic Dry Index (BDI, Baltic Dry Index) is an authoritative indicator reflecting the level of freight rates in the international dry bulk shipping market, and is also a barometer of the world's economic and trade conditions. The influence of China's dry bulk trade in the international arena has also been rising, since 2003 China's share of iron ore imports has been ranked first in the world, and in recent years China's share of coal and grain imports has also jumped to the world's first. However, in the environment of the spread of the new crown epidemic, the global economic downturn superimposed

challenges and uncertainties, so therefore the study of the correlation between the BDI index and China's dry bulk import trade is of great theoretical and practical significance.

1.2 Literature Review

Existing literature on the BDI index and dry bulk import and export trade is as follows: Emmanuel Joel Aikins Abakah [1] et al. investigated the asymmetric dependence of the Baltic Dry Bulk Index (BDI) on traditional financial markets over the period 1995-2023. Lang Xu [2] et al. used a GARCH-MIDAS model to divide the volatility of the BDI into long-run and short-run components, and then used least squares regression to empirically test the effect of increased number of infections on volatility, and found that the increased number of infections effectively affects the volatility of BDI. Ma Min and Hao Yuzhu [3] found that the BDI index can indeed play a certain role in predicting the movement of China's dry bulk trade volume. Wang Dashan and Liu Wenbai[4] predicted the future supply and demand situation in the international dry bulk shipping market and the trend of annual BDI index based on the linkage model. Shao Jungang and Hao Yannan[5] found that the impact of international crude oil price on BDI is mainly positive. Lv Liang, Wang Xian, Wang Gou [6] used XGBoost model to forecast the BDI index. Fan, Y.F., Xing, Y.W., and Yang, H.L. [7] used the GARCH(1,1) model to analyse the persistence and lag in the volatility of the BDI index and forecasted the BDI. Sunghwa Park [8] et al. used time-series data to study the impact of macroeconomic shocks on the shipping market. Zhang Yongfeng, Zhao Gang and Chen Jihong[9] set up a GARCH model to assess the extent of the spillover effect and its correlation between trade in bulk goods and the capital market. Wu Peijian and Chen Yongping[10]. İsmail Canöz, Hakan Kalkavan uses Bayesian time-varying VAR models to predict the dynamics of the Istanbul real estate market and understand housing affordability. established an ARMA(1,2) model for short-term forecasting of dry bulk freight rates[11]. Emmanuel Joel Aikins Abakah et al. [12] used rolling window wavelet correlation (RWWC) and time-varying parameter vector autoregression (TVP-VAR) to study the asymmetric dependence of the Baltic Dry Index on traditional financial markets from 1995 to 2023.

In summarize, the research results of domestic and foreign scholars on the BDI index are relatively rich, which can be mainly divided into the following three categories:

- (1) research on the volatility of the BDI index.
- (2) research on the prediction of the BDI index and its future trends.
- (3) research on the BDI index and other economic indicators.

Such as the Shanghai Stock Exchange Index, Dow Jones Index and so on. But for the interrelationship between BDI index and China's dry bulk trade has not been studied in depth.

2 Analysis based on VAR Vector Autoregressive Modeling

As the dynamic relationship between BDI index and China's dry bulk import trade is mutual influence, and there is no specific theory in the existing literature to elaborate the relationship between the two. Therefore, this paper chooses the vector autoregressive model (VAR) to empirically analyze the relationship between the two.

In this paper, the monthly data of China's import trade volume of iron ore, soybean and coal from September 2015 to December 2023 and the opening value of BDI index on the first day of each month are used as samples. The raw data of the BDI index used in this paper comes from the Baltic Shipping Exchange, and the data of the import trade volume of iron ore, soybean, and coal used come from the official website of the General Administration of Customs of the People's Republic of China. The variables and descriptions are shown in the Table 1.

Table 1. Specific variable information

| Variable type | Variable name | Mark | Description |
|----------------------|---------------|-------|---|
| explained variable | BDI index | y | BDI Index Monthly Opening Data on the 1st of each month |
| explanatory variable | Coal | x_1 | China's coal import trade volume |
| explanatory variable | Soybean | x_2 | China's soybean import trade volume |
| explanatory variable | Iron ore | x_3 | China's iron ore import trade volume |

2.1 Impulse Response Analysis

Impulse response function is used to reflect the dynamic path of the impact of shocks among variables. The impulse corresponding analysis of different VAR models of goods import volume can get the impact of BDI index on import trade volume in each lag period. As shown in the Figure 1.

Iron ore and the BDI index

For iron ore, the BDI index for its implementation of the impact of its import trade volume immediately after the obvious response, the response image are located in the upper part of the 0 indicates that the response is greater than zero, is a positive impact, and in the second period of the time to reach the peak, and then slowly fall back to zero in the fifth period. It can be seen that the impact of the BDI index on the import trade of iron ore is a positive impact, and the degree of the impact is short-term and rapid.

Soybeans and the BDI index

For soybeans, the BDI index imposes a shock on it, and there is an immediate and significant response in its import trade, with the response images between periods 1-3 all located above zero, a positive shock, peaking in the second period. However, unlike iron ore, the response image is located below 0 between periods 3-4, indicating that the BDI index has a certain negative impact on the import trade of soybean in that period, and finally drops to zero in the fifth period. It can be concluded that the BDI index has

both positive and negative impacts on soybeans, and the impact period is relatively short and large in magnitude.

Coal and the BDI index

Coal import trade volume exhibits a small positive response to the BDI index, and its fluctuations are largely determined by itself. This is different from the other goods above.

Coal, Soybeans, Iron Ore and the BDI index

By exploring the impact of the three major dry bulk commodities on the BDI index can be found: China's three major dry bulk import trade volume for the BDI index has a very small impact, indicating that the changes in the BDI index is also largely determined by itself.

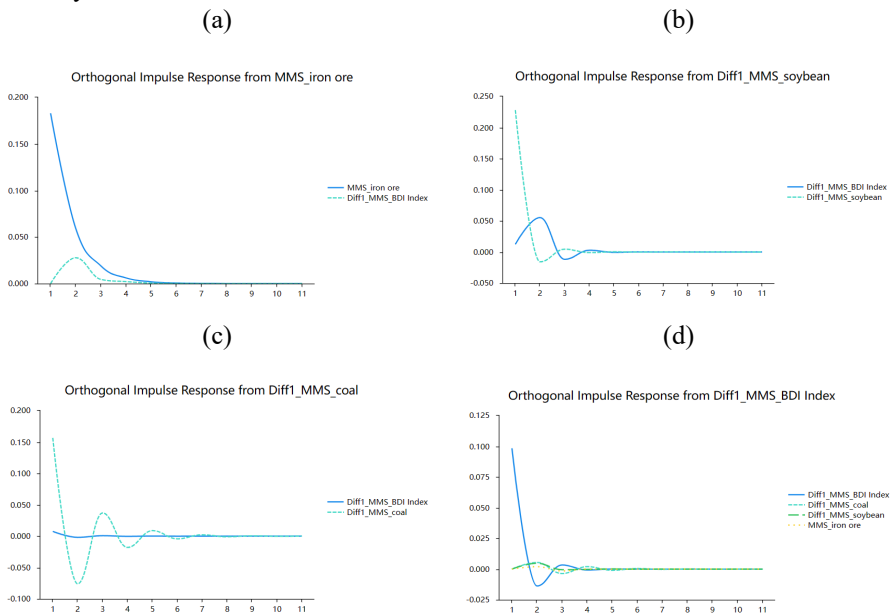


Fig. 1. Impulse response analysis, (a) Iron ore,(b) Soybeans,(c) Coal,(d) The three major dry bulk carriers for the BDI index

To summarize, the impact of BDI index on the import trade of iron ore is positive, and the impact on soybean is positive and negative, both of which are relatively short-lived and have relatively large impacts; however, the import trade volume of coal shows a smaller response to the BDI index.

China's iron ore and coal trade volume at the beginning of the BDI changes in the positive response may be due to the BDI index as a reflection of the global economy and trade conditions of the leading economic indicators, when the BDI index rises, indicating that the global and China's economic trend is good, the increase in the demand for primary products such as iron ore, coal, and so on, which will make China's iron ore and coal trade volume increase; but for soybeans. Food as a necessity of human life, people's demand for it has a certain degree of rigidity, and the government tends to take

some protective measures, so the soybean import trade curve changes with the BDI index of the impact of the opposite curve to offset the BDI index on its impact, so as to maintain at a relatively stable level.

BDI index fluctuations are very little affected by China's dry bulk trade volume. This may be due, on the one hand, to the fact that the BDI index is the result of a combination of factors in which the volume of China's dry bulk trade does not play a dominant role, and, on the other hand, to the fact that the BDI index is less influenced by the demand for shipping capacity and is determined to a greater extent by other factors.

2.2 Variance Decomposition

The impulse response function captures the dynamic impact of shocks to one variable on the path of another, whereas the variance decomposition is an indication of how much of the volatility of a series variable originates from its own shocks and how much of it is caused by shocks to other perturbations in the VAR model. The variance decomposition of the BDI index for the three major dry bulk commodities is shown in the Table 2. The BDI index explains less than 10% of the import trade of all three major dry bulk commodities, while soybeans explains the most (6.050%), iron ore the second most (3.550%), and coal the least (0.191%).

For the BDI index, as shown in the Table 3 the three major dry bulk commodities have a very small degree of explanation, respectively: 0.173%, 0.216%, 0.383%, which also reinforces the conclusion that the BDI index is very little affected by China's dry bulk import trade.

In summary, the BDI index for China's three major dry bulk import trade have a non-negligible impact, while China's dry bulk import trade can not obviously affect the BDI index, mostly by its own decision.

Table 2. Variance decomposition of the BDI index for the three major dry bulk commodities

| Coal | | Soybeans | | Iron ore | |
|--------------|----------|--------------|--------------|--------------|--------------|
| BDI index(%) | Coal (%) | BDI index(%) | Soybeans (%) | BDI index(%) | Iron ore (%) |
| 0.232 | 99.768 | 0.291 | 99.709 | 0.722 | 99.728 |
| 0.200 | 99.800 | 5.798 | 94.202 | 3.477 | 96.523 |
| 0.193 | 99.807 | 6.036 | 93.964 | 3.539 | 96.461 |
| 0.191 | 99.809 | 6.050 | 93.950 | 3.554 | 96.446 |
| 0.191 | 99.809 | 6.050 | 93.950 | 3.555 | 96.445 |
| 0.191 | 99.809 | 6.050 | 93.950 | 3.555 | 96.445 |
| 0.191 | 99.809 | 6.050 | 93.950 | 3.555 | 96.445 |
| 0.191 | 99.809 | 6.050 | 93.950 | 3.555 | 96.445 |
| 0.191 | 99.809 | 6.050 | 93.950 | 3.555 | 96.445 |

Table 3. Variance Decomposition of Three Major Dry Bulk Cargoes for the BDI Index

| BDI index(%) | Iron ore (%) | Soybeans (%) | Coal (%) |
|--------------|--------------|--------------|----------|
| 100.000 | 0.000 | 0.000 | 0.000 |
| 99.441 | 0.131 | 0.215 | 0.213 |
| 99.284 | 0.172 | 0.216 | 0.328 |
| 99.243 | 0.172 | 0.216 | 0.369 |
| 99.231 | 0.173 | 0.216 | 0.379 |
| 99.229 | 0.173 | 0.216 | 0.382 |
| 99.228 | 0.173 | 0.216 | 0.383 |
| 99.228 | 0.173 | 0.216 | 0.383 |
| 99.228 | 0.173 | 0.216 | 0.383 |
| 99.228 | 0.173 | 0.216 | 0.383 |

3 Conclusion

This paper studies the correlation between the BDI index and China's dry bulk trade from the perspective of empirical analysis, and the main conclusions are as follows: in terms of the impact of China's dry bulk import trade volume on the BDI index, they have all been at a very low level since 2015, indicating that in recent years, the BDI index has been affected by the volume of China's dry bulk trade in a very small degree, and in terms of the import trade of the three major dry bulk commodities, the BDI index for iron ore import trade are positive, for soybean impact has positive and negative impact, the impact period are relatively short, the magnitude is relatively large; but the coal import trade volume on the BDI index shows a smaller response, BDI only a small positive impact on it. According to the results of the variance decomposition, the degree of explanation of the BDI index for the import trade of the three major dry bulk commodities is less than 10%, while the degree of explanation of soybean is the highest (6.05%), followed by iron ore (3.55%), and coal is the lowest (0.191%). For the BDI, the three major dry bulk commodities explain very little: 0.173%, 0.216%, and 0.383%, respectively. In contrast, BDI has the highest impact contribution to soybean, followed by iron ore and the least to coal, while dry bulk has almost no impact contribution to the BDI index. At the same time, in order to support the accuracy of the VAR model, this paper then uses the gray correlation method to supplement the quantitative analysis of gray correlation method shows that: the BDI index for iron ore and soybean is still higher than the degree of coal, the correlation is 0.815, 0.807, 0.783, respectively.

The findings of this paper have certain guiding significance for shipping enterprises, and the specific countermeasures are suggested as follows:

(1) Establish the early warning system of shipping market tariffs. China's dry bulk shipping market has entered an era of comprehensive integration into globalization, the establishment of shipping market tariff early warning system can play a guiding role in the main body of the shipping market competition, when major events lead to fluctuations in the BDI index, the early warning signal is issued, which is conducive to the

adjustment of business strategies. At the same time, it is conducive to shipping enterprises to reduce operating costs, enhance competitiveness and improve service quality through route pooling or mutual leasing of space.

(2) Build a linkage system between the price of iron ore, coal and other energy sources and shipping tariffs, from the conclusions of this paper, we can see that the BDI has a greater impact on the import of iron ore as well as coal in China, and we should pay attention to the changes in the price of iron ore and energy sources as well as supply and demand conditions, and build a multi-chain price linkage system for trade and shipping. Chain price linkage system, accurately grasp the market situation of commodities, judging the trend and changes in the commodity market, so that shipping enterprises can adjust their business strategies in time, strengthen cost management, and grasp the development opportunities of the shipping market. For cargoes with strong endogenous rigidity such as grain, shipping enterprises should grasp the market situation and implement business strategies prudently.

(3) Effectively utilize all kinds of shipping derivatives to reduce the shipping market's freight risk. Learning from the lessons and experience of the substantial fluctuations in shipping freight rates in the past two decades, government managers and shipping investors should be prepared to deal with long-term risks, by strengthening forward-looking research in the industry, combining with the operating law of dry bulk freight rates, consider hedging through forward freight agreements, futures freight indexes, and other shipping derivatives to reduce the risk of preventing the freight risk of the shipping enterprises, and to reduce the comprehensive logistics of the trading enterprises costs.

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