Study on the Correlation of Influencing Factors of BDI

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Abstract. In recent years, the international shipping market has generally recovered, and the general trend of the shipping market is better. But the BDI index is still low. The development of international shipping market still faces some challenges. In this paper, theoretical research, mathematical analysis and statistical knowledge are used to calculate the correlation between the influencing factors of BDI index and BDI, and their correlation is analyzed. Two economic factors which have great influence on BDI were found out. This is of great significance to help the shipping industry avoid risks and make timely coping strategies, reduce economic losses, and forecast the future shipping market.

The Background and Significance of Theme Selection

Topic Background

The international shipping industry bear the amount of 90% of world trade, a country's shipping industry is the basic industry of the national economy, the development trend of the shipping industry development and its social, economic and trade are closely related. The BDI index has important reference value for the judgment of the world development of international shipping industry. A few years ago, due to China rapid economic development has also led to the development of the global economy, many countries demand for raw materials is greatly increased, leading to a rapid development of the shipping industry. In 2003, the BDI index is less than 3000, and by 2004, the index reached more than 6000 points, exactly doubled. In 2007 the shipping market booms, major shipping companies are accelerating expansion, construction of new vessels, improve the capacity of the BDI index, even as high as ten thousand. In 2008, the world financial crisis, the BDI index fell sharply, the shipping industry fall into the trough, many companies go bankrupt. Thus, no BDI index to determine the impact on the shipping industry is very big.

Significance of Research

The significance of this study is that the above-mentioned research can find out several factors that have a greater impact on the BDI index. Therefore, after judging the market by scientific methods, shipping enterprises can effectively arrange routes and timely adjust ship types, choose the right time to increase or reduce investment, effectively avoid risks, reduce costs, etc., so as to maximize profits. After mastering the law of development of shipping market, relevant institutions can issue a series of laws and policies to macro-control the shipping market, which is relatively stable. Reduce the adverse effects of fluctuations in the shipping market on the shipping industry.

Current Research Situation at Home and Abroad

As an important index to measure the prosperity of shipping industry, the BDI index has been studied by experts and scholars at home and abroad for many years. Liu Jianlin et al. (2005) studied the futures price and spot price of BDI index futures market; Lin Wenyong et al. (2006) studied the influence of international economic growth rate and international trade volume on BDI index; Li Hua et al. (2013) studied the relationship between imported iron ore price and BDI index by establishing an econometric model; Li Ruihua et al. (2014) studied the price of
BDI and gold respectively. The VEC model of the Dow Jones index is established, and the conclusion that BDI is negatively correlated with gold price and Dow Jones index is drawn; KAVUSSANOS et al. (2004) studies the relationship between dry bulk market and FFA market; Erdogan et al. (2012) studies the relationship between the BDI index and the Dow Jones index by using multivariate analysis method; Alizadhe et al. (2014) studies the relationship between the BDI index and the Dow Jones index by using the standard Puer index. The relationship between the index and shipping price; Faqinlin (2014) studied its impact on the BDI index from the democratic process in Sahara; Qingsong et al. (2016), studied the relationship between the BDI index and the international crude oil index, and found that the international crude oil index had a strong impact on the BDI in a short time.

There are many studies on the influencing factors of the BDI index, but most of them only study the influence of one factor or two factors on the BDI index. There are few economic variables, and there is no more in-depth study on the extent of these economic factors affecting the BDI, so they have a certain one-sidedness. This paper makes up for their shortcomings. It is more comprehensive and convincing to analyze the influencing factors of BDI index from multiple economic variables and the extent of the impact. At the same time, the calculation method of correlation R value is used, and the results are more accurate and reliable.

Influencing Factors of BDI Index

The BDI index is an important index to study the future performance and investment value of the shipping industry. It is also a microcosm of the global economy. It can objectively reflect the development status of the total closed shipping market. It has been widely concerned by shipping and international trade circles. There are many factors affecting BDI, such as the growth rate of global GDP, the volume of international trade, the price of gold, the import volume of iron ore, the throughput of goods, the number of ship dismantling, the price of international fuel oil and the war disaster. In this paper, only some of the more important factors are taken as the research object. The influencing factors are the growth rate of global GDP, the import of iron ore from China, the average price of international fuel oil, and the new shipbuilding orders.

3.1 The Growth Rate of Global GDP

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<tbody>
<tr>
<td>Global gross domestic product (US$100 million)</td>
<td>63.4</td>
<td>60.1</td>
<td>65.9</td>
<td>73.3</td>
<td>74.9</td>
<td>77.0</td>
<td>79.1</td>
<td>74.8</td>
<td>75.9</td>
<td>80.6</td>
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<tr>
<td>Global GDP growth rate (%)</td>
<td>-5.1</td>
<td>9.67</td>
<td>11.1</td>
<td>2.26</td>
<td>2.78</td>
<td>2.70</td>
<td>-5.4</td>
<td>1.46</td>
<td>6.25</td>
<td>/</td>
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Figure 1. Growth rate of global GDP 2008-2017.
The above chart shows the total of global GDP and the growth rate of GDP in 2008-2017, of which the series represents the growth rate of global GDP. From the chart, it can be seen very intuitively that the growth rate of global GDP has fluctuated obviously in recent years, and the fluctuation is large. In 2008 and 2014, the growth rate of global GDP showed negative growth. In 2011-2013 and 2015, the growth rate was slow but relatively stable. In 2009 and 2010, the growth rate of global GDP was rapid, reaching 9.676% and 11.128% respectively.

**Import of Iron Ore in China**

Table 2. Imports of iron ore in China from 2008 to 2017.

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<tbody>
<tr>
<td>Iron ore imports (100 million tons)</td>
<td>4.44</td>
<td>6.28</td>
<td>6.19</td>
<td>6.86</td>
<td>7.44</td>
<td>8.21</td>
<td>9.33</td>
<td>9.53</td>
<td>10.24</td>
<td>10.75</td>
</tr>
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</table>

From the above chart, we can see very intuitively the import situation of Chinese iron ore from 2008 to 2017. China's import of iron ore is growing at a rate of about 10%, from 444 million tons in 2008 to 1,075 billion tons in 2017, an increase of 142.1%. In 2011, China's import of iron ore decreased compared with the previous year, and in 2016, the import of iron ore exceeded the billion mark.

**Average International Fuel Price**

Table 3. Average price of IFO 380 fuel in 2009-2015.

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<tbody>
<tr>
<td>IFO 380 Average Price (USD/T)</td>
<td>392.36</td>
<td>481.57</td>
<td>655.12</td>
<td>685.82</td>
<td>643.28</td>
<td>599.66</td>
<td>364.23</td>
</tr>
</tbody>
</table>

International fuel prices fluctuate due to supply factors, demand factors, strategic factors and financial factors. When supply exceeds demand, fuel prices fall; on the contrary, fuel prices rise. During the period of 2009-2015, international fuel prices fluctuated considerably, reaching a peak of $756.17 per ton, while in a sluggish fuel market, fuel prices were as low as $261.8 per ton. From
the second half of 2011 to 2014, the international fuel price stabilized at more than 600 US dollars per ton, and the fuel market was in good condition.

Shipbuilding Order Quantity


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<tbody>
<tr>
<td>Total Load Tons of New Shipbuilding Orders (Unit: 10,000 tons)</td>
<td>3700</td>
<td>2041</td>
<td>6984</td>
<td>6000</td>
<td>3126</td>
<td>2107</td>
<td>3373</td>
</tr>
</tbody>
</table>

The chart above shows the total weight of new domestic shipbuilding orders from 2011 to 2017, which is an important factor in judging the turnover of the shipping industry. As can be seen from the chart above, the total load tonnage of new orders varies greatly and the shipping market fluctuates uncertainly. The shipping industry flourished in 2013 and 2014. The total tonnage of new shipbuilding orders reached 69.84 million and 60 million respectively. In recent two years, the shipping industry has been in a general market. In 2016, the total tonnage of new shipbuilding orders was only 21.17 million, which was 64.9% lower than that in 2014.

Relevance Analysis of Influencing Factors of BDI Index

Definition and Explanation of Correlation Coefficient

Coefficient of correlation, or linear correlation coefficient, Pioneer product moment correlation coefficient, is used to measure the degree of linear correlation between two random variables. It was proposed by Carl Pearson in the 1880s and has been widely used in various fields of science.

Simple definition of correlation coefficient  
\[ r(X,Y) = \frac{Cov(X,Y)}{\sqrt{\text{Var}[X]\text{Var}[Y]}} \]

Cov (X, Y) is the covariance of X and Y, Var [X] is the variance of X and Var [Y] is the variance of Y. Sample correlation coefficient is usually expressed by R.

The range of correlation coefficient (r) is [-1,1], r > 0 means positive correlation, r < 0 means negative correlation, and | R | indicates the degree of correlation between variables. In particular, r = 1 is called completely positive correlation, r = -1 is called completely negative correlation, r = 0 is called irrelevant. Generally, when | R | is greater than 0.8, it is considered that there is a strong linear correlation between the two variables.

The bigger the absolute value of correlation coefficient is, the stronger the correlation is. The closer the correlation coefficient is to 0, the weaker the correlation degree is. Usually, the
correlation intensity of variables is judged by the following range of values: correlation coefficient
0.8-1.0 extremely strong phase; 0.6-0.8 strong correlation 0.4-0.6 moderate degree correlation;
0.2-0.4 weak correlation 0.0-0.2 very weak correlation or no correlation; 1 OR-1 correlation is the
strongest.

Relevance of Influencing Factors of BDI Index

In 2003, the BDI index was less than 3,000 points. By 2004, the index had doubled to more than
6,000 points. From 2004 to 2007, the BDI index continued to climb all the way, from 6,000 to 1,1039, an increase of nearly 200%. In the second half of 2007, the BDI index rose steadily and was
significantly higher under the pressure of transportation and the speculation of FFA (Forward
Freight Agreement Forward Freight Agreement). On May 20, 2008, after experiencing a major
shock, the BDI index soared for many days, continuing to record a new high, hitting a record high
of 11793 points. Since then, there has been a slight increase in BDI in 2010 and 2014. In recent
years, although the BDI index is low, its fluctuation is relatively small and the shipping market is
relatively stable.

Figure 5. Baltic Dry Bulk Freight Index (BDI).


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<tbody>
<tr>
<td>Annual average of BDI index</td>
<td>7071</td>
<td>6390</td>
<td>2617</td>
<td>2758</td>
<td>1549</td>
<td>920</td>
<td>1206</td>
<td>1105</td>
<td>718</td>
<td>673</td>
<td>1081</td>
</tr>
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Correlation Coefficient Calculation

Relevance between Global GDP Growth Rate and BDI Index

Table 6. Relevance calculation of Global GDP growth Rate and BDI index.

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<tr>
<th>X</th>
<th>5.194%</th>
<th>9.676%</th>
<th>11.128%</th>
<th>2.265%</th>
<th>2.781%</th>
<th>2.700%</th>
<th>-5.419%</th>
<th>1.461%</th>
<th>6.251%</th>
</tr>
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<tbody>
<tr>
<td>Y</td>
<td>6390</td>
<td>2617</td>
<td>2758</td>
<td>1549</td>
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r=-0.237

After calculation, R is negative and the absolute value is small. It can be concluded that the
growth rate of global GDP is negatively correlated with the BDI index, and the growth rate of
global GDP has a weak influence on the BDI index.

The Correlation between Import Volume of Iron Ore and BDI Index in China

Table 7. Relevance calculation of Import Volume of Iron Ore and BDI index.

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r=0.812
The calculated value of R is 0.812, so the import volume of iron ore in China is positively correlated with the BDI index, and the correlation is very strong. Thus, China's iron ore imports have a great impact on the shipping market.

**Relevance between International Fuel Average Price and BDI Index**

Table 8. Relevance calculation of International Fuel Average Price and BDI index.

<table>
<thead>
<tr>
<th>X</th>
<th>392.36</th>
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</table>

The data are brought into the formula to get $r = -0.365$, so the average price of international fuel is negatively correlated with the BDI index, and the correlation is weak.

**The Correlation between New Orders and BDI Index in Shipbuilding Industry**

Table 9. Relevance calculation of New Orders Index in Shipbuilding Industry and BDI.

<table>
<thead>
<tr>
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<th>3700</th>
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<th>6000</th>
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The value of R is 0.483, so the development of shipbuilding industry is positively correlated with the BDI index, which shows that the development of shipbuilding industry has a greater impact on the BDI index.

**Summary**

By calculating the R value of the correlation between the influencing factors of the BDI index and the BDI, we can get the correlation between the influencing factors of the BDI index and the BDI more accurately. Through the above calculation, it is found that the import volume of iron ore in China and the new orders in shipbuilding industry are positively correlated with the BDI index, and the import volume of iron ore in China is highly correlated with the BDI index, which shows that the import volume of iron ore in China has a greater impact on the shipping market. Shipping enterprises should pay close attention to the import of iron ore in China, make certain judgments on the development of shipping industry and make timely decisions. The correlation between new orders and BDI index in shipbuilding industry is moderate in Chengdu, which shows that new orders in shipbuilding industry also have a great impact on shipping market. The growth rate of global GDP and the average price of international fuel are negatively correlated with the BDI index, and the related industries are weak. Therefore, these two factors have little influence on the BDI index, and their reference value to shipping enterprises is small. There are still some shortcomings in this paper. The object of study is not comprehensive enough. In the future, further research will be carried out in order to draw more objective and effective conclusions.

**References**


