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# The Relationship between the Prices of Shipping Market and China's Economy

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# The Relationship between the Prices of Shipping Market and China's Economy

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**Abstract:** To explore the relationship between the prices of shipping market and China's economy, this paper analyzes the data of BDI and China's GDP from 2000 to 2015. By stabilizing the BDI and GDP data, this paper identifies the one-way causal relationship between the BDI and China's GDP via the granger causality test. The conclusion shows that BDI effects China's GDP positively at rate of 22% by using impulse response function and variance decomposition method. Accordingly, this paper establishes VAR forecasting model of China's GDP, which has a good forecasting ability.

**Keywords:** VAR model, China's GDP, Baltic Dry Index, Granger Causality Test

## 1. INTRODUCTION

Based on the volume of China's economy and its important position in the global economy, Investors are increasingly concerned about china's GDP and its forecast. The predictive analysis is only done to GDP, which can not reflect the internal causes of change. The study of the relationship between maritime market price index and China's GDP can take into account the impact of global international trade and make some explanation to the change of GDP. In addition, the shipping price index has a good timeliness, which can effectively improve the GDP forecast lag problem. This paper uses Baltic Dry Index (BDI) of an important indicator of maritime market price to reflect the prices of shipping market, which provide a new way of thinking for the analysis and forecast of China's GDP.

## 2. LITERATURE REVIEW

The relationship between BDI and economic growth is manifested through interaction , BDI is antecedent variable of economic growth , which has had corresponding research results that can be used as a basis. Li gen and Zhao jin lou (2011) studied the relationship between Baltic Dry Index (BDI) and Macroeconomic Climate Index, analyzed the fluctuation characteristics of the two, the study and analysis showed that the two existed stable positive relationship, the growth of BDI can pull the rise of Macroeconomic Climate Index<sup>[1]</sup>. Lin Ling (2013) came up with ideas that the fluctuation of world economy can be reflected by the frequency of international trade and the frequency of international trade can be indirectly reflected through BDI, explained that BDI can indirectly reflect economic situation of the world, was a leading indicator that can better reflect macroeconomic climate situation<sup>[2]</sup>.

Nicholas Apergis and James E. Payne (2013) studied the joint predictability capacity of the BDI for both financial assets and industrial production by using panel methodological approaches and daily data spanning the period 1985–2012, the results reveal the role of the BDI in predicting the future course of the real economy, yielding a link between financial asset markets and the macroeconomy<sup>[3]</sup>. Liu Chong xian and Ma Min (2014) studied the relationship between EPI and BDI by Cointegration Test, Granger Causality Test and Impulse Response Function. Research shows that there is a positive equilibrium relationship between the two, BDI has one-way causality relationship across EPI , the growth of BDI can significantly promote the rise of China's

macro-economy , which will last for a long time<sup>[4]</sup>. Bildirici M E, Kayıkçı F and Onat I Ş (2015) used MSIAH (3) -VAR (4) model to analyze the relationship between BDI and economic growth for the United

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States, found that BDI improvements effects economic growth positively, BDI can be used for an indicator of a crisis in GDP growth for the United States<sup>[5]</sup>.

Some scholars have studied the influence of macroeconomic across BDI, Li Jian li, Zhen Hong and Xu Ka (2009) studied the relationship between BDI and GDP for the United States by correlations and regression analysis. The result showed that there was strong correlation between GDP and BDI, the independent variable GDP can explain 69.7% of the dependent variable BDI<sup>[6]</sup>. WU Pei-jian and CHEN Yong-ping (2010) found that the fluctuation of BDI is affected by economic fluctuation greatly via the causal and empirical analysis of the fluctuation of Baltic Dry Index<sup>[7]</sup>. Kim (2011) analyzed the co-relationship between the BDI, ship's space, and the Chinese economic trend by assuming that says the Chinese economic fluctuation caused by national development is a major factor in the world bulk traffic fee fluctuation. the analysis had concluded that China's economic fluctuations continue to affect the dry bulk traffic fee and the bottom<sup>[8]</sup>. Li Rui hua and Song Bing liang (2015) indicated that the demand level of the international dry bulk shipping market is closely related to the current world's macroeconomic fluctuation in the analysis of the influencing factors of international dry bulk shipping market demand, The growth rate's trend of the two in general are the same<sup>[9]</sup>. Ding Yan and Yan Guangle (2015) studied China's GDP and BDI via using the attractor, calculus and GARCH, the study showed that China's GDP has a stronger attraction to BDI during the period of international economic steady development. However, during the international economic downturn, the rest of the world has more influence across BDI<sup>[10]</sup>.

In summary, the existing literature has confirmed BDI is closely related with the economy. Some researchers have done empirical research on the data of other countries in the shipping and economic index, have analyzed the interaction between them Comprehensively, while lack the comprehensive two-way causal study on the Chinese data.

### 3. EMPIRICAL ANALYSIS

#### 3.1 Data

The data of China's GDP comes from the National Bureau of Statistics of the People's Republic of china, BDI is derived from the Wind Financial Terminal and the Value 500 Investment Navigation, The data are selected from 2000 to 2015. Baltic Dry Index has been done a preliminary treatment, the date of BDI uses the annual average value. See appendix for specific data.

#### 3.2 Unit Root Test

Because the data are time series, in order to avoid pseudo-regression phenomenon between china's GDP and BDI and be easy to build model, the paper uses Augmented Dickey-Fuller test method to test the stability of the two. DGDP and D2GDP denote the 1st and 2nd difference of GDP respectively. DBDI and D2BDI denote the 1st and 2nd difference of BDI respectively. In the 1st difference, It is found that BDI is stable, while GDP is not stable. So the 1st differential data can not be used; while the 2nd difference of two are both stable, therefore this paper uses the 2nd differential data of two.

**Table 1. Unit root test results**

Series	Test type (c,t,n)	5% Test critical values	ADF test statistic	Probability	Test result
BDI	(c,t,0)	-3.759743	-1.703359	0.6986	Unstable
DBDI	(c,t,1)	-3.828975	-4.440051	0.0197	stable
D2BDI	(c,t,1)	-3.875302	-6.166452	0.0021	stable
GDP	(c,t,0)	-3.759743	-2.582578	0.2911	Unstable
DGDP	(c,t,0)	-3.791172	-1.979333	0.5620	Unstable
D2GDP	(c,t,1)	-3.875302	-5.260365	0.0070	stable

Description: c means that there is intercept, t means that there is a trend, n means lag coefficient, the system automatically gives.

### 3.3 Granger Causality Test

In order to explore whether there is causal relationship between China's GDP and the BDI, the Granger Causality Test is used and the 2nd difference of the two in Unit Root Test is used.

**Table 2. Granger Causality Test results**

Null Hypothesis	F-Statistic	Probability	Lag Order
Variable GDP can not Granger cause variable BDI	0.40479	0.75829	3
variable BDI can not Granger cause variable GDP	49.7585	0.00127	3

Based on the test results, when the significance level is 5% and the lag length is 3, the Probability that variable GDP can't Granger cause variable BDI is 0.75829, which is more than 0.05, therefore, this paper accept the null hypothesis that variable GDP can't Granger cause variable BDI. the Probability that variable BDI can not Granger cause variable GDP is 0.00127, which is less than 0.05, therefore, this paper reject the null hypothesis that variable BDI can not Granger cause variable GDP. variable BDI can Granger cause variable GDP. Therefore, this paper identifies the one-way causal relationship between the BDI and China's GDP via the Granger Causality Test. The results are explained as follows:

First, the variable GDP can not Granger cause variable BDI. The reason is that BDI's change is not only caused by external factors, largely depends on internal factors such as route selection, route weight and the number of merchant ships<sup>[11]</sup>. China is a shipping, import and export power, although China's GDP can affect the international import and export partly, BDI is not only affected by international trade, internal factors have a great impact on it, under the influence of internal factors, the influence of China's GDP is not obvious for BDI.

Second, the variable BDI can Granger cause variable GDP. The reason is that the Baltic Dry Index is regarded as the economic leading indicator, and its fluctuation directly reflects the international economic situation and the international trade volume<sup>[12-13]</sup>. the communication and trade between China and other countries have been more frequent at present, which makes that the speed of China's economic development has been improved than that of the past, at the same time, the economic situation of China has certain connections with other countries', Especially, after becoming a member of the World Trade Organization, China's economic development and international economic development are closely related. Therefore, the fluctuation of BDI will inevitably have some impact for China's economy.

### 3.4 VAR model

Granger causality test shows that there is correlation between China's GDP and BDI. On this basis, the VAR model is built to further analyze the relationship between the two.

#### 3.4.1 Vector Autoregressive Theory

Vector Autoregressive model can be used to predict the system of associated economic time series, analyze the dynamic impulse of stochastic disturbance to the variable system, and further explain the impact of economic impulse to economic variables. The expression of the VAR model with lag order P is

$$y_t = A_1 y_{t-2} + A_2 y_{t-2} + \dots + A_p y_{t-p} + Bx_t + u_t \quad (t = 1, 2, 3, \dots, n) \quad (1)$$

$y_t$  is k-dimensional endogenous variable vector;  $x_t$  is d-dimensional exogenous variable;  $u_t$  is the k-dimensional error vector;  $A_1, A_2, \dots, A_p, B$  is the matrix of coefficients to be estimated. Thus, The expression of the VAR model can also be written as follows:

$$\begin{pmatrix} y_{1t} \\ y_{2t} \\ \vdots \\ y_{kt} \end{pmatrix} = A_1 \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \\ \vdots \\ y_{kt-1} \end{pmatrix} + A_2 \begin{pmatrix} y_{1t-2} \\ y_{2t-2} \\ \vdots \\ y_{kt-2} \end{pmatrix} + \dots + A_p \begin{pmatrix} y_{1t-p} \\ y_{2t-p} \\ \vdots \\ y_{kt-p} \end{pmatrix} + B \begin{pmatrix} x_{1t} \\ x_{2t} \\ \vdots \\ x_{dt} \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \\ \vdots \\ u_{kt} \end{pmatrix} \quad (t = 1, 2, \dots, n) \quad (2)$$

As can be seen from the above equation (2), the VAR(p) model consists of k equations<sup>[14]</sup>.

### 3.4.2 The identification of the optimal lag order

Before establishing VAR model of BDI and China’s GDP, this paper needs to determine the optimal lag length. This paper finds that most of literature use AIC and SC information criteria via reading a large number of literature, AIC and SC information criteria is that the smaller is the value of two, the better is lag length. Therefore this paper uses the two information criteria to determine the optimal lag length. According to the results, it can be seen that when the lag length is 3, the value of two information criterion is the smallest , so the VAR (3) model of BDI and GDP is the most reasonable.

**Table 3. The identification of lag order of VAR method**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-222.3963	NA	1.80e+15	40.79932	40.87167	40.75372
1	-219.5762	4.101981	2.29e+15	41.01385	41.23088	40.87704
2	-200.6561	20.64002	1.70e+14	38.30112	38.66284	38.07310
3	-185.8033	10.80208*	3.26e+13*	36.32787*	36.83428*	36.00865*

\* indicates lag order selected by the criterion

LR: sequential modified LR test statistic(each test at 5% level )

FDE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ : Hannan-Quinn information criterion

### 3.4.3 Construction of VAR model

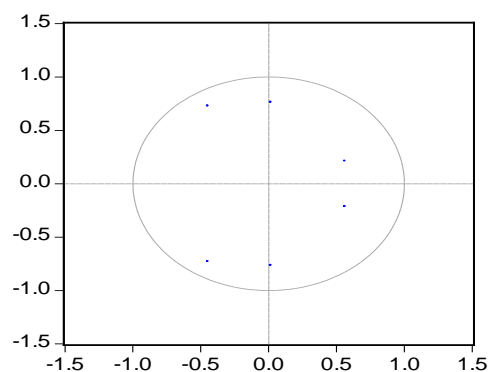
The results of VAR (3) model parameters are as follows:

$$\begin{pmatrix} GDP_t \\ BDI_t \end{pmatrix} = \begin{pmatrix} 0.8312 & 0.9681 \\ -0.0978 & -0.5781 \end{pmatrix} \begin{pmatrix} GDP_{t-1} \\ BDI_{t-1} \end{pmatrix} + \begin{pmatrix} -0.0507 & -5.0266 \\ 0.0406 & -1.0124 \end{pmatrix} \begin{pmatrix} GDP_{t-2} \\ BDI_{t-2} \end{pmatrix} + \begin{pmatrix} -0.0271 & 16.1730 \\ -0.0218 & -0.6839 \end{pmatrix} \begin{pmatrix} GDP_{t-3} \\ BDI_{t-3} \end{pmatrix} + \begin{pmatrix} -190.7167 \\ -55.6584 \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix} \quad (3)$$

R2=0.98

The value of R2 show that there is a positive correlation between GDP and BDI , the 1st lag, 2nd lag and 3rd lag of GDP effect BDI weakly by the equation (3), which can not be considered, as a whole GDP effect its own positively. The 1st lag of BDI has a slight positive effect on GDP, the 2nd lag has negative effect on GDP, the 3rd lag effect GDP positively, altogether, BDI has positive effect on GDP and BDI has negative influence on itself.

The model shows that China's GDP has almost no effect on the BDI , while the BDI has a greater impact on China's GDP, the analysis results of VAR (3) model and the results of Granger causality test are consistent.



**Figure1. AR root test of VAR model**

In order to observe whether the model is reasonable, the AR root test is adopted. The test results show that the model is stable and can carry out Impulse Response Function, Variance Decomposition and prediction analysis.

### 3.5 Impulse Response Function and Variance Decomposition based on VAR model

As the result of VAR model and Granger Causality Test shows that China's GDP has little effect on BDI , therefore this paper only does the analysis of Impulse Response Function and Variance Decomposition for the effects of BDI to GDP and GDP to itself.

#### 3.5.1 Impulse response function

When China's GDP and BDI are exerted the impulse of the size of a standard variance ,the change in GDP can be obtained, as shown in Figure 2 and Figure 3. Figure 2 shows that when BDI are exerted the impulse of the size of a standard variance ,GDP in the first period do not respond, make larger negative response in the third and sixth period ,the value is about -5000. GDP make significant positive response about 5000 in the fourth and fifth period , And the second positive peak is reached about 4000 in the eighth period , then the response gradually weakens, and finally tends to zero. From the above analysis we can see that the impact of BDI on GDP is obvious in the first-eighth period, the impact gradually weakens with the passage of time, as a whole BDI has a positive impact on GDP. As can be seen from Figure 3, the one impulse of GDP will bring itself positive impact from the first period to the third period , produce reverse impact in fourth-sixth period, produce positive impact in sixth-seventh period, Then the response changes between positive and negative, but the degree of response decreased, the response that GDP is on itself gradually disappears after 10 period.

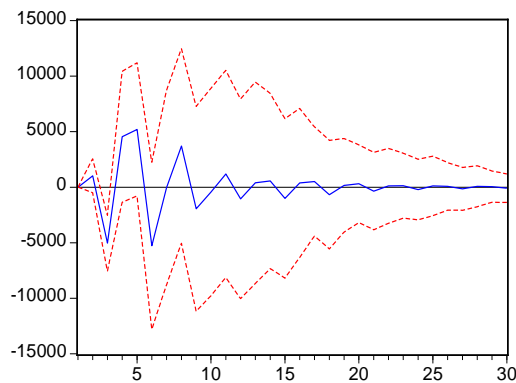


Figure2. Response of GDP to Cholesky One S.D.BDI Innovation

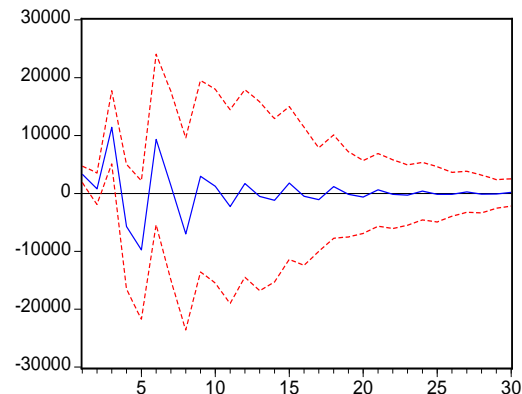


Figure3. Response of GDP to Cholesky One S.D. GDP Innovation

#### 3.5.2 Variance decomposition

This paper uses Variance Decomposition to analyze the contribution rate of BDI to China's GDP and to itself, as can be seen from Figure 4, we can see that GDP contributes to itself at 100% in the first lag period, then slowly declines. after the fourth lag period, the contribution rate that GDP contributes to itself stabilizes at about 78%. While the contribution rate of BDI to GDP gradually increases from 0, and finally maintained at about 22%.It can be seen that the fluctuation of BDI has higher contribution rate for fluctuation of China's GDP, which can't be ignored.

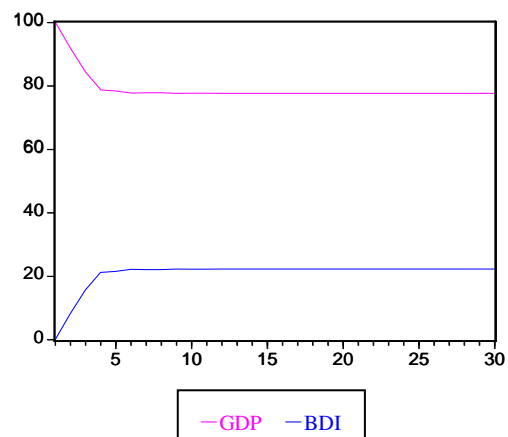


Figure 4. Contribution of GDP and BDI to GDP

#### 4. VAR PREDICTED MODEL OF GDP AND COMPARISON OF GDP BETWEEN THE ACTUAL VALUE AND THE PREDICTED VALUE

The empirical analysis shows that the impact of China's GDP on BDI is almost negligible, the impact of BDI on China's GDP can not be ignored. Based on the empirical analysis, this paper only makes a forecast analysis on China's GDP.

##### 4.1 VAR predicted model of GDP

The advantage of using VAR model for forecasting is that the explanatory variables of VAR model do not contain any current variables, all problems that related to the simultaneous equation model do not exist in VAR model<sup>[15]</sup>. Therefore, the history data of GDP and BDI is put into GDP forecast equation, the forecast value of GDP can be got. The forecast equation of GDP is:

$$\begin{aligned} GDP = & 0.8311700006 * GDP(-1) - 0.05068741017 * GDP(-2) - 0.02711660197 * GDP(-3) \\ & + 0.9681263825 * BDI(-1) - 5.026588988 * BDI(-2) + 6.173032452 * BDI(-3) - 190.7167212 \end{aligned} \quad (4)$$

##### 4.2 Comparison of GDP between the actual value and the predictive value

In order to Observe the predicted effect of China's GDP immediately, this paper compares the predicted value of China's GDP with the actual value from 2000 to 2015, and the predicted error and error percentage are shown in Table 4.

**Table 4. The comparison table of Chinese GDP's actual and predictive value**

Years	GDP actual value	GDP predicted value	Prediction error	Percentage of error
2000	99776.3	99776.3	0	0
2001	110270.4	110270.4	0	0
2002	121002.0	121002.0	0	0
2003	136564.6	136564.6	0	0
2004	160714.4	160714.4	0	0
2005	185895.8	186532.7	636.9	0.34
2006	217656.6	216913.1	-743.5	-0.34
2007	268019.4	271783.4	3764	1.40
2008	316751.7	312682.3	-4069.4	-1.28
2009	345629.2	345057.4	-571.8	-0.17
2010	408903.0	406188.3	-2714.7	-0.66
2011	484123.5	484195.9	72.4	-0.01
2012	534123.0	535461.4	1338.4	0.25
2013	588018.8	589264.0	1245.2	0.21
2014	635910.2	636979.2	1069	0.17
2015	676708.0	676681.5	-26.5	-0.0039

It can be seen from Table 4, there is smaller deviation between GDP actual value and GDP predictive value of 2000-2015 years, the predictive accuracy is very high, the following figure is effect diagram of GDP's forecasting model.

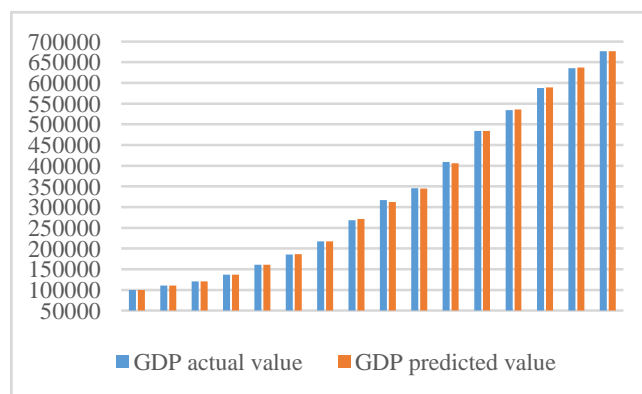


Figure 5. The effect diagram of forecasting model

## 5. CONCLUSIONS

The empirical analysis verifies that the prices of shipping market has positive correlation with the china's economy, the prices of shipping market exist single causal relationship with the china's economy, effect china's economy obviously in the first-eighth period, gradually weaken with time. the contribution rate that the prices of shipping market are to china's economy gradually increases in the first-fourth period, finally maintains at about 22%. While the impact of china's economy to the prices of shipping market is very small , can be ignored. The GDP forecasting model based on VAR model has higher precision, can be used to forecast the trend of China's GDP, can provide reference for domestic investors that pay attention to the trend of economic development , provides a new way for the forecast analysis of China's GDP.

## ACKNOWLEDGEMENT

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## REFERENCES

- [1] Li Gen, Zhao Jin lou . (2011).Empirical Research of the Relationship between Baltic Dry Index and China's Macroeconomic Climate Index . Price Theory and Practice,(12):49-50 (in Chinese)
- [2] DAI Lin ling. (2013).The Baltic Dry Index is the benchmark of world economy . Data , (12):48-49(in Chinese)
- [3] Apergis N, Payne J E. (2013).New Evidence on the Information and Predictive Content of the Baltic Dry Index.International Journal of Financial Studies,1(3):62-80.
- [4] Liu Chong xian, Ma Min. (2014).Research on the Impact of International Freight Price Index to China 's Macro - economy.China Business and Trade , (21): 205-207(in Chinese)
- [5] Bildirici M E, Kayıkçı F, Onat I Ş. (2015).Baltic Dry Index as a Major Economic Policy Indicator: The Relationship with Economic Growth. Proscenia - Social and Behavioral Sciences,210:416-424.
- [6] Li Jian li, Zhen Hong, Xu Kai. (2009).Regression analysis between US GDP and shipping freight rate under the economic crises .Journal of Yan shan University,33(6):555-560(in Chinese)
- [7] WU Pei-jian, CHEN Yong-ping. (2010).The Fluctuation Law of Baltic Dry Index and Its Enlightenment to China - The Barometer of International Dry Bulk Transportation Market . Price Theory and Practice,(11): 50-51(in Chinese)
- [8] Kim H. (2011).Study about How the Chinese Economic Status Affects to the Baltic Dry Index.International Journal of Business and Management, 6(3):116.
- [9] LI Rui-hua, SONG Bing-liang. (2015).The Influencing Factors and Rules of International Dry Bulk Shipping Market .Journal of Shanghai Maritime University,36(3):35-39(in Chinese)



- [10] DING Yan, YAN Guangle. (2015). Empirical Research on the Attraction Force of China's GDP Across BDI. *Journal of University of Shanghai for Science and Technology*, 37 (2): 199-204 (in Chinese)
- [11] Zeng Qingcheng, Qu Chenrui. (2014). An approach for Baltic Dry Index analysis based on empirical mode decomposition. *Maritime Policy and Management*, 41(3): 224-240.
- [12] Batrinca G. I, Cojanu G., Surugiu I. (2013). Application of autoregressive models for forecasting the baltic exchange dry index. *Analele Universitatii Maritime Constanta*, 20(20): 205-208.
- [13] Lin F, Sim N C S. (2013). Trade, income and the Baltic Dry Index. *European Economic Review*, 59(4):1-18.
- [14] Agung I, Gusti Ngurah. (2011). *Time Series Data Analysis Using EViews*. New York: John Wiley & Sons Inc, 230.
- [15] Nyberg H., Saikkonen P. (2014). Forecasting with a noncausal var model. *Computational Statistics & Data Analysis*, 76:536-555.

**Appendix :** the data statistics of China's GDP and BDI

Years	China's GDP (Billion)	BDI (Annual average)
2000	99776.3	1615.3
2001	110270.4	1187.2
2002	121002.0	1181.8
2003	136564.6	2733.6
2004	160714.4	4482.9
2005	185895.8	3252.8
2006	217656.6	3239.3
2007	268019.4	7252.3
2008	316751.7	6069.8
2009	345629.2	2641.2
2010	408903.0	2674.8
2011	484123.5	1522.3
2012	534123.0	885.3
2013	588018.8	1255.8
2014	635910.2	1065.4
2015	676708.0	703.0