

BALTIC DRY INDEX AS ECONOMIC LEADING INDICATOR IN THE UNITED STATES

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Abstract:

This working paper describes the current state of research on the usefulness of application of the index Baltic Dry Index to forecast changes in the economic situation in the United States. The first part of the article briefly describes what the Baltic Dry Index and how it is constructed. Further discussed are reasons to regard this index as an index of pre-economic situation and is described chosen test method. The method is based on an Bry-Boschan research algorithm determining turning points in the cycle. The aim of the study is to identify the level of diffusion index between changes in US GDP and the Baltic Dry Index for different periods of time (from 0 up to 90 days).

Keywords: Leading Indicator, Baltic Dry Index, BDI, Bry-Boschan, United States, GDP

1. BALTIC DRY INDEX

1.1. BDI history and composition

Baltic Dry Index is one of indexes quoted on the London Stock Exchange *Baltic Exchange*. It is an index listed each day. Its composition is based on prices of the sea freight on selected routes. This index is designed to reflect the changes in prices of the sea transport.

Moreover, *Baltic Exchange* publishes a number of other indexes¹: Capesize (BCI), Panamax (BPI), Supramax (BSI), Panamax (BEP Asia), Supramax (BES Asia), Handysize (BHSI), CleanTankers Asia (BITR Asia), Time Charter Equivalents (TCE), Dirty Tanker (BDTI), VLCC TCE, Suezmax TCE, Aframax TCE, Clean Tanker (BCTI), MR TCE, LPG (BLGP). The main difference between BDI and ww. freight price index is cross-cutting nature of the first one. Because it includes freight transports on 23 routes between different regions of the world by ships with diversified transit possibilities (from Handysize to Capesize).

This index is published daily from Monday to Friday since 1985, at first it was called Baltic Freight Index and included slightly different routes of goods transport.² Its composition is as follows³:

$$BDI = \frac{\text{CapesizeTCA} + \text{PanamaxTCA} + \text{SupramaxTCA} + \text{HandysizeTCA}}{4} * 0.113473601$$

where TCA indicates *time-charter average* and visible at acronym names are the class names of ships used in transports.

Relation between changes in economic conditions and the value of BDI occurs because due to the long period of manufacturing of ships and their long lifetime, the level of the supply of maritime transport is fixed in a short period of time. Changes in the level of demand for sea freight submit to changes in prices of freight. Whereas changes in the level of demand for the goods imported by sea (particularly bulk goods) may signal a change in the level of economic activity, which in the ratio of the scale of purchases may be a signal to change the economic situation.

Baltic Dry Index in its aim is supposed to reflect prices of goods transport by sea. It is a synthetic indicator i.e. created on the basis of data of market freight prices, but it doesn't constitute the freight price. Important feature of the Baltic Dry Index from the point of further deliberations, thanks to its daily publication, is a speed in which it is possible to obtain information about the change in prices of transports, and the fact that its composition is based on values derived from so-called part of the real economy, rather than exclusively on financial data.

2. BALTIC DRY INDEX AS ECONOMIC LEADING INDICATOR

Indicated above features caused that Baltic Dry Index shown great interest as an economic leading indicator. The first publications considering possibility to use the Baltic Dry Index as an economic leading indicator appeared at the end of first decade of 21st century. Koskinen and Hilmola in their work entitled *Investment Cycles in the Newbuilding Market of Ice-Strengthened Oil Tankers* in 2005

¹ Freight Indices, The Baltic Exchange, <http://www.balticexchange.com/market-information/product-overview/indics/index.shtml>, (2015.12.27)

² P. Odom, Shipping Indexes Signal Global Economic Trends, Globalization and Monetary Policy Institute 2010 Annual Report, Federal Reserve Bank of Dallas, 2010, p. 1

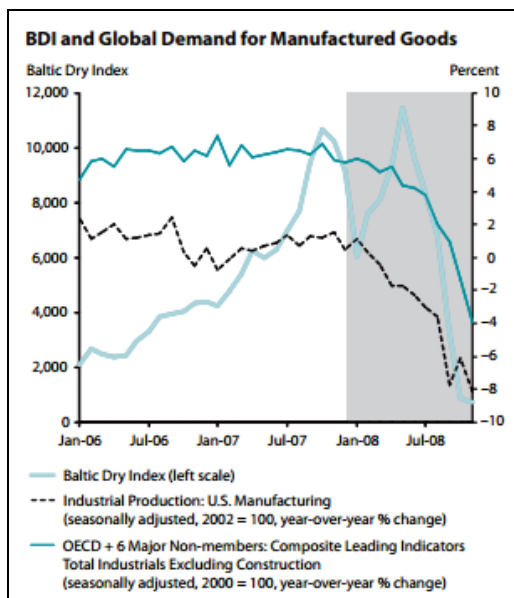
³ P. Odom, Shipping Indexes Signal Global Economic Trends, Globalization and Monetary Policy Institute 2010 Annual Report, Federal Reserve Bank of Dallas, 2010, p. 2

pointed out that BDI may be used in a competitive economy to predict attitudinal changes of stock exchanges and economic activity.⁴

Further research on the Baltic Dry Index usefulness in predicting economic activity was conducted among others in the Republic of South Africa. *Dino Roberto Zuccollo* under scientific direction of *Kurt Sartorius* in his work⁵ pointed to existence of the connection between changes in freight prices expressed with changes of BDI indicator and changes of the economic activity level in the Republic of South Africa. This dependency can be partly explained by RSA position, as well as great dependence of the sea transport and higher development level than neighboring States, by which the part of production is directed to distant geographical market.

Further studies on the Baltic Dry Index changeability were conducted in the United States under auspices of the Federal Reserve System. In 2009 Rajdeep Sengupta and Yu Man Tam published the work entitled *Recent Movements in the Baltic Dry Index* where BDI was determined as “The BDI can be viewed as the equilibrium price of shipping raw materials, determined by the supply of cargo ships and the demand for transporting raw materials by ship”.⁶

Picture 1



Source: R Sengupta, Y. Man Tam, *Recent Movements in the Baltic Dry Index*, Economic SYNOPSES, Nr 12,2009, Federal Reserve Bank of St. Louis, St. Louis, p. 1.

They point attention to visible on graph 1 similarity of the course between Baltic Dry Index and industrial production in the United States in 2006-2008. Following research conducted by *Payton Odom* also from the Bank of the Federal Reserve System in Dallas⁷ considers the price indexes of transport, including the Baltic Dry Index, which can be used to predict future changes in the economic activity – economic times. Low correlation presented here between individual analyzed indexes

⁴ D. R. Zuccollo, *The Baltic Dry Index: A Leading Economic Indicator and its use in a South African context*, University of the Witwatersrand, p. 7

⁵ D. R. Zuccollo, *The Baltic Dry Index: A Leading Economic Indicator and its use in a South African context*, University of the Witwatersrand, p. 1

⁶ R Sengupta, Y. Man Tam, *Recent Movements in the Baltic Dry Index*, Economic SYNOPSES, Nr 12,2009, Federal Reserve Bank of St. Louis, St. Louis, p. 1-2

⁷ P. Odom, *Shipping Indexes Signal Global Economic Trends*, Globalization and Monetary Policy Institute 2010 Annual Report, Federal Reserve Bank of Dallas, 2010.

(correlations with pairs) and, what's more important from the point of further deliberations, high changeability of BDI index expressed as a standard.⁸

Bildirici, Fazıl and Onat Işıl Şahin also describes in their article BDI as a Major Economic Policy Indicator⁹ also issues regarding the treatment of the BDI as a leading indicator downturn. They take an attempt to build a model to analyse the relationship between BDI and economic growth for the United States. They state also that it can be regarded as the indicator of a crisis in GDP growth for the United States. Lin Façin, Sim Nicholas C.S in their two articles Fri. Baltic Dry Index and the Democratic window of opportunity¹⁰ and Trade, income and the Baltic Dry Index¹¹ are treating BDI as a starting point to construct a new measure of trade cost, based on BDI.

Further studies on the use of Baltic Dry Index in predicting future economic activity levels were conducted by among others the team, which consisted of: Gurdip Bakshi, George Panayotov, Georgios Skoulakis.¹² They pointed to the possibility of relation in which this BDI may constitute a binding element of the real and financial economy.

3. RESEARCH METHODOLOGY

3.1. Objective

An aim of conducted study is to determine whether there is a possibility to relate changes in the value of Baltic Dry Index with future changes in economic activity, measured as change in real value of the gross domestic product (GDP). There is a hypothesis that Baltic Dry Index can be regarded as a leading indicator. In order to determine whether it is possible to predict changes, they used the analysis of turning points for Baltic Dry Index and GDP of the United States. For both values with the algorithm described in the next subsection, turning points and direction, in which the index changes are carried out in a given period, were defined. Due to quarterly period of publications about changes of GDP in the United States in further research quarterly periods will be analyzed.

Based on obtained results for different lead-times between BDI and GDP in the United States, the lead-times with the most optimal results were shown.

3.2. Research algorithm

Indicated in the working paper the results obtained using the Bry-Boschan algorithm are presenting a fragment of research. Subsequently, expected in the future presentation of successive test results obtained by other methods. In view of the need to objectively determine the beginning and end of different phases, an increase and decrease was used to appoint individual extremes modified to

⁸ P. Odom, Shipping Indexes Signal Global Economic Trends, Globalization and Monetary Policy Institute 2010 Annual Report, Federal Reserve Bank of Dallas, 2010, p. 7

⁹ E. Bildirici Melike, F .Kayıkçı, S. Onat Işıl, Baltic Dry Index as a Major Economic Policy Indicator: The Relationship with Economic Growth, Procedia - Social and Behavioral Sciences, Volume 210, 2 2015, 416-424.

¹⁰ F. Lin, N. Sim, Baltic Dry Index and the democratic window of opportunity, Journal of Comparative Economics, 42, 1, 2014, 143-159

¹¹ F. Lin, N. Sim, Trade, income and the Baltic Dry Index, European Economic Review, Volume 59, 2013, 1-18.

¹² G. Bakshia, G. Panayotovb, G. Skoulakisc, The Baltic Dry Index as a Predictor of Global Stock Returns, Commodity Returns, and Global Economic Activity, 26.11.2011, <https://www.business.unsw.edu.au/About-Site/Schools-Site/banking-finance-site/Documents/G.%20Skoulakis%20-%20The%20Baltic%20Dry%20Index%20as%20a%20Predictor%20of%20Global%20Stock%20Returns.pdf>, (29.12.2015), p. 1

needs of this study with Bry-Boschan algorithm. Modification of the procedure adopted by NBER¹³ was dictated with a need to adapt to quarterly published details of GDP and daily values of BDI. Adopted research method was loosely based on Bry-Boschan algorithm.

The algorithm of analysis was as follows:

1. Nominal GDP values published quarterly were realized by use of deflator. From these real values a time series was created.
2. Turning points were appointed (local extremes) for GDP according to modified for the analysis purposes with quarter patterns from Bry-Boschan algorithm:

$$(\Delta y_{t-2}, \Delta y_{t-1}) < \Delta y_t > (\Delta y_{t+2}, \Delta y_{t+1}) \text{ or } (\Delta y_{t-2}, \Delta y_{t-1}) > \Delta y_t < (\Delta y_{t+2}, \Delta y_{t+1})$$

where y – indicates the value of GDP, and t – number of consecutive quarterly period.

3. Turning points were appointed according to the same research algorithm for BDI; in addition values from the end of each calendar quarter and the value with lead-times in relation to the end of quarter, rather than increases in these values, were studied.
4. On the base of above, the diffusion rate was calculated for GDP and BDI. In addition this rate was calculated for different leading of BDI.

Presented above research algorithm is aimed to determine by what part of analyzed period the both values moved in the same direction. Based on diffusion index results calculated for different leading of 0 to 90 days, the lead-times were determined, characterized by the highest similarity of Baltic Dry Index course.

4. RESULTS

4.1. Data sources

During study the quarterly GDP values of the United States and Baltic Dry Index values were used. The analyzed period included data from 3rd quarter of 2009 to the end of 2014. This period was chosen due to availability of data, methodology stability for Baltic Dry Index calculation and lack of sudden significant events which may disturb the freight price relation¹⁴. Data concerning the size of United States GDP came from Bureau of Economic Analysis.¹⁵ Data of Baltic Dry Index value came from the Bloomberg Office.¹⁶

4.2. Analysis and interpretation of results

Based on above data, six extremes were indicated for the gross domestic product of the United States economy, 3 local highs per period, respectively: 2nd quarter of 2010, 2nd quarter of 2011 and 2nd of 2014 and 3 local lows per period: 1st quarter of 2011, 4th quarter of 2012 and 1st quarter of 2014. In above analysis, two very short changes are visible – in 2011 and 2014, this may indicate quickly following changes in the level of the economic activity or weakness of selected research algorithm. In order to verify the cause of this state of affairs, it is planned to carry out further research using a different algorithm for determining local lows and highs in the upward economy trend, measured using gross domestic product.

Not less, the current level of conducted research may turn out to be interesting. Graph 2 presents the course of gross domestic product of the USA and Baltic Dry Index indicator.

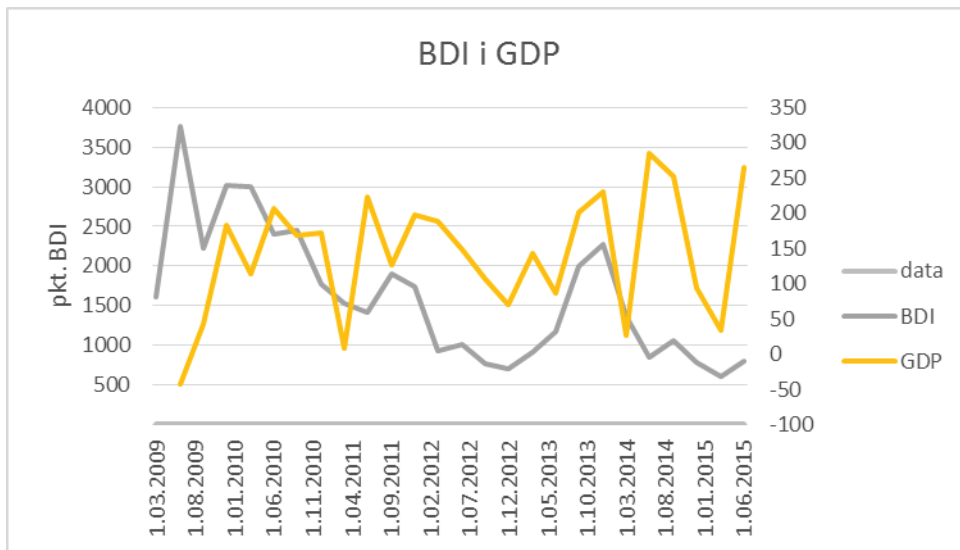
¹³ M. Ulrichs, M. Błażej, J. Jędrych, Parallel and aggregated leading indicator, clock of the economic situation. Identification of mechanisms and course of business cycle for Poland; Methodology, Central Statistical Office, Department of Macroeconomic and Finances, Warsaw, 2014, p. 14

¹⁴ It is about events such as the collapse of large banks at the beginning of crisis in 2007, or impediment of the navigation caused by natural disasters

¹⁵ National Data, U.S. Bureau of Economic Analysis (BEA), <http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=3&isuri=1&903=5>, (30.12.2015)

¹⁶ BDIY:IND, Bloomberg Business, <http://www.bloomberg.com/quote/BDIY:IND>, (30.12.2015)

Picture 2: GDP USA changes on the level of Baltic Dry Index in 2009-2014



Source: Own study.

Left axis indicates the Baltic Dry Index values, thus right axis indicates change of GDP value in bn USD. On the above graph it is hard to notice the concurrency of the course of both examined variables. Table 1 presents received results.

Table 1: Presentation of results

Number of lead-days for Baltic Dry Index	0	15	30	45	60	75	90
Number of extremes	9	9	9	7	8	8	5
Including highs	5	4	5	4	4	5	3
Including lows	4	5	4	3	4	3	2
Number of periods with relation to extremes	1	0	1	2	2	0	0
Dispersion indicator	17%	0%	17%	33%	33%	0%	0%
Number of periods in which both indicators moved in the same direction	29%	21%	21%	38%	38%	21%	29%
Number of false readings that could indicate a change in the business cycle	8	9	8	5	6	8	5

Source: Own study.

Based on visible synthetic overview in Table 1, it is possible to conclude that at selected research method the compliance of Baltic Dry Index changes with changes of GDP USD resulted in the highest compliance for lead-times of 45 days, a little worse results was 60-days. However, overall compliance in highs and lows for studied data is little, because even for the most coincident lead-times it was possible to correctly identify only two such periods – highs in the second quarterly of 2010 and lows in the first quarter of 2011.

There is also visible a large number of false indications, which pointed to approximation of maximum or minimum in the business cycle, which proves that based on selected method it isn't possible to point with the accuracy greater than 50% (accuracy for draws) of upcoming recession period or the height in economic activity.

5. CONCLUSIONS

Obtained results using one method to determine points of inflection in the trends of changes in business cycle, don't provide answer – whether the Baltic Dry Index can be regarded as economic leading indicator for the United State economy, although it is possible to falsified this hypothesis due

to low level of compliance in the time between local lows and highs for BDI, and changes of the economic activity.

For this reason, it seems advisable to carry out analogous research using other methods to determine the beginning and end of business cycles in order to clearly define whether there are grounds for rejection of presented above hypothesis. In the course of further research, the methodology based on autoregression switching Markov's model is considered, but the final method has not yet been selected. Research conducted with regard to possibility of Baltic Dry Index use as an economic leading indicator must also be extended with data of other countries, for proper verification of this hypothesis.

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