TRADE IN EUROPE IN DIFFERENT TIME PERSPECTIVES

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Abstract. The aim of the article is to analyze term in Europe in different time perspectives. In addition the aim of the article is indication using the appropriate tools and models of factors having the greatest and least impact on the development of this phenomenon in different time horizons. Trend analysis and long and short period dependencies in trade globalisation are based non-linear ordering and wavelet analysis. A discrete wavelet was used for wavelet analysis of the time series studied. In the process of discrete wavelet transformation, the received signal is divided into so-called approximation and detail. Approximation is then subjected to a subsequent division into further approximation and detail, while details are not subject to further divisions. In this way, the signal is presented as the sum of the approximation of the last level and the details from all levels.

Keywords: foreign direct investment, globalization, trade, wavelet

1. Introduction

Foreign direct investment is an “investment from one country into another (normally by companies rather than governments) that involves establishing operations or acquiring tangible assets, including stakes in other businesses. The purchase or establishment of income-generating assets in a foreign country that entails the control of the operation or organisation. FDI is distinguished from portfolio foreign investment (the purchase of one country’s securities by nationals of another country) by the element of control. Standard definitions of control use the internationally agreed 10 per cent threshold of voting shares, but this is a grey area as often a smaller block of shares will give control in widely held companies. Moreover, control of technology, management, even crucial inputs can confer de facto control. FDI is not just a transfer of ownership as it usually involves the transfer of factors complementary to capital, including management, technology and organisational skills” (*Foreign Direct Investment Definition from Financial Times Lexicon*". lexicon.ft.com).

In the top ten countries with the largest GFICA¹ index value in 2018, the following countries were included: United States - 76.1; Switzerland -73.9, United Kingdom -72.8, Hong Kong –

¹ The purpose of GFICA index is to measure and study, in an ongoing manner, 8 world regions’ attraction as FDI destinations by means of quantitative indicators, while at the same time comparing each group performance with an extended group of different countries and relevant geographical areas. This study shall be carried out on a yearly basis, thus enabling the monitoring of each country’s development with respect to different categories considered to cover the most important pillars that MNEs bear in mind when making investment decisions. The index aggregates and provides the requisite information for FDI allocation decisions. The results shall obviously serve as a support tool in assessing the reasons

72.5; Netherlands - 71.1, Singapore - 71.0, Germany - 71.0, Sweden - 70.0, Denmark - 69.5, Canada - 67.2. The following countries close the ranking: Benin - 28.6, Ethiopia - 27.7, Cameroon - 27.6, Venezual - 26.8, Sudan - 25.2, Mauritania - 24.6, Iraq - 24.2, Yemen - 23.2, Chad - 16.5, Cent. African Rep. - 14.7 (see fig. 1).

Figure 1: Rank variation from 2017 to 2018.

Source: GFICA.

The article presents an unconventional approach to trade, namely through the prism of trade globalization. Trade (in percent of GDP): sum of exports and imports of goods and services measured as a share of gross domestic product. The study was limited to countries that are part of the European continent.

boosting or slowing down foreign investment in a considered region of the world. The attractiveness analysis benchmarks the attractiveness of 109 countries to receive FDI allocations representing 97% of the world inward FDI stocks and covers a total of 60 indicators structured around 11 FDI key drivers covering three pillars which aim to group together the main sources of competitive advantage that internationalization offers to MNEs: Prerequisites indicators, Underlying Indicators and Externalities Indicators. The three pillars are described below. The ranking provides the evidence for which factors a considered region/country stands behind and has to improve them in order to become more attractive.

2. Trade globalisation index

Trade globalization is understood at work through the prism of the KOF trade globalization index as follows: “The sub-dimension trade globalisation includes variables that measure the exchange of goods and services over long distances. We use the sum of exports and imports of goods as a share of GDP, the sum of exports and imports of services as a share of GDP and a variable that measures trade partner diversification in goods trade. Trade partner diversification is computed as the inverse of the average Herfindahl-Hirschmann trade partner concentration index for exports and imports of goods. Herfindahl-Hirschmann trade partner concentration index is computed as the sum of squares of trade partner shares in exports and imports respectively for a given country. The more dispersed the trade of a country over different trade partner is, the higher the value in the variable. The variable therefore favours countries whose export and import structure is globally oriented as compared to countries that primarily trade regionally. (Gygli, at al., 2018)”

Trade globalization index since 1970 has been growing by 0.818% on average. The largest increase in trade globalization is in Europe & Central Asia - 0.94%, and the smallest in North America - 0.21% (Fig. 2).

Figure 2: Average annual rate of change.

Source: Own elaboration.

3. Empirical analysis

3.1 Research tool

The research analysis was based on a wavelet analysis with a discrete wavelet (see, among others, Hadaś-Dyduch 2015a, 2015b, 2016a, 2016b, 2016c, 2017) and non-linear ordering. Non-linear ordering consists, from the geometric side, in projecting objects placed in a multidimensional space of variables into a plane. It does not allow to set the hierarchy of objects, but only to define for each of the objects, similar objects.

The simplest wavelet is the Haar wavelet. In 1910 Alfred Haar introduced a function which presents an rectangular pulse pair. After that various generalizations and definitions were proposed. In 1980s it turned out that the Haar function is in fact the Daubechies wavelet of order 1. This enabled to introduce the Haar wavelet, which is the simplest orthonormal wavelet with compact support. It should be mentioned that the Haar wavelet has an essential shortcoming: it is not continuous. In the points of discontinuity the derivatives do not exist, therefore it is not possible to apply the Haar wavelet directly for solving differential equations (Babolian & Shahsavaran, 2009).

Figure 3: Haar wavelet and Haar scaling function.

Source: Own elaboration.

The Haar wavelets family for $t \in [0,1]$ is defined as follows (Lepik, 2007):

$$H_i(t) = \begin{cases} 1 & \text{for } t \in \left[\frac{k}{m}, \frac{k+0,5}{m}\right) \\ -1 & \text{for } t \in \left[\frac{k+0,5}{m}, \frac{k+1}{m}\right) \\ 0 & \text{for other } t \end{cases}$$

Integer $m = 2^j$, $j = 0,1,2, \dots, J$ indicates the level of the wavelet; $k = 0,1,2, \dots, m-1$ is the translation parameter. Maximal level of resolution is J . The index i is calculated according the formula $i = m + k + 1$; in the case of minimal values $m = 1, k = 0$ we have $i = 2$; maximal value of i is $i = 2M = 2^{J+1}$. It is assumed that the values $i = 1$ corresponds to the scaling function which $H_1 \equiv 1$ in $[0,1]$ and vanishes elsewhere.

Figure 4: An example of Haar transform.

Source: Own elaboration.

3.2 Description of the algorithm

Wavelet analysis and nonlinear ordering were used for the study. The algorithm constructed for this study was subjectively named WWK (see Fig. 5).

The algorithm combines wavelet analysis with nonlinear ordering. Wavelet analysis in the described algorithm allows the decomposition of the series, and then the evaluation of the phenomenon in various time oscillations around the trend. On the other hand, the introduction to the non-linear ordering algorithm allows for classification of series obtained from the wavelet analysis, into clusters according to oscillations around various time trends. Thus, the ranks were first expanded to include a number of observations equal to a multiple of 2. Then the algorithm of a discrete wavelet transform was applied. The obtained coefficients were introduced into the classification algorithm, obtaining on the output clusters of countries with the closest links around the 2-year trend. Then further wavelet decomposition was made, obtaining the coefficients necessary to create clusters containing countries with the closest oscillation around the 4-year trend. The central idea of the wavelet transform analysis in this algorithm is to decompose a signal into different levels of resolution (this process is known as multiresolution). The multiresolution representation provides a simple hierarchical framework for the interpretation of the information in the time series. At different resolutions, the details of a signal usually characterize different physical structures of themselves. At a coarser resolution, these details generally characterize large structures that provide information and with the increase of the resolution finer details are obtained.

Figure 5: Framework of algorithm

Source: Own elaboration.

3.3 The research results

The algorithm application described in chapter 3.2 allows for the construction of clusters containing groups of similar countries in a given time trend and also for the following conclusions.

Albania, Belarus, Ukraine, Bulgaria are countries that have a similar trend of "trade globalization" in the 2-year trend. A separate group is made up of Austria, Spain, France, Germany, Finland, Italy, Greece, Portugal (Fig. 6).

Figure 6: Application results of the algorithm. Classification of the countries of the European continent according to the oscillation around the 2-year trend.

Source: Own calculations and simulations.

Analyzing Trade Globalization oscillations around the 4-year trend, we get that countries like Croatia, Germany, Greece, United Kingdom, Denmark, France, Netherlands, Iceland, Italy,

Spain have a similar development trend (see: Fig. 7). A separate group is made up of Albania and Belarus.

Figure 7: Application results of the algorithm. Classification of the countries of the European continent according to the oscillation around the 4-year trend.

Source: Own calculations and simulations.

Analyzing the oscillations of Trade globalization around the 8-year trend, we get that Albania, Germany, Latvia, Bulgaria, Finland, Belarus, Ukraine have a similar development trend.

Figure 8: Application results of the algorithm. Classification of the countries of the European continent according to the oscillation around the 8-year trend.

Source: Own calculations and simulations.

In the long-term trend with similar volatility, there are countries: Albania, France, Italy, Greece, Spain. As a separate group, you can classify: Finland, Sweden, Portugal, Germany, Poland, Romania, United Kingdom.

Figure 9: Application results of the algorithm. Classification of the countries of the European continent according to the oscillation around the long-term trend.

Source: Own calculations and simulations.

4 Conclusion

The article classifies the countries of the European continent according to the trade globalization index. The countries that are the most similar in terms of the trend have been merged into groups. Four classifications were made: 2-year trend, 4- year trend, 8-year trend, long-term trend. The subject matter is important. In the economic field, many advantages of the globalization process are underlined. Optimists do not perceive any threats, on the contrary - they believe that the global economy is becoming more and more open and integrated internally thanks to the globalization process, which is served by international trade, free flow of capital, technology, information and organizational solutions, and even ideas and standards. The advantage of globalization is the rationalization of activities in line with the principle of maximizing costs and minimizing losses. Decisive is reducing the costs of information flow: "it accompanies this process by reducing the costs of obtaining and transmitting information, and thus increasing the possibility of access to modern technology for an increasing number of countries and societies".

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