

Comparative Assessment the Dynamics of Stock Indices in France, Germany, Italy and Great Britain

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Abstract: *Comparative assessment is one of the tools for data processing and analysis. This assessment allows you to assess the effectiveness of interaction and direction of development between the objects that are compared. Among the various spheres of scientific and applied research, the analysis of the development of economic relations deserves special attention. This is necessary to understand the dynamics of general economic development, the functioning of economies in difficult conditions (for example, in the context of a pandemic). The object of such a study can be various financial flows. The generalizations of the movement of financial flows are stock indices. We examined the relationship between the dynamics of stock indices in France, Germany, Italy and the UK. We reviewed the most significant stock indices in each of the countries. This makes it possible to assess the economic development of such European countries, their mutual influence on each other, to show the level of interconnection. For this we use the ideology of wavelet analysis. Based on wavelet coherence, we examined estimates of the relationship between stock indices in France, Germany, Italy and the UK. The results of calculations for real data are presented. The results show the real level of economic interconnection between the countries we study. These results are based on the real dynamics of stock indices. This allows making decisions for the development of mutual economic ties between European countries, between European countries and the rest of the world.*

Keywords—assessment; analysis; stock index; European countries; wavelet analysis; wavelet coherence.

1. INTRODUCTION

The functioning of the world economic space is determined by the effectiveness of the relationships between various market agents (individual business entities, industries or sectors of the economy, countries) [1], [2]. The relationship between various agents of market relations is determined by their cooperation, the division of spheres of influence, the conditions for conducting core activities, access to the raw material markets and product sales, and other factors. Nevertheless, this relationship is based on the concept of financial flow [3]-[5]. Then the effectiveness of the relationship between various market agents is determined by the conditions of movement of input and output financial flows [2], [3], [6]. This makes it necessary to consider, first of all, the relationship between various agents of economic markets in financial markets [7]-[9]. At the same time, the functioning of the financial market is provided by corporations, banks and other credit and financial organizations, stock exchanges [10]-[12].

Among the various segments of the financial market, one can single out the stock market, which ensures the redistribution of free financial resources between various participants in market relations. The reflections of the functioning of the stock market, the efficiency of its development are stock indices [13]-[15].

Stock indices reflect the dynamics of price changes for a certain group of goods. Thus, the stock index is a formalized generalization of the movement of financial flows. At the same time, the stock index is also a generalization of the influence of different financial flows on each other.

Analysis of key stock indices of individual countries allows you to analyze and evaluate the relationship between different countries (as representatives of individual agents of economic relations). At the same time, in each region, you can choose a number of countries that determine the economic development of such a region, its relationship with other regions of the world. In our study, we have selected a number of European countries that determine the overall development of Europe and significantly affect world economic development. Thus, the main task of this work is to carry out a comparative assessment of the dynamics of stock indices in France, Germany, Italy and Great Britain.

2. MATERIALS AND METHODS

2.1 Related Work

The analysis of stock indices is one of the areas of economic research. In their works, various authors consider both the theoretical aspects of the dynamics of stock indices and a number of applied issues of the relationship of such dynamics with other factors that affect economic development.

O. Ratanapakorn and Sharma analyze in detail the dynamics of various stock indices [16]. At the same time, the authors consider the relationship between the dynamics of stock indices in the context of individual regions. The assessment of this relationship is carried out against the background of two periods: the pre-Asian crisis and during the crisis. The paper deals with the US stock markets, European stock markets, Asian stock markets, Latin American stock markets, stock markets of Eastern Europe and the Middle East. This makes it possible to better assess the relationship between the economic developments of different regions. For this analysis, various statistical methods and estimates were used: cointegration, vector error correction model, Granger causality [16].

B. H. Boyer, T. Kumagai and K. Yuan analyze the dynamics of stock indices in order to answer the question: how does a dynamic of stock indices reflect crises in stock markets [17]. The authors consider the mutual dynamics of various stock indices, paying attention to the profitability of securities of such indices. This comparison is based on the methods of statistical analysis, visualization of the dynamics of stock indices and the dynamics of the development of crisis phenomena.

In their study, O. Kwon and J. S. Yang argue that analyzing the relationship between various stock indices helps to understand the dynamics of economic development [18]. Analysis of the relationship between dynamics between various stock indices provides primary information for understanding the processes that take place in the economy. At the same time, for the analysis, the authors use various statistical methods and estimates.

M. Asutay, Y. Wang and A. Avdukic conduct a comparative analysis of the dynamics of stock indices in Europe and the Asia-Pacific region [19]. Such an analysis allows you to better understand the dynamics of economic development of individual countries, choose a balanced investment strategy, and form a certain portfolio of securities. To analyze the dynamics of stock indices, the authors use the CAPM-EGARCH models.

The work [20] examines the relationship between the mutual dynamics of regional and world stock indices. This approach is used to assess the systemic risks of various segments of the financial market. This is due to the fact that stock indices contain information about the respective processes that are taking place. To analyze the mutual dynamics of stock indices and assess systemic risk, the authors use classical methods of correlation analysis.

Z. Janková and P. Dostál consider the mutual dynamics of various stock indices to build a forecast model [21]. Such a model is based on time series about stock indices and fuzzy logic to analyze such a series. This allows you to build adequate predictive models that take into account positive and negative periods in the dynamics of stock indices.

B. Maraqa and M. Bein examine the dynamic relationship between stock indices in Europe, oil prices and the price of shares of leading European companies [22]. Such analysis helps to understand the mutual dynamics between stock indices and the price of oil. This allows predicting economic development or economic downturn, giving investors accurate signals. For their analysis, the authors use classical statistical methods and approaches.

Z. Jiang, and S. M. Yoon investigate the relationship between the dynamics of stock indices and the price of oil in oil importing and exporting countries [23]. This analysis allows us to understand the dynamics of oil prices, the dynamics of stock returns, the direction of economic development in the countries of oil importers and exporters. For the analysis, the authors use methods of statistical analysis and approaches of wavelet ideology: multiscale wavelet decomposition, wavelet coherence.

J. J. Krüger uses wavelet coherence to analyze the mutual dynamics of the main indicators of the business cycle from the point of view of the German economy [24]. Among the main indicators of business activity, the author also considers stock indices. The author also makes a comparison with other European countries.

Thus, a comparative assessment of the mutual dynamics of stock indices is one of the areas of research in the functioning of the stock market, economic relationships between different agents of economic relations. Such an analysis is of interest for all spheres of economic relations. Various statistical methods and approaches are usually used to carry out the appropriate analysis. At the same time, among the latest studies, special interest is given to the ideology of wavelets.

2.2 Wavelet Coherence as a Tool for Analyzing the Dynamics of Stock Index Values

Wavelet coherence is one of the data analysis methods based on wavelet ideology. In general, the wavelet analysis allows us to identify the most significant points in the initial data series. These are the key points of change in the values of such a series. For such analysis, various wavelet functions are used that help to identify significant points of the data series that is being investigated [25]-[27]. Wavelet coherence allows one to estimate the mutual dynamics of data series for a certain time interval. Then wavelet coherence is some generalization of multiple correlations.

To implement wavelet coherence, you can use the following expression [28]-[30]:

$$Q^2(a, b) = \frac{|\Theta(a^{-1}W_{z1z2}(a, b))|^2}{\Theta(a^{-1}|W_{z1}(a, b)|^2)\Theta(a^{-1}|W_{z2}(a, b)|^2)},$$

where:

$W(a, b)$ – is a values of cross wavelet spectra;

a, b – is a scale and center of time localization, that determine the scale of the wavelet transform;

z_1, z_2 – is a data series that we explore;

Θ – is a smoothing operator;

$Q^2(a, b)$ – is a squared wavelet coherency coefficient.

$0 \leq Q^2(a, b) \leq 1$. If these values tend to zero, then we have a weak correlation. Otherwise, we have a strong correlation.

2.3 Data for Analysis

To achieve the goal of this study, we will consider the stock indices of France, Germany, Italy and the UK. These data cover the period from 03.01.2021 to 14.11.2021 and are presented in averaged weekly values. Data from the site - <https://investing.com>.

We are looking at the following stock indices for

France – CAC 40 (FCHI) and SBF 120 (SBF120);

Germany – DAX (GDAXI) and Midcap (MDAXI);

Italy – Italy 40 (invt40) and FTSE MIB (FTMIB);

UK – FTSE 100 (FTSE) and FTSE 250 (FTMC).

These are the most significant stock indices that cover the securities of various companies.

In fig. 1 shows the dynamics of the values of the main stock indices of the French stock market.

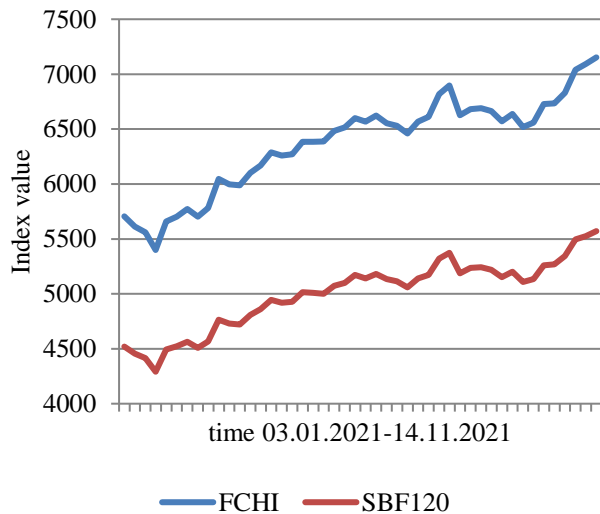


Figure 1: Dynamics of the values of the main stock indices of the French stock market

In fig. 2 shows the dynamics of the values of the main stock indices of the German stock market.

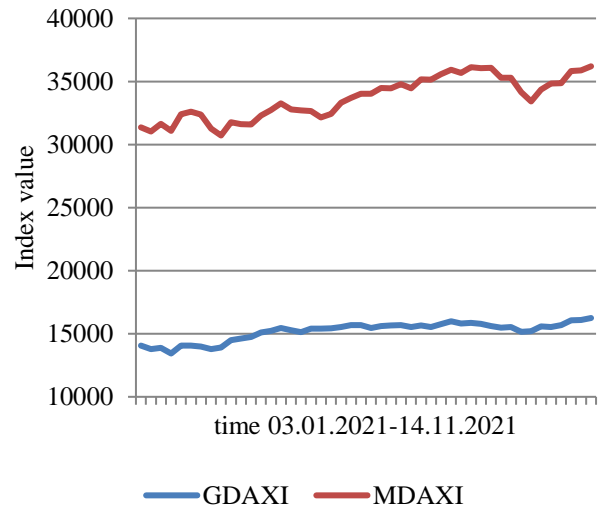


Figure 2: Dynamics of the values of the main stock indices of the German stock market

In fig. 3 shows the dynamics of the values of the main stock indices of the Italian stock market.

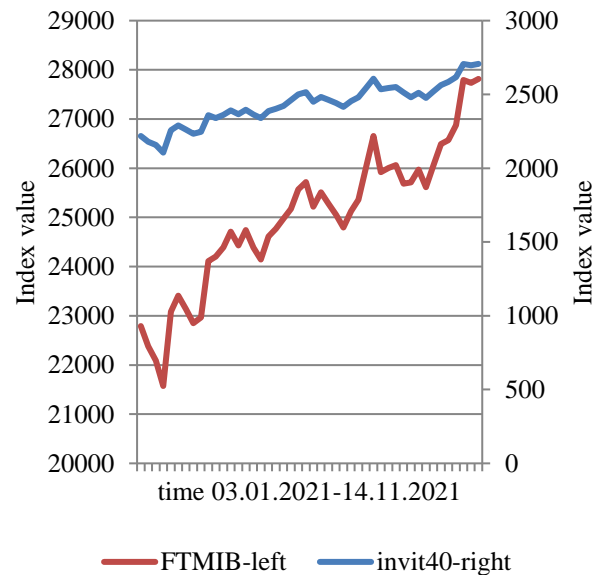


Figure 3: Dynamics of the values of the main stock indices of the Italian stock market

In fig. 4 shows the dynamics of the values of the main stock indices of the UK stock market.

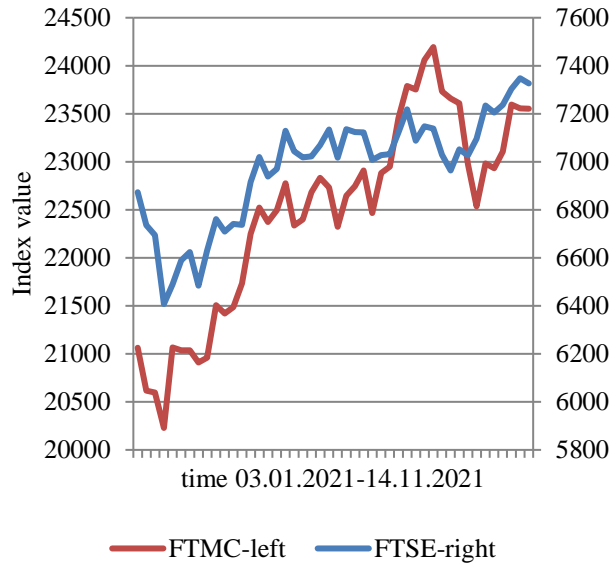


Figure 4: Dynamics of the values of the main stock indices of the UK stock market

We see that the trends in the development of the dynamics of the values of stock indices within the same country are the same. And this is understandable. At the same time, the dynamics of changes in the values of stock indices within one country is not identical. Although for some countries such changes are comparable (see, for example, data in fig. 1 or data in fig. 4, but only for some time intervals). Thus, the use of wavelet coherence is reasonable and logical. In this case, we can conduct a more detailed analysis of the mutual dynamics of stock indices both within each country and between different countries.

3. RESULTS AND DISCUSSION

Before considering the wavelet coherence of the mutual dynamics of various stock indices, we will make a number of explanations. These explanations, first of all, relate to the data that will be presented in the corresponding figures.

The abscissa (for all the figures below) shows the time period that we are analyzing. The ordinal values of the data that we are examining from the interval 03.01.2021-14.11.2021 are shown.

On the ordinate axis (for all figures presented below) – the depth of cross-references between the time series that we are examining is displayed. In essence, it is the depth of the cross-references for which the corresponding multiple correlation values are considered.

White dotted line (for all figures below) – limits the values of the wavelet coherence with the most reliable level of significance.

The column on the right (for all the figures below) – the values of the wavelet coherence from 0 to 1, which also have a color characteristic.

At the same time, we do not consider which time series of data is the main one, but which inherits the behavior of another series of data. We look at the degree of influence between data series.

First, consider the wavelet coherence of the dynamics of stock indices for each country (in accordance with the data in fig. 1–fig. 4).

In fig. 5 shows the wavelet coherence values for the dynamics of the values of the main stock indices of the French stock market (between FCHI and SBF120).

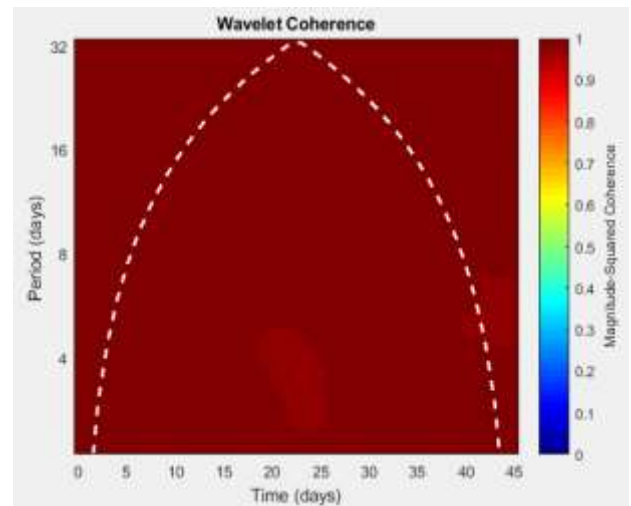


Figure 5: Wavelet coherence values between FCHI and SBF120

In fig. 6 shows the wavelet coherence values for the dynamics of the values of the main stock indices of the German stock market (between GDAXI and MDAXI).

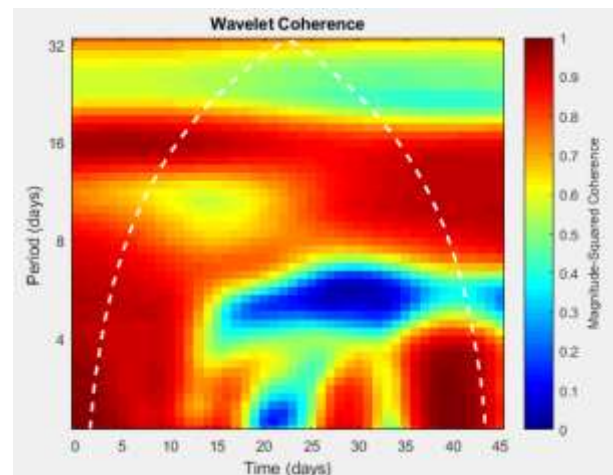


Figure 6: Wavelet coherence values between GDAXI and MDAXI

In fig. 7 shows the wavelet coherence values for the dynamics of the values of the main stock indices of the Italian stock market (between invit40 and FTMIB).

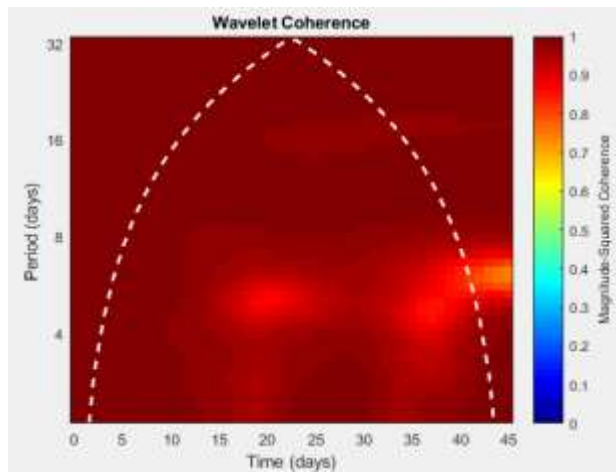


Figure 7: Wavelet coherence values between invit40 and FTMIB

In fig. 8 shows the wavelet coherence values for the dynamics of the values of the main stock indices of the UK stock market (between FTSE and FTMC).

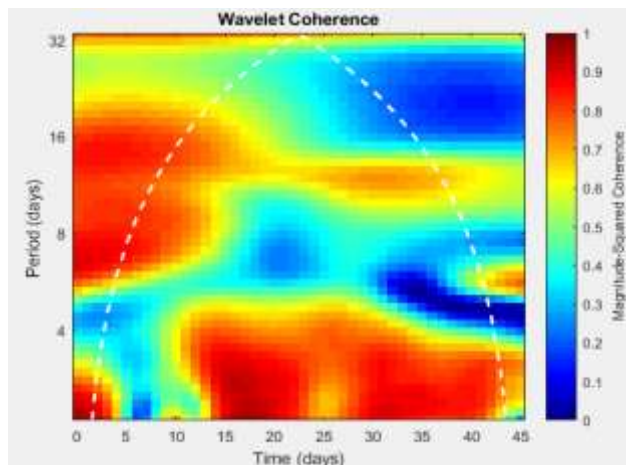


Figure 8: Wavelet coherence values between FTSE and FTMC

It should be noted that there is a different consistency between the dynamics of individual stock indices from the point of view of different countries. For the French stock market and the Italian stock market, the dynamics of the consistency of their main stock indices is identical (see fig. 5 and fig. 7). For the German stock market and the UK stock market, the dynamics of the consistency of their main stock

indices is not identical (see fig. 6 and fig. 8). Moreover, the consistency of the dynamics of the major stock indexes in Germany and the UK differs from each other. These facts must be taken into account when developing predictive models to assess the volatility of various stock indices.

It should also be noted that the data obtained correlate with the results obtained by other authors [31]-[35].

We also consider the wavelet coherence of the dynamics of stock indices, which are typical for different countries. Below are such estimates of the wavelet coherence.

In fig. 9 shows the values of the wavelet coherence between FCHI (France) and FTMIB (Italy).

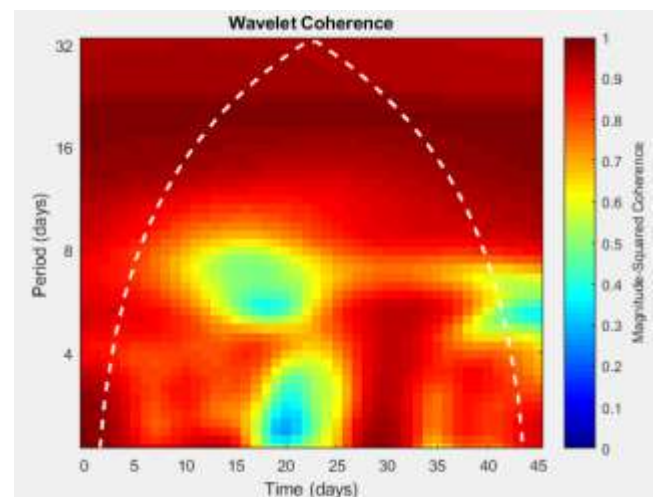


Figure 9: Wavelet coherence between FCHI (France) and FTMIB (Italy)

In fig. 10 shows the values of the wavelet coherence between MDAXI (Germany) and FTMC (UK).

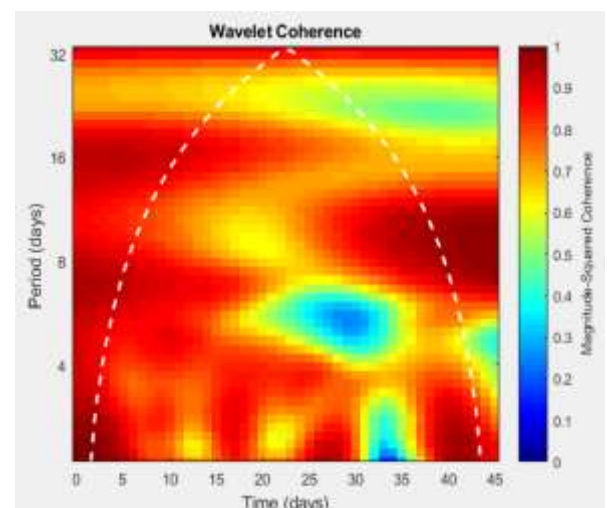


Figure 10: Wavelet coherence between MDAXI (Germany) and FTMC (UK)

Fig. 9 and fig. 10 show that we can observe different dynamics of consistency between stock indices of different countries. This also needs to be taken into account when building predictive models, choosing a strategy for investment, and implementing a certain economic policy. At the same time, it should also be noted that the results obtained are consistent with the research results of other authors [31]-[33].

4. CONCLUSION

The paper deals with the analysis of the dynamics of the values of stock indices. Special attention is paid to the comparative assessment of such dynamics. This allows you to make the right investment decisions, adjust the implementation of the selected economic policy, and build forecast models.

We use wavelet coherence to conduct a comparative analysis and consider the corresponding estimate. Wavelet coherence is one of the methods of wavelet ideology, which is used to analyze data presented in the form of a time series. This analysis was carried out to assess the stock indices of countries such as France, Germany, Italy and the UK. Shown are the pairs of stock indices that have the greatest wavelet consistency. Differences in the dynamics of stock indices in different countries are also noted. The research results are obtained for real data. This helps to draw informed conclusions.

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