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Assessment Dynamics the Development of Financial Markets in the UK and Japan in the Context of COVID-19 Pandemic

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Abstract: *The negative dynamics of the spread of the COVID-19 pandemic affects all areas of daily and economic activity. At the same time, the degree of such influence is largely determined by the continuity of the movement of various financial flows, the possibility of their rapid renewal in cases of emergency slowdown or interruption of movement. For the analysis of the movement of financial flows, it is important to study the development of financial markets. It is important to carry out such an analysis from the point of view of different segments of the financial market. At the same time, it is also necessary to take into account the general trend in the development of the financial market, the relationship of its individual segments. This can be done based on the analysis of the relevant stock indexes. The paper considers the dynamics of the real values of stock indices, which reflect the dynamics of the development of individual sectors of the financial market. The paper also takes into account the aspects of conducting a comparative analysis, which allows us to identify common patterns. To do this, we consider the values of the UK and Japan stock indices. To conduct a comparative analysis, we use the methodology for constructing wavelet coherence estimates. The paper presents many graphs and charts for specific real data. This allows you to understand the logic of the study and the results obtained.*

Keywords—assessment; development dynamics; financial market; stock indices; COVID-19 pandemic; wavelet analysis; wavelet coherence.

1. INTRODUCTION

Financial markets play an important role in the development of individual business entities and the economy as a whole. The functioning of financial markets is ensured by a number of institutions and relevant legislation. Financial markets are the basis for ensuring the movement of various financial flows between all subjects of market relations [1], [2]. At the same time, various instruments can be used in financial markets that ensure the accumulation and redistribution of financial resources. These tools help ensure the continuous movement of financial resources with specified parameters and time characteristics [3], [4].

The financial market consists of a number of separate segments. Such segments of the financial market, in particular, include: the stock market, the banking sector of the economy, the foreign exchange market [2], [3], [5]-[8]. These markets interact together and are interconnected and interdependent. Nevertheless, the key parameters of all segments of the financial market that can characterize them are the corresponding stock indices [9]-[11]. Such indices reflect the movement of financial resources in different segments of the financial market. Therefore, the analysis of the dynamics of the values of stock indices is an important aspect in the study of financial markets. Such an analysis allows revealing both the features of changes in individual segments of the financial market and the relationship between different segments of the financial market.

An analysis of the dynamics of the development of financial markets is most significant under the influence of global factors. Among such factors that have a significant impact, many researchers currently single out the COVID-19 pandemic [12]-[17]. The COVID-19 pandemic has had a significant impact on the classical architecture of the economies of different countries. Many types of businesses were forced to stop their work, other types of economic activity were significantly transformed. All this had an impact on the movement of financial flows, individual sectors of the financial market. Therefore, an important aspect when considering the dynamics of the development of financial markets at the present time is to take into account the impact of the COVID-19 pandemic.

An important aspect of the study of the dynamics of the development of financial markets is also a comparative analysis. As such a comparison, it is advisable to select and consider the financial markets of individual countries. This allows you to identify the difference or some of the same patterns in the dynamics of the development of financial markets. Thus, the topic of this study is of great theoretical and practical importance and is relevant.

2. REVIEW OF PUBLICATIONS RELATED TO THE RESEARCH TOPIC

The study of the financial market is one of the directions, which is considered in the works of various authors. At the same time, the scope of such research is very wide.

O. Evans considers the relationship between blockchain technology and the financial market [18]. This is a promising direction, as it affects data protection issues, which is important for the free and uninterrupted movement of financial flows. The author shows that blockchain technology has a positive and significant relationship with the financial market in the US and China [18]. At the same time, O. Evans notes that blockchain innovations are an important positive factor for well-developed financial markets [18]. This work is based on the use of a modified least squares method and the Toda-Yamamoto causal relationship.

P. H. Haritha and R. Uchil analyze the relationship between factors affecting investor sentiment and investment decision making by individual investors [19]. To do this, the authors study the dynamics of the relevant stock indices, which are compared with the data of a survey of individual investors. The obtained data are modeled by structural equations. This makes it possible to obtain estimates of the relationship between factors, namely market effect, herding behavior, media, social interaction, and the recommendation of a lawyer that affects the mood of investors [19]

The work [20] provides an empirical analysis of the influence of the process of integration of the Integrated Market of Latin America (MILA) on its behavior in the stock markets, as well as on the degree of their integration. We see that the authors of this study directly point to the relationship between the financial and stock markets. At the same time, the paper notes that the analysis of stock indices allows a better understanding of the dynamics of financial markets. For analysis, the paper considers time series for stock returns, volatility, volume and number of transactions and securities. To analyze the impact of MILA on the behavior of the stock market and forecasting, the DCC-MGARCH model, dynamic correlations [20] was used. To analyze the stability, we used the Markov model of switching modes [20].

P. Kaur and H. Arora, in their study, conduct a detailed empirical analysis that reveals the relationship of financial markets in India [21]. The paper examines the levels of correlation and joint integration between various financial markets in India. The authors examined the degree of interdependence between the stock market, the foreign exchange market, government bonds and the commodity market. For the purposes of this study, a cointegration test was used, using electronic representations to examine long-term relationships between variables [21]. The Granger test was also used to study the causal relationship between different variables [21].

A. Zaremba, D. Y. Aharon, E. Demir, R. Kizys and D. Zawadka explore the impact of government policy on the liquidity of the global stock market [22]. At the same time, such an impact is assessed in the context of the spread of COVID-19. The authors reviewed data from 49 countries from January to April 2020. This made it possible to draw a conclusion about the impact of government policy on the liquidity of the global stock market. Such influence has been shown to be limited in scope and scope. At the same time, the authors note that information campaigns about the new coronavirus contribute to trading activity [22].

G. S. Uddin, M. Yahya, G. G. Goswami, B. Lucey, and A. Ahmed review the related dynamics of Asian and global financial markets affected by the outbreak of the coronavirus (COVID-19) pandemic [23]. The paper investigates the time dependence and connectivity of the affected markets with the global financial market [23]. Various statistical methods are used for this analysis. As a result, the authors note that there is a strong positive relationship between the studied markets due to the outbreak of COVID-19 [23].

P. K. Narayan, N. Devpura and H. Wang explore the relationship between the Japanese currency and stock markets [24]. For this analysis, the authors use several variants of econometric models and empirical specifications. This expands the understanding of the processes that take place in the Japanese financial market. It also provides more information to understand the impact of the COVID-19 pandemic on the development of the Japanese financial market.

C. Alexakis, K. Eleftheriou, and P. Patsoulis explore the relationship between COVID-19 containment measures and stock market returns [25]. For such an analysis, the authors use spatial econometrics. The paper shows that stock market returns and blocking intensity are negatively related. The authors also talk about the presence of negative direct and indirect effects that affect the profitability of the stock market [25].

B. M. Henrique, V. A. Sobreiro and H. Kimura in their study provide an overview of machine learning methods that are used to predict the development of the stock market [26]. The authors suggest using bibliographic review methods that highlight the most important texts for the field of study. At the same time, among the most commonly used models for forecasting, the authors distinguish: support vector machines (SVM) and neural networks [26].

We can also highlight the wavelet coherence estimation method, which is used to compare data with each other [27]-[29]. This, as noted above, is an important point in understanding the development of the financial market. This is especially important during the spread of the COVID-19 pandemic. Such an analysis helps to better understand the patterns that are characteristic of the development of the financial market, to conduct a better data analysis.

In general, we can say that various methods and approaches are used to study the financial market. At the same time, comparative analysis occupies a special place in such studies.

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3. WAVELET COHERENCE AS AN ANALYSIS TOOL

To conduct a comparative analysis, we use the methodology for obtaining wavelet coherence estimates. Wavelet coherence allows one to estimate the mutual dynamics of two data series. The following expression [30]-[34] is used for this:

$$R^2(a,b) = \frac{\left|\Omega(a^{-1}V_{g(t)z(t)}(a,b))\right|^2}{\Omega(a^{-1}\left|V_{g(t)}(a,b)\right|^2)\Omega(a^{-1}\left|V_{z(t)}(a,b)\right|^2)},$$

where:

$V(a,b)$ – 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;

$g(t), z(t)$ – is a data series that we explore;

Ω – is a smoothing operator;

$R^2(a,b)$ – is a squared wavelet coherency coefficient. $0 \le R^2(a,b) \le 1$. If these values tend to zero, then we have a weak correlation. Otherwise, we have a strong correlation.

Note that we will use the values of the number of infections per day as a data series $g(t)$, and the values of the corresponding stock indices as a data series $z(t)$.

4. INITIAL DATA AND THEIR BRIEF ANALYSIS

As initial data, we consider the number of infections per day for the UK and Japan, respectively. These data are selected in accordance with the dynamics of the formation of the values of stock indices, which change daily. At the same time, we do not consider the impact of the total number of infections in the cumulative aspect.

Among stock indices, as indicators of individual segments of the financial market, we consider: the main stock market index, the stock index of the banking sector of the economy and the stock index of the insurance market.

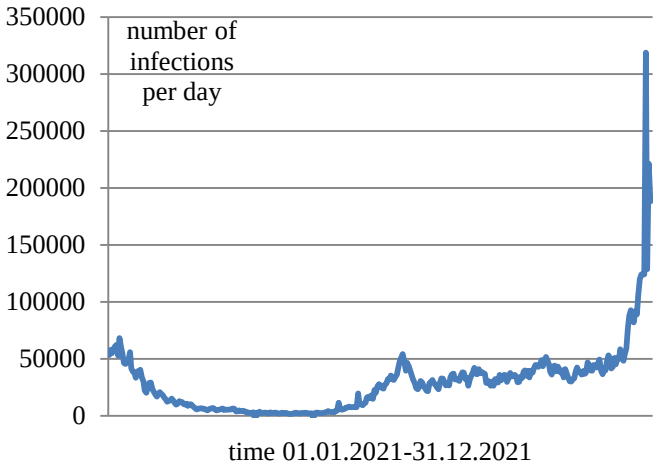
So for the UK it is: FTSE 100 (FTSE) – the main stock market index; FTSE 350 Banks (FTUB3010) – stock index of the banking sector of the economy; FTSE 350 Insurance (FTUB3030) is the insurance market stock index.

For Japan, these are: Nikkei 225 (N225) – the main stock market index; Nikkei 500 Banking (NBKS) – stock index of the banking sector of the economy; Nikkei 500 Insurance (NISU) is an insurance market stock index.

For this analysis, we consider the time period from 01.01.2021 to 31.12.2021. All data is taken from official sources:github.com/datasets/covid-19, datahub.io/core/covid-19, investing.com.

On fig. 1 shows the dynamics of infections per day for the UK.

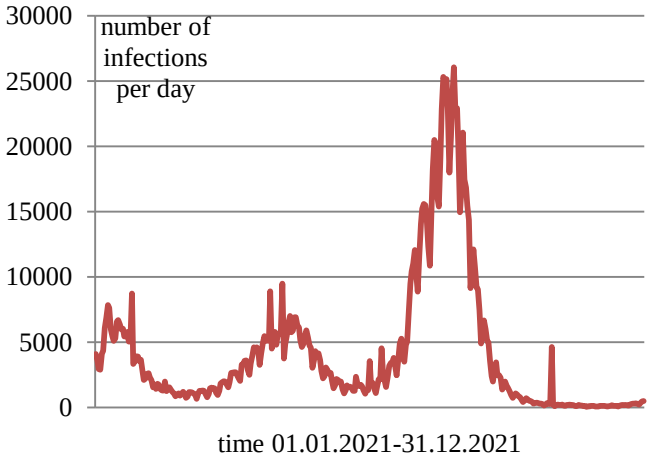
Figure 1: Dynamics of infections per day for the UK during the period 01.01.2021-31.12.2021



On fig. 2 shows the dynamics of infections per day for Japan.

Figure 2: Dynamics of infections per day for the Japan during the period 01.01.2021-31.12.2021

We see that the dynamics of infections in the UK and Japan



are different.

On fig. 3 shows the dynamics of the values of the FTSE stock index for the studied period of time.

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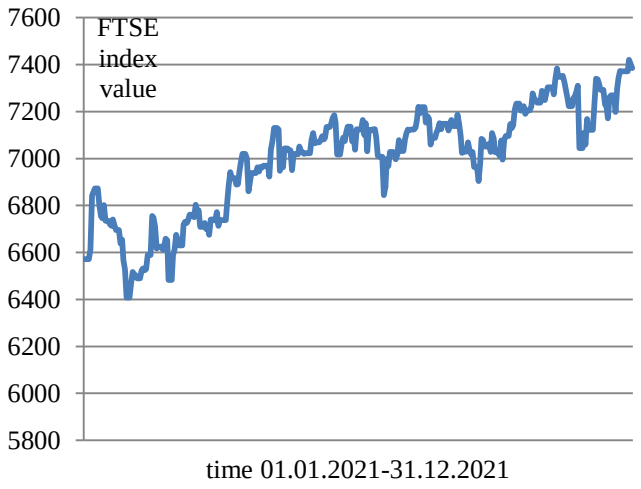
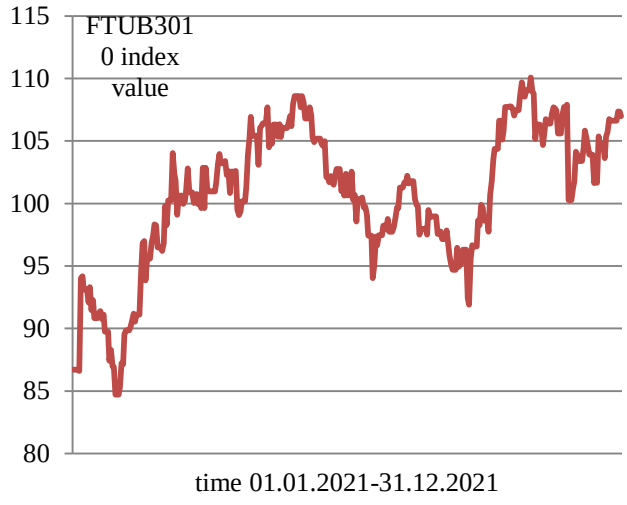


Figure 3: Dynamics of the values of the FTSE stock index for the studied period of time

On fig. 4 shows the dynamics of the values of the FTUB3010 stock index for the studied period of time.

Figure 4: Dynamics of the values of the FTUB3010 stock



index for the studied period of time

On fig. 5 shows the dynamics of the values of the FTUB3030 stock index for the studied period of time.

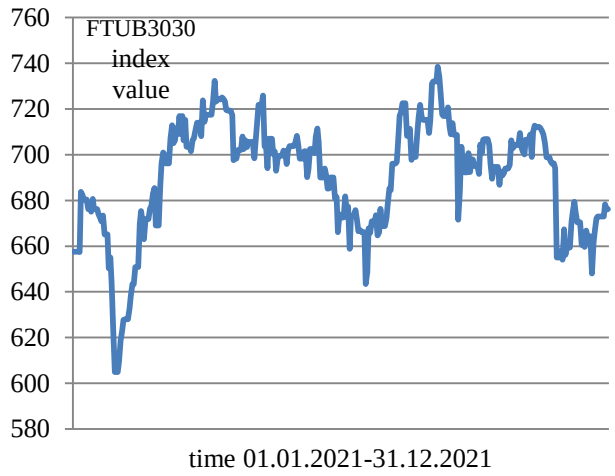


Figure 5: Dynamics of the values of the FTUB3030 stock index for the studied period of time

The data of fig. 3 – fig. 5 refer to the UK financial market. We see that the corresponding stock indices have approximately the same development trends. At the same time, it should be noted that such trends are still different. This difference lies in the different amplitude of changes in the values of the stock index, the presence of local trends in some periods of time.

On fig. 6 shows the dynamics of the values of the N225 stock index for the studied period of time.

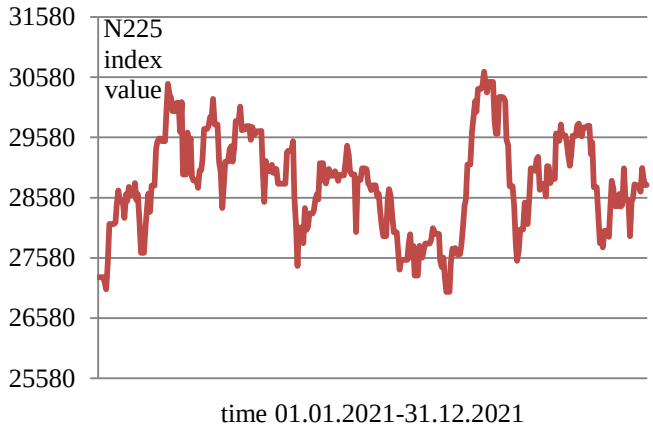


Figure 6: Dynamics of the values of the N225 stock index for the studied period of time

On fig. 7 shows the dynamics of the values of the NBKS stock index for the studied period of time.

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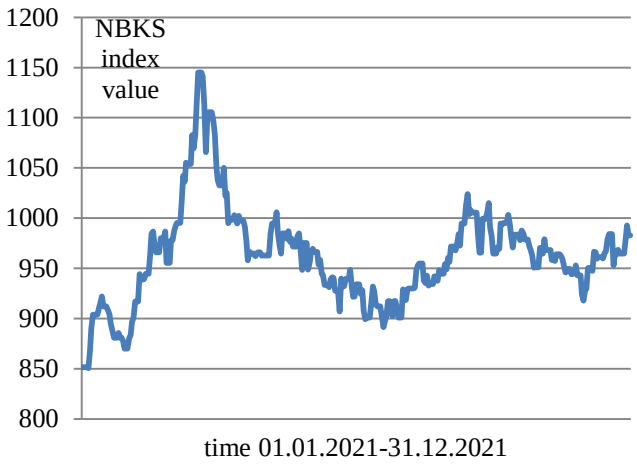

Figure 7: Dynamics of the values of the NBKS stock index for the studied period of time

On fig. 8 shows the dynamics of the values of the NISU stock index for the studied period of time.

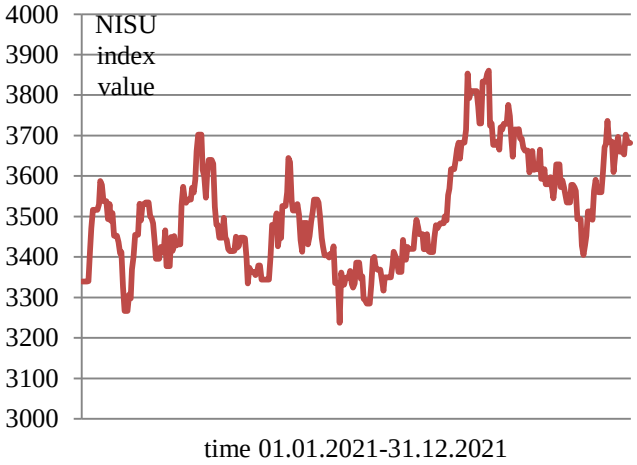

Figure 8: Dynamics of the values of the NISU stock index for the studied period of time

The data of fig. 6 – fig. 8 refer to the Japanese financial market. We see that these data differ from the dynamics of the data presented in Fig. 3 – fig. 5. At the same time, the dynamics of the data in Fig. 6 – fig. 8 is also different from each other. All this indicates the expediency of using wavelet coherence for a more detailed analysis.

5. Data from wavelet coherence on the dynamics of development of the studied financial markets

First of all, it should be noted that the estimates of wavelet coherence presented below reflect the degree of mutual influence between the studied data: the dynamics of the number of infections and the corresponding dynamics of stock index values. On fig. 9 shows an estimate of the wavelet coherence of the number of infections in the UK and the values of the FTSE 100 (FTSE) stock index.

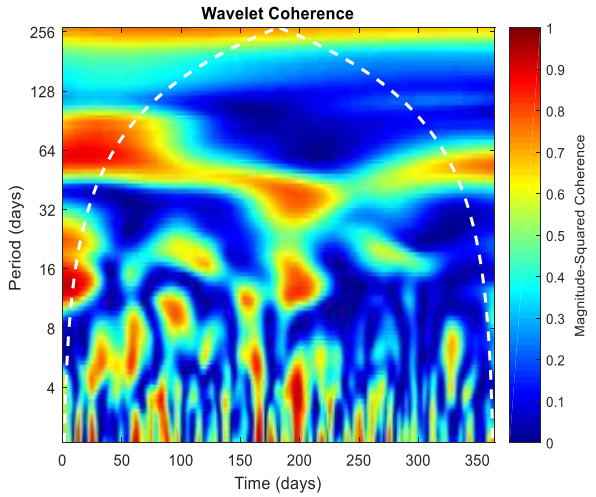

Figure 9: Evaluation of wavelet coherence between the dynamics of infections in the UK and the dynamics of the values of the FTSE 100 (FTSE) stock index

On fig. 10 shows an estimate of the wavelet coherence of the number of infections in the UK and the values of the FTSE 350 Banks (FTUB3010) stock index.

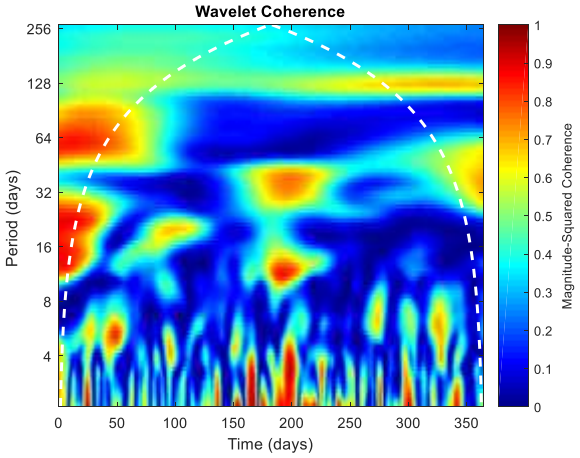

Figure 10: Evaluation of wavelet coherence between the dynamics of infections in the UK and the dynamics of the values of the FTSE 350 Banks (FTUB3010) stock index

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On fig. 11 shows an estimate of the wavelet coherence of the number of infections in the UK and the values of the FTSE 350 Insurance (FTUB3030) stock index.

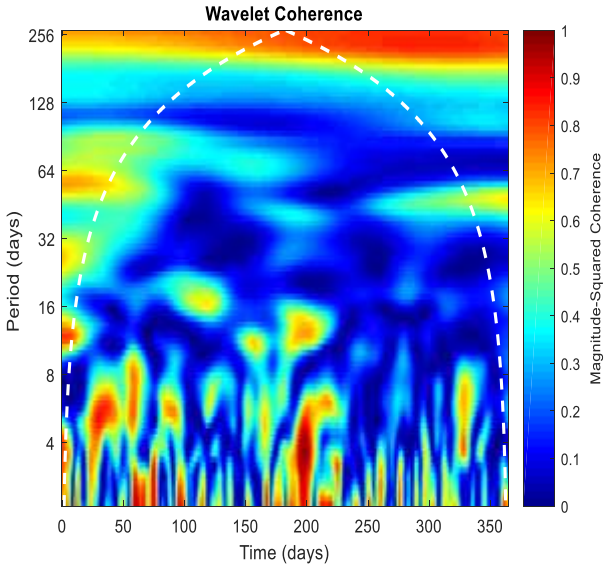

Figure 11: Evaluation of wavelet coherence between the dynamics of infections in the UK and the dynamics of the values of the FTSE 350 Insurance (FTUB3030) stock index

We can see that the relationship between the development of the COVID-19 pandemic and the corresponding values of stock indices (as a reflection of the development of financial markets) from the UK point of view is ambiguous. This ambiguity manifests itself in the fragmentation of the strong wavelet coherence between the data that are examined on a given time interval (see fig. 9 – fig. 11).

We can also observe that the impact of the COVID-19 pandemic on the development of individual segments of the UK financial market is different. This difference is manifested in different fragmentation amplitudes of the corresponding values of wavelet coherence, different manifestations of wavelet coherence in the short, medium and long term. The biggest impact of the COVID-19 pandemic is on the stock market (see fig 9). Less influence is felt by the banking sector of the economy (see fig. 10).

At the same time, it should be noted that the largest impact of the COVID-19 pandemic, in terms of data for the UK, was in mid-2021.

By analogy, consider the data for Japan. Let's compare these results with the results for UK.

On fig. 12 shows an estimate of the wavelet coherence of the number of infections in the Japan and the values of the Nikkei 225 (N225) stock index.

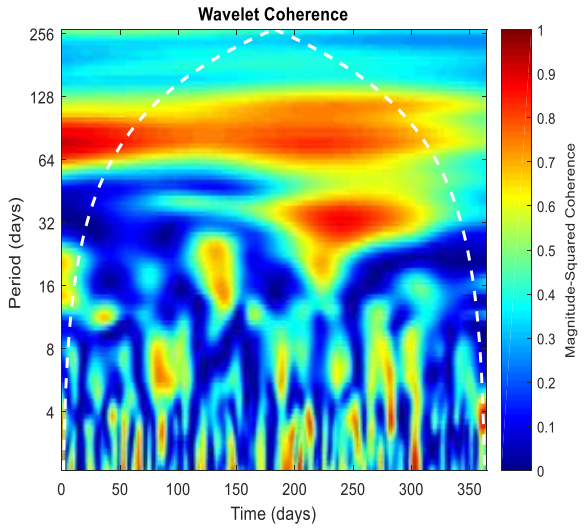

Figure 12: Evaluation of wavelet coherence between the dynamics of infections in the Japan and the dynamics of the values of the Nikkei 225 (N225) stock index

On fig. 13 shows an estimate of the wavelet coherence of the number of infections in the Japan and the values of the Nikkei 500 Banking (NBKS) stock index.

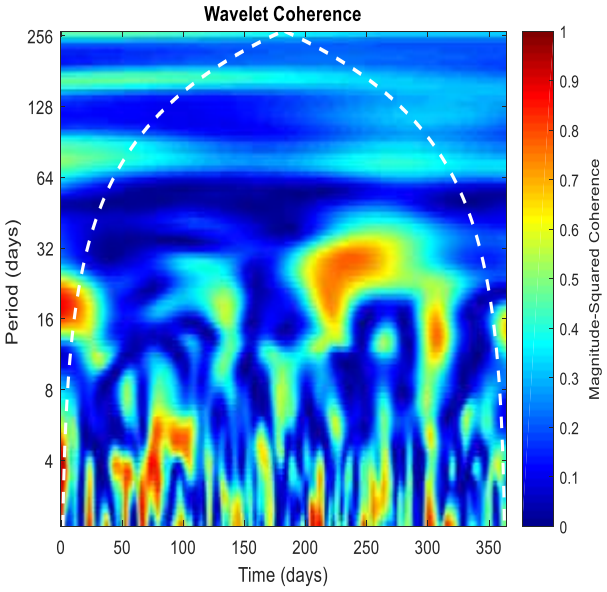

Figure 13: Evaluation of wavelet coherence between the dynamics of infections in the Japan and the dynamics of the values of the Nikkei 500 Banking (NBKS) stock index

On fig. 14 shows an estimate of the wavelet coherence of the number of infections in the Japan and the values of the Nikkei 500 Insurance (NISU) stock index.

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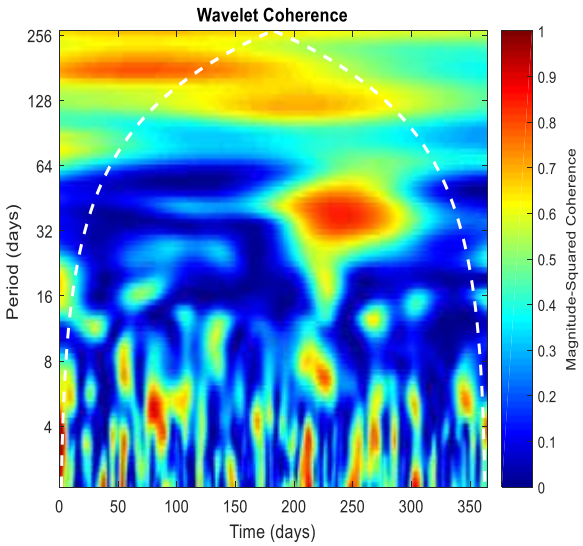

Figure 14: Evaluation of wavelet coherence between the dynamics of infections in the Japan and the dynamics of the values of the Nikkei 500 Insurance (NISU) stock index

First of all, it should be noted that the wavelet coherence estimates for data from the UK and Japan are similar. This similarity is manifested in the presence of fragmentation of strong and weak relationships between the data for which these estimates were obtained. At the same time, this indicates the expediency of using the wavelet coherence method for carrying out the corresponding analysis.

The biggest impact of the COVID-19 pandemic, in terms of data for Japan, is on the stock market (see fig. 12). We see the same for data from the UK. The least impact of the COVID-19 pandemic, in terms of data for Japan, is on the insurance market (see fig. 14). This distinguishes the development of the financial market in the UK and Japan.

We can also observe a denser fragmentation of the wavelet coherence estimates for the data from Japan compared to the data from the UK. Also different are the medium and long-term impact of the pandemic on the development of the financial markets in the UK and Japan. The greatest impact of the COVID-19 pandemic is also different. In Japan, this impact either occurs in the first half of 2021 or is distributed evenly throughout the year. In the UK, this impact is concentrated in mid-2021.

6. Conclusion

The paper considers the issues of analyzing the development of financial markets in the context of the spread of the COVID-19 pandemic. To do this, we consider individual segments of the financial market, which are characterized by the corresponding stock indices.

For the analysis, we use the methodology for obtaining estimates using the wavelet coherence method. For comparative analysis, we consider data for the UK and Japan. The analysis carried out and the results obtained allow us to speak about the expediency of using the wavelet coherence method for relevant studies.

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