

On the Relationship Between the Dynamics of Interest Rates on Deposits and Loans in the Banking Sectors of Australia, Canada, China, Brazil and South Africa

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Abstract: *The continuous movement of financial flows makes it possible to achieve stable economic functioning and development. In this process, a significant role is assigned to banking institutions. Banks are able to generate various financial flows with specified characteristics and parameters. For appropriate management, various tools are used that directly or indirectly affect banking activities. In this aspect, it is important to take into account interest rates. Here we single out interest rates on credit and deposit operations, which determine the essence of conducting the main activities of banks. We compare the dynamics of changes in interest rates on loans and deposits. For these purposes, we use the methods of statistical analysis. Methods of statistical comparison of data are also applied. We consider the relationship between interest rates for different countries. This helps to take into account the influence of individual factors and get more objective results. The presented graphs help to understand the course of our study and evaluate the results obtained.*

Keywords—comparison; dynamics; deposits; loans; bank; interest rates; financial flows; banking sector; statistical analysis; economic analysis; development

1. INTRODUCTION

The modern development of economic relations, and as a result, the functioning of individual business entities, the state as a whole, is impossible without the implementation of banking activities. Banks are a key element of such activities [1]-[5]. These are institutions that are capable of accumulating and redistributing resources between different participants in market relationships [6], [7]. Banks also contribute to the process of accumulating funds for the population and the implementation of investment plans and strategies. Therefore, the stable functioning of banks determines the development of all levels of economic relations, individual enterprises and companies, the state. This determines the importance of the analysis of banking activities. And the results obtained are of direct practical importance. The results obtained can help in developing a methodology for evaluating the activities of banking institutions, choosing strategies for their management, and improving certain areas.

Among the indicators of banking activity, interest rates should be singled out. The values of such an indicator are used in the calculations of other indicators of banks, to assess the performance of such elements of the market infrastructure, to analyze and improve the efficiency of banks. Interest rates are generalized characteristics of the main areas of banking activity, analysis of the movement of their input and output financial flows [8]-[10].

Interest rates on deposits are directly involved in the implementation of the policy of raising funds, the possibility of their accumulation in the bank on customer accounts [11], [12]. This is the basis for the formation of the resource base. Such rates make it possible to implement other areas of banking activity, to function and develop the institution. Deposit rates have a different gradation and their typification depending on the terms and volumes of raising funds. Appropriate interest rates should also be characterized as an element of investment policy, the possibility of implementing the accumulation process.

Interest on loans affects the operations for the placement of bank funds [13]-[15]. Such indicators also, ultimately, form the bank's revenue base. This is one of the sources of profit for the bank. Consequently, interest on loans allows the bank to function and develop, to support the implementation of daily activities. Like deposit rates, interest rates on loans can be ranged according to the timing of the provision of borrowed funds and their volumes. This allows you to optimize the distribution of bank resources, to form the necessary reserves.

It is important to have a balanced mix between interest rates on deposits and loans. In this regard, the analysis of the values of such rates is crucial. For the relevant research, various tools are used that allow you to make the necessary assessments and obtain balanced decisions [16]-[24].

Thus, as the main goal of this work, we define the analysis of the dynamics of changes in the values of interest rates on

deposits and loans. To do this, we study the change in the relevant indicators, compare and evaluate them.

2. RELATED WORKS

The significance of the analysis of banking activities, the ratio of credit and deposit rates is confirmed by a number of studies by other authors.

E. Nizam, A. Ng, G. Dewandaru, R. Nagayev and M. A. Nkoba conduct a comprehensive analysis of the activities of banks [25]. The authors explore the entire industry, identifying factors influencing the functioning of the banking sector. For these purposes, various financial data and indicators are considered. The main attention is paid to social and environmental factors in the development of banks, the possibility of their access to appropriate financing programs. Various types of regressions are used for the analysis: cross-sectional and nonlinear with threshold restrictions. The importance of cross-analysis between data is emphasized.

M. Ali and C. H. Pua pay attention to the factors that affect the profitability and sustainable development of banks [26]. Such a study is carried out on the example of the banking sector of Pakistan. To do this, the authors apply the methodology of panel regression analysis. Various models are considered that allow comparison, to obtain a reasonable result. The obtained results can help to achieve the stability of the banks. Among the internal factors that influence the conduct of banking activities, the authors highlight interest rates. Particular attention is paid to the comparative analysis.

X. Chen analyzes the financial results of Chinese banks in a comparative aspect [27]. At the same time, the sources of such results are considered, where interest rates on loans are highlighted. For these purposes, the Grifell-Tatje and Lovell profit change decomposition model is used [27]. Before the start of the study, the initial data are normalized. The author also explores technical efficiency, technical effect and its size, price stability in relation to interest rates. A number of results have been obtained that help explain the mutual influence of various factors.

M. K. Alam conducts a systematic study of the management, functioning and development of banking institutions [28]. The author also considers the procedure for selecting data for the corresponding analysis. The banks of Bangladesh are considered as the initial base. The work uses the saturation process, NVivo analysis, followed by the application of qualitative ranking methods. This approach allows you to generate clear results based on qualitative analysis.

M. Jünger and M. Mietzner consider increasing the efficiency of banking in the context of its deep digitalization [29]. Various high-tech innovations and their impact on the banking industry, a change in confidence in banking services are considered. Particular attention is paid to the factors of changes in interest rates.

K. Liu explores the factors that affect lending rates [30]. To do this, the author considers data on Chinese banks in the period from 2008 to 2017. The paper analyzes the relationship between interest rates and the discount rate, which determines the level of lending rates. The author notes the presence of the influence of money market rates on the interest rates of banks. This influence has a different direction at certain points in time. It was also noted that lending rates are subject to many factors of influence, among which are highlighted: macroeconomic conditions, market development, asset quality, shadow economy.

The study by T. Schelling and P. Towbin provides a detailed analysis of the relationship between different types of rates in banking [31]. The authors compare negative rates with the volume of attracted deposits and loans. The conclusion is made about different directions in the work of the bank, when negative credit rates are possible. It essentially depends on the deposit portfolio of banks. It is shown that negative rates negatively affect the formation of profits. Issues of the emergence and development of the corresponding type of risk in banking are summarized. The conclusion is made about the importance of the dynamics of the policy rate of the central bank.

J. Zhang and X. Deng study the issue of interest rate liberalization and its impact on banking activity [32]. The authors consider the relationship between bank rates and liquidity and try to determine the type of this relationship. For the study, data on the banking sector of China were used. The method of econometric modeling based on the construction of regressions was chosen as a tool. The paper shows that the relationship between liquidity and rates is non-linear, which has an inverted U-shape [32]. This must be taken into account in the liberalization of banking activities, the choice of strategies for such transitions. At the same time, it is necessary to take into account the general vector of economic development. It is also important to take into account the risks and their level that may arise.

I. N. Yakubu and A. H. Abokor analyze the factors influencing the growth of deposits in the banking sector of the Turkish economy [33]. This is an empirical analysis based on a lot of data from 2000 to 2016. For analysis, the authors use a delayed autoregression model. This allows you to evaluate cross-references between data. The authors also take into account various temporal aspects of the relationship between data. Such links affect the deposit portfolio of banks in different ways. Among the factors that influence the growth of the deposit mass, the following are highlighted: the stability and efficiency of the bank, the money supply, and interest rates. This necessitates a comprehensive analysis of data on the dynamics of changes in bank rates on loans and deposits.

We see different aspects of the analysis of the activities of banks, which are associated with the attraction of resources and their subsequent placement. However, constant changes in the banking sector and the economy as a whole, determine the conduct of new clarifying studies. At the same time, an

important aspect of such an analysis is a more detailed study of the retrospective after a certain period of time. This allows you to better understand the economic dynamics, to justify new solutions.

3. DYNAMICS OF INTEREST RATES THAT WE STUDY

Given the main goal of this study, we will consider the change in the values of deposit and lending rates.

We will analyze data from the banking sectors of Australia, Canada, China, Brazil and South Africa. This will allow us to understand and consider general trends in the market for basic banking services.

We will also consider a retrospective of such data for different time horizons. Below is the relevant data, which is taken from the worldbank.org website.

The first figure shows changes in interest rates on deposits and loans for the Australian banking sector between 1981 and 2019.

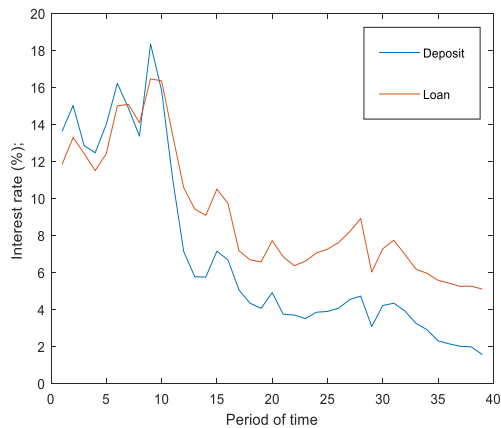


Figure 1: Bank interest rate developments in Australia

We see that from 1981 to 1989 deposit rates were higher than lending rates. Further, since 1990, we have observed the excess of bank rates on loans over rates on deposits. And this is a natural situation in the banking services market. It should also be said that there is a decrease in the values of such interest rates. At the same time, these rates inherit each other.

The ratio of deposit and lending rates for the Canadian banking sector is presented below. These data cover the period from 1981 to 2017. This dynamics differs from that which is typical for the banking sector in Australia.

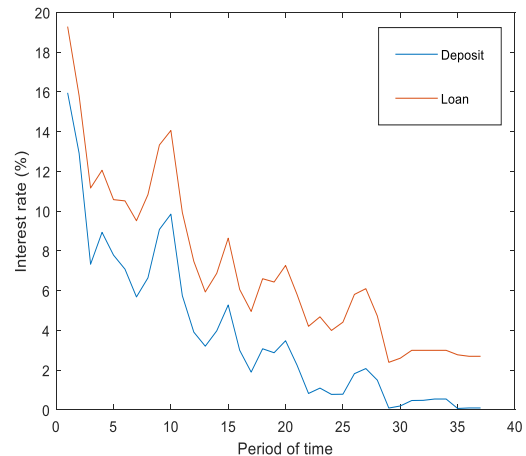


Figure 2: Interest rates in the Canadian banking sector

It should be noted that in the Canadian banking sector, lending rates exceed deposit rates throughout the entire time period. We see a significant legacy of one rate dynamics from another. Although there are also some distinctive features that show up in the details of the change in each interest rate. The overall change in the values of deposit and lending interest rates is decreasing in the period from 1981 to 2017.

Now we will look at the banking sector in China.

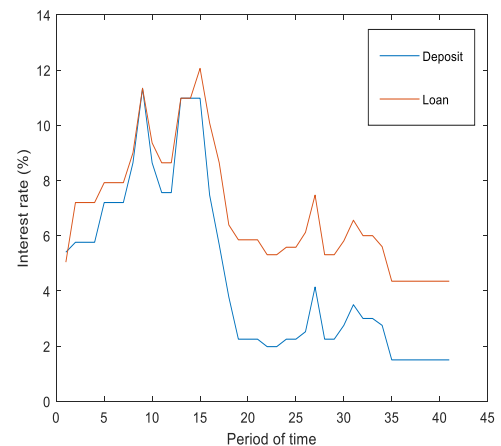


Figure 3: Deposit and lending rates in China

The data in Fig. 3 reflect the change in rates between 1981 and 2021. From 1981 to 1995 there was an increase in bank rates. From 1996 to 2014, we can note a decline in performance. From 2015 to 2021, the rates do not change. In general, also rates on loans prevail over rates on deposits. This prevalence is most pronounced after 1995.

Next, we examine the change in rates in the Brazilian banking sector. The data presented here is from 1997 to 2021.

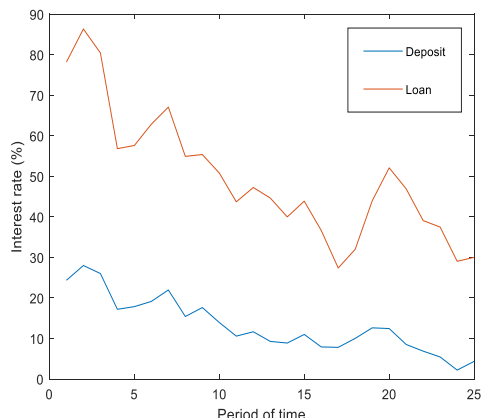


Figure 4: Brazilian banking sector

It should be noted that there is a significant gap between deposit and lending rates for the Brazilian banking sector. We also see that the dynamics of bank rates is declining. It is also impossible to say that such data completely inherit each other. Interest rates on loans are more volatile than deposit rates. The former prevail over the latter.

On Fig. 5 shows changes in the dynamics of percentage values in the banking sector of South Africa. We are looking at the period from 2001 to 2021.

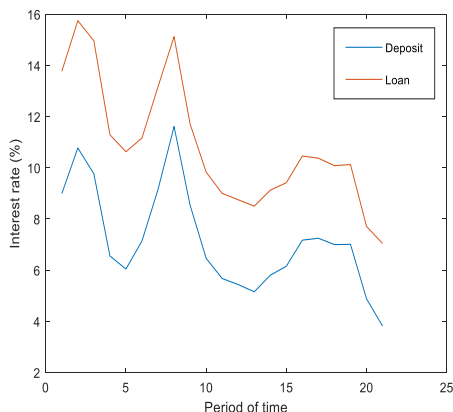


Figure 5: Bank rates in South Africa

We can talk about wave dynamics in changing the values of bank rates in South Africa. This is typical for both rates on deposits and loans. In general, there is a drop in the values of rates in the period from 2001 to 2021.

We looked at various banking sectors. There are various trends in changing such data. Therefore, it is important to

consider the relationship between interest rates within each individual country.

4. ANALYSIS OF THE RATIO OF BANK RATES

For this stage of the study, we will consider the ratio of the values of rates on loans to rates on deposits for each country separately. Typically, this ratio should be greater than one. Next, we can see the results of such a relationship.

In the sixth figure, it should be noted the increasing dynamics of the ratio of interest rates for the banking market in Australia. The studied values in terms of the ratio of the values of bank rates do not exceed the value of 3.5.

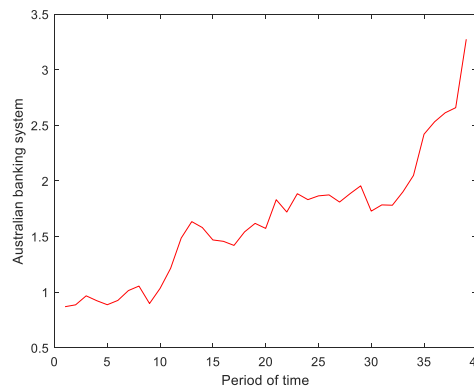


Figure 6: Data for Australia

Below we see the dynamics of the ratio between rates on loans to deposits for the Canadian banking sector.

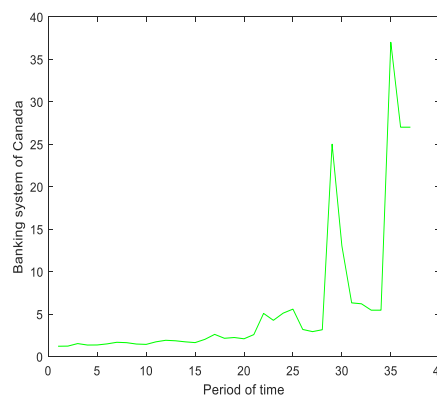


Figure 7: Interest Rate Relationships for the Canadian Banking Sector

Here, several anomalous bursts can be noted, when lending rates significantly exceed deposit rates. In general, the ratio between the rates is in an acceptable range.

The dynamics of the ratio of interest rates in the banking sector of China has an abrupt dependence. This dynamic, after a smooth change, undergoes a jump to a new level, and then

again there is a relatively calm period. Gradually, the ratio between the rates increases.

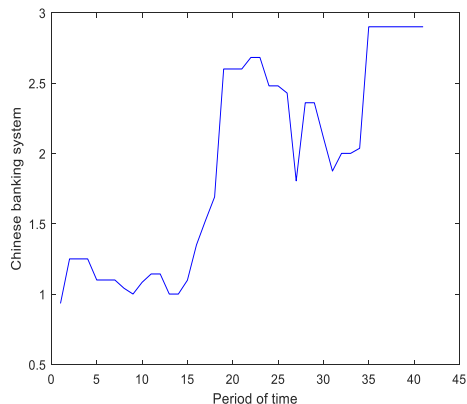


Figure 8: Relationships between rates in the Chinese banking system

The ratio of lending to deposit rates in the Brazilian banking sector tends to increase. This ratio exceeds the previously considered data, with the exception of individual anomalous periods.

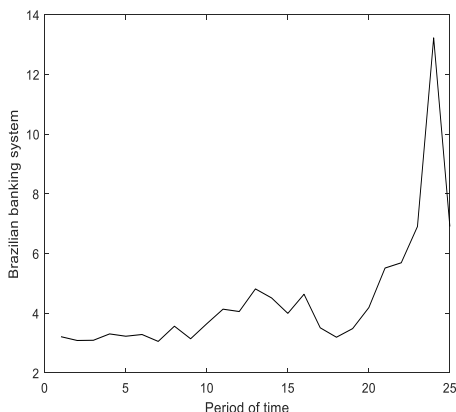


Figure 9: Brazilian banking sector data

At the same time, the Brazilian banking sector is also seeing a significant increase in the ratio of rates in 2020. Then in 2021 there is a sharp decline in such values.

The last figure in this subsection reflects the dynamics of the ratio of bank rates in South Africa. It should be noted that the presented data have a wave character. The growth of this ratio alternates with its decline during 2001-2021.

In general, the presented dynamics in Fig. 10 credit rates to deposit rates in South Africa does not exceed 1.5.

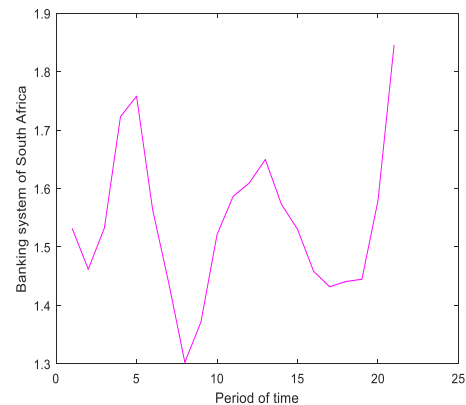


Figure 10: Relationships of bank rates in South Africa

Thus, the considered data on the dynamics of the relationship between bank rates from the point of view of individual countries differ from each other. The general trend of such data is a gradual increase in the gap between lending and deposit rates.

For a more detailed analysis, let's consider the mutual dynamics of interest on credit operations and attracted deposits, taking into account data for each individual country. To do this, we use the ideology of wavelets.

5. WAVELET COHERENCE ESTIMATES AS A TOOL FOR INTEREST RATE ANALYSIS

One of the tools for data analysis is the wavelet comparison methodology. Here, a special place is given to estimates of wavelet coherence [34]-[36]. This approach has found wide application in the study of economic data [37]-[43]. Such indicators can be represented in the form of time series and wavelet analysis methods can be applied.

Wavelet coherence allows us to evaluate cross-references between data and obtain results for different time horizons that we are exploring. This expands the possibilities of research, obtaining reliable results and forecasts. Ultimately, we can improve planning, development of strategies for behavior in the banking services market.

Next, we consider some wavelet coherence estimates for individual countries.

On Fig. 11 shows estimates of the relationship between interest rates in the Australian banking sector.

We see that there is complete consistency between the rates on loans and deposits in the banking sector for Australia. At some time intervals, such consistency is not strongly pronounced. This is due to the fact that between 1981 and 1989, deposit rates were higher than lending rates.

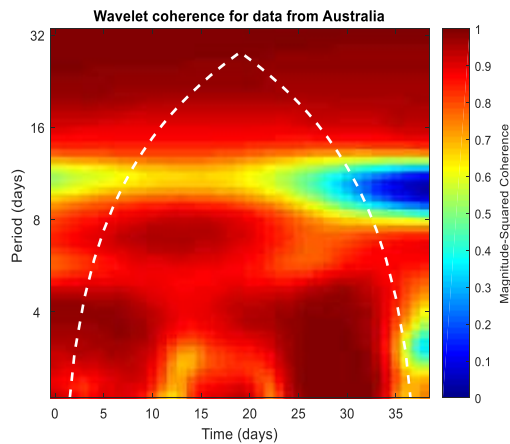


Figure 11: Relationship between Australian data

However, the data in Fig. 11 allow you to make informed decisions and make predictions. This is based on the depth of relationships that we have received and evaluated.

Now consider the data for the banking sector in Canada.

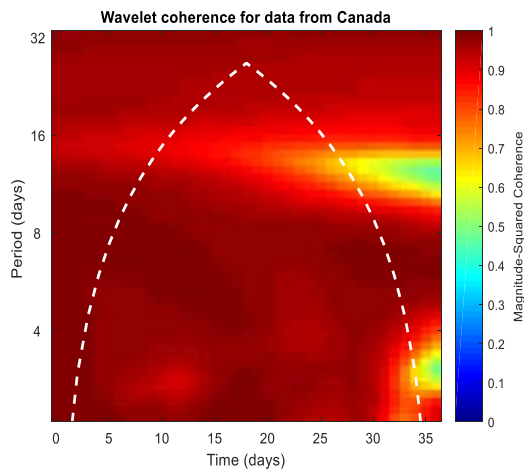


Figure 12: Wavelet coherence between interest rates from Canada

Consistency between interest rates on loans and deposits from the point of view of the banking sector in Canada is higher than in Australia. This allows you to make more reliable decisions. We can also use the Canadian banking sector as a platform for risk insurance.

For the Chinese banking market, there is also significant consistency in the dynamics of interest rates on loans and deposits.

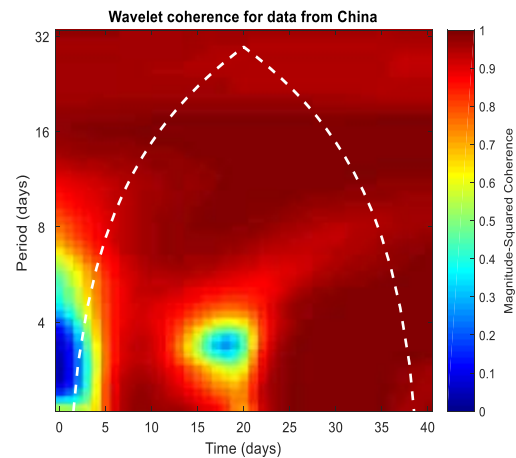


Figure 13: Assessing the relationship between interest rates in China

Data analysis Fig. 13 shows that there is only one period of time when the relationship between the data was negligible. This corresponds to a sharp change in rates since 1997. But in general, we can use the result to make decisions.

And so, we see quite acceptable consistency between the percentages in the main areas of banking for different countries. This allows us to speak about the expediency of using the considered approaches for the analysis of rates on loans and deposits.

6. CONCLUSION

The paper considers the main points of the analysis of the dynamics of interest rates on deposits and loans in the banking sector of the economy. For such a study, we conducted a review of the literature and identified the main tasks to achieve the main goal of our article.

We consider various countries such as Australia, Canada, China, Brazil and South Africa. We are looking into the historical data.

To study the dynamics of interest rates, we use simple methods of statistical analysis, a ratio for comparison and wavelet coherence. The results obtained make it possible to evaluate banking activities in different countries, to show their characteristic features. It also helps to take the necessary balanced strategies in the banking market.

7. REFERENCES

- [1] Stiroh, K. J. (2006). A portfolio view of banking with interest and noninterest activities. *Journal of Money, Credit and Banking*, 1351-1361.
- [2] Lee, C. C. (2013). Insurance and real output: The key role of banking activities. *Macroeconomic Dynamics*, 17(2), 235-260.
- [3] Vasyurenko, O., & et al.. (2014). Efficiency of lending to natural persons and legal entities by banks of Ukraine:

- methodology of stochastic frontier analysis. Herald of the National Bank of Ukraine, 1, 5-11.
- [4] Азаренкова, Г., & Ляшенко, В. (2009). Відношення переваг у порівняльній оцінці діяльності банків. Банківська справа, 5, 65-72.
- [5] Слюніна, Т. Л., Бережний, Є. Б., & Ляшенко, В. В. (2007). Розвиток вітчизняної мережі банківських установ: особливості та регіональні аспекти. Вісник ХНУ ім. В. Н. Каразіна. Економічна серія, 755. 84–88.
- [6] De Jonghe, O. (2010). Back to the basics in banking? A micro-analysis of banking system stability. Journal of financial intermediation, 19(3), 387-417.
- [7] Galazova, S. S., & Magomaeva, L. R. (2019). The Transformation of Traditional Banking Activity in Digital. International Journal of Economics & Business Administration (IJEBA), 7(Special 2), 41-51.
- [8] Kuzemin, A., & et al.. (2005). Analysis of movement of financial flows of economical agents as the basis for designing the system of economical security (general conception). In Third international conference «Information research, applications, and education (pp. 27-30).
- [9] Kuzemin, A., & Lyashenko V. (2011). Microsituation Concept in GMES Decision Support Systems. In Intelligent Data Processing in Global Monitoring for Environment and Security, 217–238.
- [10] Kuzemin, A., & Lyashenko, V. (2009). Methods of comparative analysis of banks functioning: classic and new approaches. Information Theories & Applications, 16(4), 384-396.
- [11] Adewuyi, A. A., & Mohamed Naim, A. (2016). The nexus between rate of return on deposit of Islamic banks and interest rates on deposits of conventional banks in a dual banking system: A cross country study. International Journal of Economics and Financial Issues, 6(4S), 111-117.
- [12] Corvoisier, S., & Gropp, R. (2002). Bank concentration and retail interest rates. Journal of Banking & Finance, 26(11), 2155-2189.
- [13] Hartley, T., & Kallis, G. (2021). Interest-bearing loans and unpayable debts in slow-growing economies: Insights from ten historical cases. Ecological Economics, 188, 107132.
- [14] Yu, Y., Lee, Y. T., & Fok, R. C. (2021). The determinants of high-interest entrusted loans in China. Journal of Business Finance & Accounting, 48(1-2), 405-430.
- [15] Breuer, J. B. (2006). Problem bank loans, conflicts of interest, and institutions. Journal of financial stability, 2(3), 266-285.
- [16] Kots, G. P., & Lyashenko, V. (2012). Banking sectors of the economies of European countries in the representation of statistical interrelation between indices that characterize their development. European Applied Sciences, 1, 461-465.
- [17] Dobrovolskaya, I., & Lyashenko, V. (2013). Interrelations of banking sectors of European economies as reflected in separate indicators of the dynamics of their cash flows influencing the formation of the resource potential of banks. European Applied Sciences, 1-2, 114-118.
- [18] Kuzemin, A., & Lyashenko, V. (2006). Fuzzy set theory approach as the basis of analysis of financial flows in the economical security system. International Journal Information Theories & Applications, 13(1), 45–51.
- [19] Дуравкин, Е. В., & Амер, Т. К. А. Д. (2005). Использование аппарата Е-сетей для анализа распределенных программных систем. Автоматика. Автоматизация. Электротехнічні комплекси та системи, (1), 47-51.
- [20] Jassar, A. T. A., Al Salameh, S., & Al Hababsah, M. S. (2021). Improved Algorithm For Creating An Optimized Network Diagram. TEST Engineering & Management, 108-115.
- [21] Tahseen A. J. A., & et al.. (2023). Binarization Methods in Multimedia Systems when Recognizing License Plates of Cars. International Journal of Academic Engineering Research (IJAER), 7(2), 1-9.
- [22] Kobylin, O., & Lyashenko, V. (2014). Comparison of standard image edge detection techniques and of method based on wavelet transform. International Journal, 2(8), 572-580.
- [23] Matarneh, R., & et al.. (2017). Building robot voice control training methodology using artificial neural net. International Journal of Civil Engineering and Technology, 8(10), 523-532.
- [24] Работягов, А. В., Ляшенко, В. В., & Кобылин, О. А. (2016). Сегментация сложных изображений цитологических препаратов, Радиотехника: Всеукр. межвед. науч.-техн. Сб., 185, 87-94.
- [25] Nizam, E., & et al.. (2019). The impact of social and environmental sustainability on financial performance: A global analysis of the banking sector. Journal of Multinational Financial Management, 49, 35-53.
- [26] Ali, M., & Puah, C. H. (2019). The internal determinants of bank profitability and stability: An insight from banking sector of Pakistan. Management research review, 42(1), 49-67.
- [27] Chen, X. (2020). Exploring the sources of financial performance in Chinese banks: A comparative analysis of different types of banks. The North American Journal of Economics and Finance, 51, 101076.
- [28] Alam, M. K. (2021). A systematic qualitative case study: questions, data collection, NVivo analysis and saturation. Qualitative Research in Organizations and Management: An International Journal, 16(1), 1-31.

- [29] Jünger, M., & Mietzner, M. (2020). Banking goes digital: The adoption of FinTech services by German households. *Finance Research Letters*, 34, 101260.
- [30] Liu, K. (2019). The determinants of China's lending rates and interest rates pass-through: A cointegration analysis. *Research in Economics*, 73(1), 66-71.
- [31] Schelling, T., & Towbin, P. (2020). Negative interest rates, deposit funding and bank lending (No. 2020-05). Swiss National Bank.
- [32] Zhang, J., & Deng, X. (2020). Interest rate liberalization and bank liquidity creation: evidence from China. *China Finance Review International*, 10(4), 377-391.
- [33] Yakubu, I. N., & Abokor, A. H. (2020). Factors determining bank deposit growth in Turkey: an empirical analysis. *Rajagiri Management Journal*, 14(2), 121-132.
- [34] Torrence, C., & Webster, P. J. (1999). Interdecadal changes in the ENSO–monsoon system. *Journal of climate*, 12(8), 2679-2690.
- [35] Heil, C.E., & Walnut, D.F. (1989). Continuous and discrete wavelet transforms. *SIAM review*, 31(4), 628-666.
- [36] Kingsbury, N. (1999). Image processing with complex wavelets. *Philosophical Transactions of the Royal Society of London. Series A: Mathematical, Physical and Engineering Sciences*, 357(1760), 2543-2560.
- [37] Kirikkaleli, D., Adedoyin, F. F., & Bekun, F. V. (2021). Nuclear energy consumption and economic growth in the UK: evidence from wavelet coherence approach. *Journal of Public Affairs*, 21(1), e2130.
- [38] Baranova, V., & et al.. (2020). Information system for decision support in the field of tourism based on the use of spatio-temporal data analysis. *International Journal of Advanced Trends in Computer Science and Engineering*, 9(4), 6356-6361.
- [39] Mustafa, S. K., & et al.. (2020). Using wavelet analysis to assess the impact of COVID-19 on changes in the price of basic energy resources. *International Journal of Emerging Trends in Engineering Research*, 8(7), 2907-2912.
- [40] Orhan, A., Kirikkaleli, D., & Ayhan, F. (2019). Analysis of wavelet coherence: service sector index and economic growth in an emerging market. *Sustainability*, 11(23), 6684.
- [41] Kirikkaleli, D., & Gokmenoglu, K. K. (2020). Sovereign credit risk and economic risk in Turkey: empirical evidence from a wavelet coherence approach. *Borsa Istanbul Review*, 20(2), 144-152.
- [42] Wang, Y., Wei, M., Bashir, U., & Zhou, C. (2022). Geopolitical risk, economic policy uncertainty and global oil price volatility—an empirical study based on quantile causality nonparametric test and wavelet coherence. *Energy Strategy Reviews*, 41, 100851.
- [43] Adebayo, T. S. (2020). Revisiting the EKC hypothesis in an emerging market: an application of ARDL-based bounds and wavelet coherence approaches. *SN Applied Sciences*, 2(12), 1945.
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