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Probability distributions of interest rates on loans and deposits in a study of banking activities

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Abstract:

Banking activities are constantly in the focus of attention of researchers. This is due to the role of banks that they play in the functioning of the economic system as a whole, the development of the country and individual business entities. For the sustainable functioning and development of banks, a holistic understanding of the processes that are taking place is necessary. Among such processes, an important place is given to the dynamics of interest rates on loans and deposits. Based on this, the paper examines the dynamics of such indicators of bank performance for different countries and time periods. Particular attention is paid to the analysis of probabilistic distributions of interest rates. The results are presented in the form of a set of graphs, which allows you to better understand the progress of this study and its conclusion. All results are based on analysis of real data.

Key words: Probability, Distribution, Loans, Deposits, Interest Rates, Banking

Introduction

Banks are an important element in the structure of market relations. Through financial flows, banks ensure interaction between various business entities [1], [2]. The continuous movement of such flows also ensures the efficient functioning of banks. Therefore, banking activities are constantly in the focus of attention of practitioners and researchers [3]-[9], where various methods and approaches are used for appropriate analysis [10]-[17]. The need to consider various issues determines interest in the chosen research topic.

The interaction of various input and output financial flows of banks is manifested in the corresponding indicators of their activities. Among such indicators, interest rates on loans and deposits should be highlighted [18]-[20].

By reflecting the dynamics of interest rates, it is possible to track the stability of the functioning of banks, the influence of the central bank on banking activities, and identify problematic aspects of the development of such activities. In a comparative aspect with other indicators of banking activity, it is possible to reveal the interaction of the bank's financial flows at different levels. Thus, the use of new aspects in the study allows us to better understand the functioning and development of banks and justify new solutions for their development.

For the purpose of analyzing the dynamics of bank interest rates, classical methods of statistical analysis are usually used [21], [22]. Here, as a rule, absolute values of such interest rates are used as initial data.

At the same time, an important aspect of such research is the disclosure of internal factors of changes in the dynamics of interest rates. We can then use various theories and approaches that have

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found wide application in other areas of research [23]-[28]. Here you can also use the probabilistic characteristics of interest rates on loans and deposits. This will allow not only to expand the range of research, but also to draw certain statistical conclusion.

Thus, the main goal of this work is to consider the probability distributions of the dynamics of interest rates on loans and deposits in the study of banking activities. However, before moving on to reveal such a goal, we review some related work in this area. New information also appears that expands the range of initial data and the interpretation of the results obtained.

Related work

As noted earlier, the analysis of banking activities is one of the areas of relevant research. At the same time, attention is also paid separately to the issues of changing the dynamics of interest rates on loans and deposits.

G. A. Alrgaibat examines in detail the functioning and development of banking in Jordan [29]. Such research is based on financial and economic analysis. For these purposes, various statistical methods are used in the work. The performance of banks is assessed using various financial indicators. The ability of banks to fulfill their obligations is assessed, which is determined by profitability and financial liquidity. At the same time, the author notes that the process of assessing the performance of banks is considered an important goal and process for determining their skills in optimal management of their assets and ability to develop business. Such a study allows us to develop a general strategy for the development of banking.

The authors of the study [30] consider the issues of interaction in the development of a particular region and the efficiency of banking activities. First of all, the relationship between the real sector of the economy, the population and the economic activity of banks is explored. For these purposes, based on statistical analysis, the main indicators of banking activity and socio-economic indicators of a certain region are compared. Based on econometric modeling, quantitative and qualitative patterns between such indicators were identified. In particular, the relationship between gross regional product, labor productivity, growth of deposits, changes in the amount of debt on loans, loans granted to legal entities and individuals was noted. At the same time, here we did not see such basic concepts of banking as interest rates on loans and deposits.

H. Alzoubi, M. Alshurideh, B. A. Kurdi, K. Alhyasat and T. Ghazal analyze the relationship between electronic payments and online purchases and sales growth [31]. Data from the banking industry, which provides relevant financial flows, is examined. At the same time, online purchases are considered here as an intermediary activity. For these purposes, the work used a quantitative approach and correlational design. Empirical data were collected through a survey [31]. The study results showed high internal consistency among the study variables. The relationship and direct impact between online shopping and sales growth was also identified. This helps to identify promising areas of banking activity and ensure the advantage of their development.

The study by M. Al-Shboul, A. Maghyereh, A. Hassan and P. Molyneux analyzes the relationship between political risk and banking stability [32]. The work examines the regions of the Middle East and North Africa. To conduct statistical analysis, the financial fragility hypothesis is considered. This allows us to determine the most stable banking systems in the region and promising ways of their development.

A. S. Ogundipe, A. F. Akintola and S. A. Olaoye consider the relationship between banks' lending productivity and interest rates [33]. This article uses data from the Nigerian banking system. In particular, the authors explore the problem of high lending rates. Such a study takes into account

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the huge excess of unpaid loans. The main indicators of banking activity and a number of macroeconomic variables are considered. For the purposes of the study, various regression functions and correlation dependencies are constructed. The authors note a significant relationship between interest rate and loan repayment. It has been shown that an increase in the interest rate leads to a corresponding increase or decrease in loan quality.

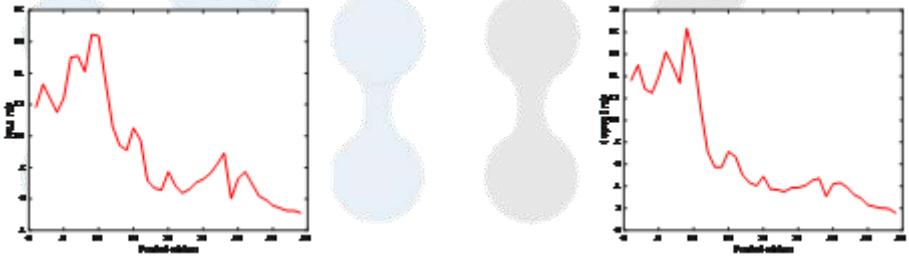
S. Demiralp, J. Eisenschmidt and T. Vlassopoulos explore the relationship between excess liquidity and retail deposits [34]. The reaction of banks to the policy of negative interest rates, which limits the impact of rate cuts on the cost of bank funding, is also studied [34]. The authors emphasize the importance of banks' excess liquidity for the effectiveness of negative interest rate policies. The connection with the liquidity of central banks in this matter is shown.

F. Heider, F. Saidi and G. Schepens discuss the issue of negative rates in banking [35]. To understand the problematic aspects of this issue, the authors consider various literary sources and conduct a critical analysis of them. It is concluded that negative interest rates are special because the pass-through of rates on retail deposits of banks is prevented by the zero lower bound [35]. However, this has a significant impact on the lending process.

Thus, the analysis of banking activities has various areas of research. A special place among these areas is occupied by the analysis of interest rates. This type of analysis is quite complex and difficult. Therefore, any research in this aspect is relevant and important.

Dynamics of selected interest rate data for some countries

To carry out further analysis, consider examples of the dynamics of interest rates for a number of countries. In Fig. 1 shows the dynamics of interest rates on loans and deposits as a whole for the Australian banking system in the period 1981-2019.



a) loan rate b) deposit rate

Figure 1: Dynamics of interest rates on loans and deposits as a whole for the Australian banking system in the period 1981-2019

In Fig. 2 shows the dynamics of interest rates on loans and deposits as a whole for the Canadian banking system in the period 1971-2017.

a) loan rate b) deposit rate

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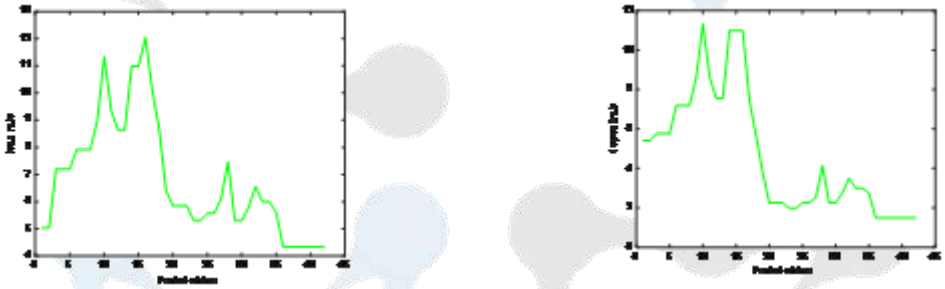
Figure 2: Dynamics of interest rates on loans and deposits as a whole for the Canadian banking system in the period 1971-2017

It should be noted that the dynamics of interest rates on loans and deposits in the Australian banking system as a whole is identical. However, significant changes are clearly visible at the beginning of the study period and at the end of the period.

At the same time, the dynamics of interest rates on loans and deposits in the Canadian banking system as a whole is more identical than in the previous example. Some changes are observed at the end of the study period. Thus, we can talk about different trends in the study of the dynamics of interest rates in the banking systems of Canada and Australia.

At the same time, interest rate trends in the banking systems of Canada and Australia have similar trends.

In Fig. 3 shows the dynamics of interest rates on loans and deposits as a whole for the Chinese banking system in the period 1980-2021.



a) loan rate b) deposit rate

Figure 3: Dynamics of interest rates on loans and deposits as a whole for the Chinese banking system in the period 1980-2021

In Fig. 3 also shows some differences in the dynamics of interest rates on loans and deposits in the Chinese banking system as a whole. At the same time, the trends in interest rates in the Chinese banking system generally correspond to the trends in the banking systems of Australia and Canada.

Probability distributions of interest rates

To analyze the probability distributions of interest rate dynamics, consider probability graphs. This plot creates a normal probability display and compares it to the distribution of the data under study. On the graph we have a reference line of the normal distribution and data points along this line. If the sample data is normally distributed, data points appear along the reference line. The reference line connects the first and third quartiles of the data and extends to the ends of the data. A distribution other than normal leads to a distortion of the data graph [36]. This allows you to determine the type of distribution under study for further research.

In Fig. 4 presents probability graphs for data on the Australian banking system, which are displayed in Fig. 1

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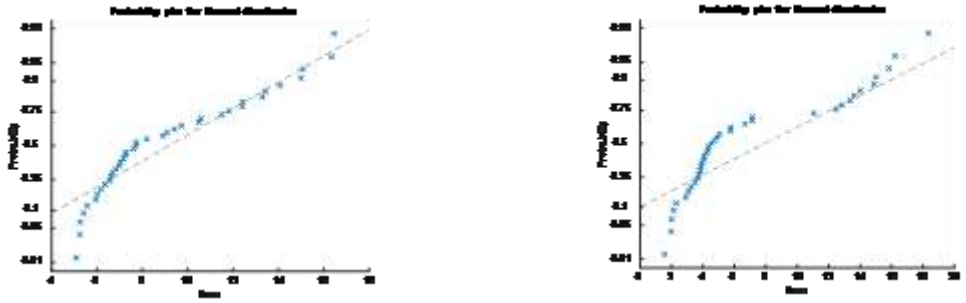
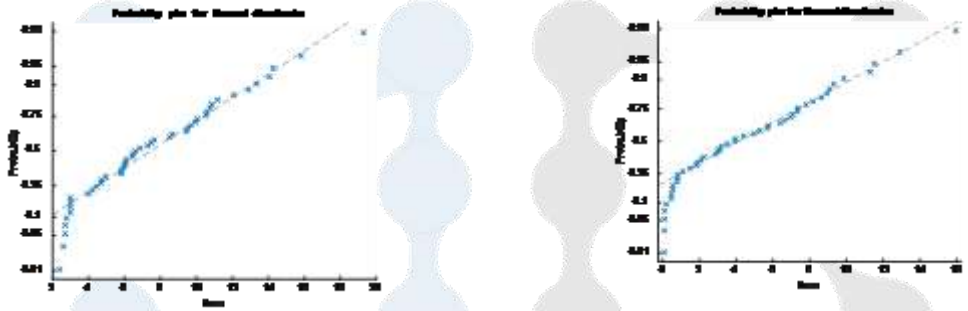


a) loan rate b) deposit rate

Figure 4: Probability plots for Australian banking data

From the data in Fig. 4 it is clear that the data under study does not correspond to the normal distribution law during the time period that we are studying. For both loan and deposit rates, the initial values of the source data stand out strongly. Moreover, for data on lending rates we are closer to a normal distribution than for data on deposit rates. In terms of lending rates, we can talk about Beta distribution. This fact must be taken into account in further studies.

In Fig. 5 presents probability graphs for data on the Canadian banking system, which are displayed in Fig. 2. Here it should be noted that there is great consistency in the probability graphs studied. This also needs to be taken into account when researching the Canadian banking system.

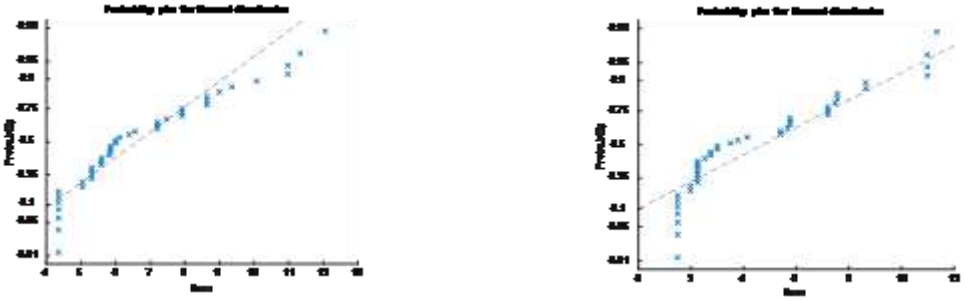


a) loan rate b) deposit rate

Figure 5: Probability plots for Canadian banking data

Here, there are also significant outliers at the beginning of the period under study, which moves these data away from the normal distribution law. Most likely, we can talk about a beta distribution. But this distribution better describes the data on deposit rates.

In Fig. 6 shows probability graphs for data on the Chinese banking system, which are displayed in Fig. 3.



a) loan rate b) deposit rate

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Figure 6: Probability plots for data on the Chinese banking system

Probability graphs for the Chinese banking system (for the corresponding data) are more distant from the normal distribution law. Here we see emissions along the entire length of the reference line. This must be taken into account in the comparative aspect of the functioning of various banking systems.

Conclusion

The article discusses general surveys of banking activity analysis. The key aspects of conducting such an analysis are highlighted. The dynamics of interest rates on loans and deposits is highlighted as a general indicator of banks' activities. From the point of view of individual economies, the peculiarity of changes in interest rates on loans and deposits is shown.

The paper examines real data on the banking systems of Australia, Canada and China over various periods of time. For the purposes of assessment and comparison, the dynamics of their absolute values, as well as probability graphs, were used. Based on probability graphs, differences in the dynamics of interest rates on loans and deposits are shown. Such analysis helps to make informed, objective decisions regarding the conduct of banking activities.

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