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Predicting the Outflow of Household Deposits Based on the Intensity of Search Queries

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ABSTRACT

The **subject** of the study is the intensity of targeted search queries as a leading indicator of bank deposits outflow. The **goal** is to propose a mechanism for accounting information about the dynamics of search queries, able to signal changes in the volumes of deposits of individuals. The study was conducted using time series analysis models. Statistical data of Rosstat, Bank of Russia, searches in Yandex wordstat, Google Trends for the period from February 2009 to May 2022 were used. The relationship between the intensity of targeted search queries and household decisions to withdraw money from deposits and bank accounts was revealed. An assessment of the short-term predictive ability of search queries on dynamics of deposits was carried out. The use of statistical indicators on the dynamics of targeted search queries as a leading indicator of the outflow of funds of the population from deposits in commercial banks is substantiated. It was revealed that the use of the intensity index of targeted search queries as a signal indicator of the outflow of the placed funds by the population increases the accuracy of forecasting on the horizon in 1 month by 0.15–0.25 p.p. to assess the dynamics of ruble deposits and by 0.20–0.35 p.p. to assess the dynamics of foreign currency deposits. The use of information from search queries for the management of commercial banks is especially useful in the event of a threat of a sharp outflow of deposits of the population. The obtained **results** indicate the prospects of using textual information, including targeted search queries in order to form leading indicators of deposits outflow of the population. Preventive identification of negative trends associated with the outflow of deposits of the population can ensure the credit institution's stability against negative macroeconomic influences.

Keywords: commercial bank deposits; search query; forecasting; management of commercial banks

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INTRODUCTION

Individual deposits account for a large portion of commercial banks' liabilities; hence it is critical for management not to allow an abrupt outflow of cash put by the population. The management of household deposits in commercial banks is directly linked to the concept of alternative choice (trade-off), which determines the relationship between profitability and credit institution sustainability. Under favorable macroeconomic conditions, it is considerably easier to maintain the optimal equilibrium between sustainability and profitability; nevertheless, the crisis dictates stochastic processes, which might result in imbalances. When applied to the subject of the research, the crisis may cause a cash outflow from the population's commercial banks, an increase in the cost of attracting new deposits, and a significant change in their structure. As a result, when prospective changes in household behavior are identified in advance, bank management can take necessary actions to minimize negative effects.

Before making financial decisions or taking active activities, contemporary economic actors must examine information by constructing relevant Internet queries. In particular, if you focus on research processes in online retail in Russia, the share of which is growing rapidly and in 2022 is about 10%,[1] then even before buying in offline stores, many consumers search and compare offers in the Internet. The share of advertising budgets that are directed to the online segment is growing steadily.[2] Sales of financial products has become increasingly established through online channels. All this determines the greater level of involvement of economic agents in online processes and, accordingly, identifies the relationship of behavior of the population with their targeted requests on the Internet.

Despite the existence of scientific articles in which the dynamics of search queries are used as the leading indicator [1–5], as well as factors of population dynamics of deposits [6–9], no works on the forecasting of the dynamics of deposits taking the intensity of targeted search queries are presented in the scientific literature. Therefore, the goal of this study is to develop a mechanism for recording information on the dynamics of search queries, able to signal in advance changes in the deposits of individuals in commercial banks. To achieve this goal, it is necessary to solve the following tasks: (1) the relationship between the intensity of search queries and the desire of households to close deposits and withdraw money from bank accounts was substantiated; (2) the influence of the population's bank deposits on the intensity of search queries was evaluated; (3) the use of statistics on the intensity of targeted search requests to obtain a forecast of the outflow of deposits of the population from commercial banks was substantiated.

Under conditions of macroeconomic volatility, which is characteristic of the current stage of development of the Russian economy, there is a high volatility of the level of confidence in the banking system. This is confirmed, for example, by households' willingness to withdraw form bank accounts in response to external negative macroeconomic signals. In the academic literature this mechanism is described on the example of studying the crisis of confidence in the closed and open economies of different countries. There have been found regularities and models of crisis development of this type: model "short of a bank run" [10] and model "bank panic" signals. [11]. In these models, investors want to withdraw money from commercial banks in the face of a serious deteriorating in the macroeconomic environment, hence generating a larger gap between the lending institution's obligations and assets. The bank's imbalances, especially in the context of macroeconomic instability, have a negative impact on the sustainability of the credit

[1] According to the Association of Internet Trade Companies. URL: https://akit.ru/analytics/analyt-data (accessed on 14.08.2022).

[2] According to the Association of Communications Agencies of Russia. URL: https://www.akarussia.ru/knowledge/market_size/id10015 (accessed on 14.08.2022).

institution and its ability to resist the crisis.

According to model D. Diamond and P. Dybvig [10] the banking panic process — is self-sustaining, i.e. when disseminating information about the deterioration in the ability of the bank to meet its obligations in a timely manner, an increasing number of depositors seek to recover their funds from the accounts of the credit institution, thereby negatively affecting its continued ability to issue funds. In the paper of A. Postlewaite and X. Vives [12] "bank panic" is considered as a spiral process, which on each new turn creates a larger gap in the structure of liabilities and assets of the credit institution, leading the bank to bankruptcy. Behavioral theories explain the mechanism of bank panic, characterized by the massive withdrawal of deposits by the population, the notion of "philosophy of the crowd" [13] when there is a general panic that spreads, initiating the actions of economic agents (for example, on withdrawals from commercial bank accounts).

Analyzing the prerequisites for the emergence of "bank panic" and considering the gradual development of this process, it is possible to assume that in the framework of identifying behavioral tendencies in the population, it is prudent to take into account the characteristic patterns of behavior of economic agents, particularly the frequency of targeted searches. Understanding public sentiments as reflected by appropriate Internet queries prior to making financial decisions and taking active actions will allow commercial bank management to proactively adjust its development strategy, thereby increasing the credit institution's sustainability.

In the papers of F. Allen, D. Gale [14] and V. Chari [15] the market mechanisms of maintaining the stability of the credit institution through changes of interest rates on active and passive operations in response to changes in the mood of depositors are defined. But the implementation of such a strategy by the management of the commercial bank is necessary and appropriate only in the case of identification of panic.

Prompt identification of the mood of economic agents is possible on the basis of text processing. Thus, the study [2] proposes a strategy for forecasting Russian population inflationary expectations using machine learning algorithms based on news monitoring on the Internet. The result is generalized in the work of A.A. Pestova and co-authors [16], which developed a system of indicators of financial instability based on high-frequency data. These studies demonstrate that the inclusion of text information in the network allows to improve the quality of forecasting of some key macroeconomic indicators, as well as to describe the dynamics of expectations of the price level and the exchange rate of the national currency. This paper contributes by demonstrating the capacity to use text data analysis to enhance estimates of changes in public deposits.

In a number of studies, textual information on the Internet, in particular from social media, has been used to assess investor sentiment and predict capital market conditions [1, 4, 5]. In the paper of T. Preis and co-authors [17] based on Google search query data, we managed to obtain indicators that identify scenario behavior of investors in the stock market, which, in the opinion of the authors, can be used to early identify a potential financial crisis.

The paper of G. Kurovskiy [3] shows that the data of search queries in Google and Yandex allow to improve the quality of forecasts of unemployment dynamics, as well as developed a methodology that can be used to predict macroeconomic indicators in the short term, including for nowcasting.

Thus, in most studies, the significant relationship between the dynamics of key macroeconomic indicators and the frequency of search queries was identified. At the same time, proactive identification of household actions that can lead to the outflow of bank deposits is necessary both to ensure the activities of a separate commercial bank and to maintain the stability of the financial system. As a result, the

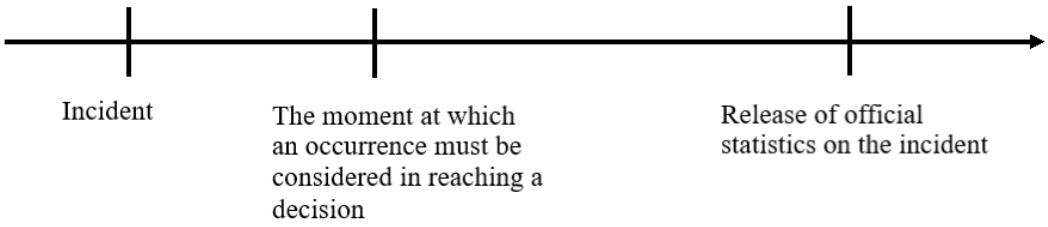

Fig. 1. **The Time Structure of the Event, the Release of Official Statistics and the Moment to Make Decisions**

Source: Compiled by the authors.

main research hypothesis is that using data on the intensity of focused search searches allows forecasting people' actions to withdraw cash from deposits.

SEARCH QUERIES AS A SOURCE OF INFORMATION ON THE DYNAMICS OF POPULATION DEPOSITS

As more and more information is available to households on the Internet, they are more likely to search through search services before making a decision to close a deposit, withdraw money from a bank account and then allocate it. n Russia, more than 98.5% of search traffic is accounted for by Yandex and Google systems,[3] so in these systems should be expected to increase the intensity of queries that may indicate the intention of individuals to close deposits and withdraw funds.

In the context of macroeconomic instability, there are risks of sudden shocks that transformation into the willingness of economic agents to close deposits and withdraw money from bank accounts. Thus, due to panic and growing general uncertainty, the population may make "short of a bank run", which will lead to a sharp outflow of client funds. Considering the specifics of the Russian financial system, the risks of ruble outflows and foreign currency deposits should be examined individually. The reasons for the decisions to close ruble deposits may include general fears about the possibility of withdrawing or using non-cash rubles as a means of payment, the expected devaluation of the ruble, the sharp rise in inflation [18–19]. The main reason for decisions to close foreign currency deposits is the fear that they may be withdrawn or used in the future. Not all deposit outflows have undesirable condition. Due to a lack of demand for foreign exchange borrowing and significant risks, several banks began to actively cut foreign exchange liabilities in mid-2022.

Information on search queries can be obtained in real time, which makes it possible to use it for the purpose of studying economic indicators, in particular forecasting the dynamics of deposits of the population. Macroeconomic statistics are published with lag, which prevents such efficiency (*Fig. 1*).

DATA AND AN EMPIRICAL STRATEGY

Methods such as synthesis, analysis, descriptive and correlation analyses were used in the study of the relationship of intensity of targeted search queries and dynamics of deposits of the population. Quantitative study with time series analysis models was conducted.

The research used monthly data from February 2009 to May 2022 (160 observations). Data have a time structure. Due to the non-stationary of variables, the first differences were used in the calculations, which are stationary.

Sources were databases of Rosstat, Bank of Russia, data on search queries Google Trends and Yandex wordstat. Since the data

[3] According to Yandex.Radar. URL: https://radar.yandex.ru/search (accessed on 14.08.22).

Table 1

Search Queries Used in the Study

Query text	Orientation to:	Implied influence mechanism
Deposits	Search	Increased intensity reflects interest in bank deposits, which can result in both deposit inflows and outflows.
Inflation		The increase in queries intensity reflects the interest in price increases; it will result in the outflow of ruble deposits and, maybe, the inflow of foreign currency deposits.
Ruble exchange rate		Increased intensity of queries reflects devaluation expectations, will lead to outflow of ruble deposits
Exchange rate		
Default		
What will happen to the ruble?	Forecast	
What will happen in Russia?		
Withdraw dollars	Action	An increase in the number of queries expressing the desire to withdraw funds from bank accounts (both in foreign currency and in rubles for eventual conversion into cash foreign currency) will result in an outflow of deposits.
Withdraw euros		
Where to buy currency?		

Source: Compiled by the authors.

on the intensity of search queries in Yandex are available only for the last 24 months, the assessment used the approach suggested in the paper of G. Kurovskiy [3].

The following equation was used to assess the dynamics of household ruble deposits while taking information from search queries into consideration:

$$\ln(DEP) = const + b_1 S + b_2 X + \varepsilon, \qquad (1)$$

where DEP — amount of ruble deposits of households; $const$ — constant; S — proxy search query intensity; X — set of control variables explaining the deposit volume dynamics; b_1, b_2 — coefficient vectors; ε — regression error.

The search queries used in the research were conditionally divided into three types:

- aimed at searching for information;
- aimed at forecasting;
- aimed at action.

The research used data on the intensity of the following search queries (*Table 1*).

Fig. 2 shows dynamics of intensity of search queries.

Since a number of factors influence the dynamics of deposits of the population, the following indicators are used as control variables [8, 9]:

- natural logarithm of money supply M2 in national definition;
- return exchange rate of dollar to ruble and euro to ruble;
- ruble inflation over the last 12 months;
- rates on bank deposits in rubles $DepRate_{RUB}$, in dollars $DepRate_{US}$ and euros $DepRate_{EUR}$ with a maturity of up to 1 year;

Fig. 2. **Search Query Intensity**

Source: Compiled by the authors based on data from Google Trends, Yandex wordstat.

Table 2

Descriptive Statistics of Variables

Variable	Min	Average	Max	SD
Growth of household ruble deposits, (%)	–4.1	0.9	7.0	1.9
Growth of household foreign currency deposits, in ruble equivalent, (%)	–17.4	0.7	18.2	4.7
Growth of household foreign currency deposits, in dollar equivalent, (%)	–21.5	0.1	5.6	2.8
Growth of money supply M2, (%)	–4.2	1.1	10.7	2.3
Annual ruble inflation, (%)	2.2	6.8	17.8	3.4
Return exchange rate of dollar to ruble	29.0	57.0	93.6	16.4
Rate on bank deposits in rubles, (%)	3.2	6.2	18.8	2.4
Rate on bank deposits in dollars, (%)	0.4	1.5	6.4	1.3
Rate on bank deposits in euros, (%)	0.1	0.9	5.2	1.2
Spread between deposit rate and zero-coupon yield in rubles, (%)	–3.8	–1.5	18.8	2.2
Spread between deposit rate and zero-coupon yield in dollars, (%)	–1.4	0.6	5.4	1.5
Spread between deposit rate and zero-coupon yield in euros, (%)	0.8	1.4	5.3	1.0

Source: Calculated by the authors based on Rosstat and Bank of Russia data.

Note: SD — Standard Deviation.

- spreads between the average deposit rate and the zero-coupon yield on sovereign debt:

$$Spread_{RUB} = DepRate_{RUB} - YTM_{RUB},$$
$$Spread_{US} = DepRate_{US} - YTM_{US},$$
$$Spread_{EUR} = DepRate_{EUR} - YTM_{EUR},$$

where $DepRate$ — average rate on bank deposits with a maturity of up to 1 year; YTM — yield to maturity of sovereign bonds in the respective currency with a maturity of up to 1 year.

Autoregression models are often used to predict indicators [3, 19, 20]. This paper used forecasts based on both the ARIMA model and the simple least squares method, with the addition of ruble deposits from households with a lag of 1 and 12 months to explain the natural logarithm variables, which allows you to take into account the potential trend and cyclical components of the dynamics of deposits. All models included control variables.

Descriptive statistics of variables are given in the *Table 2*.

In general, the set of control variables accurately describes the dynamics of population deposits (corrected coefficient R^2 exceeds 75%). However, many of these indicators refer to the same month as the change in the amount of deposits, and become visible after the end of this month (for example, for various specifications, it is robust to estimate an increase of 0.7–0.8% in deposits per 1% of M2 money supply growth, but statistics on this increase are published after the end of this month). When modeling for the purpose of research, preference was given to specifications in which the dynamics of deposits for each month are

Table 3

Model for the Dynamics of Ruble Deposits of the Population Based on Search Queries

Search query	St. forecast error in the pseudo-sample period (July 2021 — March 2022)	MAE for the pseudo-sample period (July 2021 — March 2022)	The significance of the regressor in the dynamics of search queries	Akaike Criterion
–	1.33%	1.05%	–	–592
Deposits	1.18%	1.05%	–	–591
Inflation	1.32%	1.20%	***	–597
Ruble exchange rate	1.13%	0.96%	**	–595
Exchange rate	1.17%	1.01%	***	–597
Default	1.12%	0.99%	***	–603
What will happen to the ruble?	1.07%	0.98%	***	–624
What will happen in Russia?	1.01%	0.89%	***	–604
Withdraw dollars	1.02%	0.80%	***	–601
Withdraw euros	0.91%	0.81%	***	–602
Where to buy currency?	1.19%	0.98%	*	–594

Source: Calculated by the authors.

Note: * significant at 10%; ** significant at 5%; *** significant at 1%.

established on the basis of information known at the beginning of the corresponding month, as they are more appropriate for predicting.

RESULTS AND DISCUSSION

The results indicate the use of search query data in the formulation of leading indicators for operational risk management in the context of macroeconomic insecurity.

Table 3 shows that the inclusion in the model of information from search queries increases the predictability of withdrawals from ruble deposits. The improvement in forecast accuracy is 0.05–0.25 p.p. (with a standard deviation of the dependent variable of 1.73%). Most estimates of coefficients at the variable popularity of textual queries are significant and negative, which suggests that the growth of the number of such queries is an earlier indicator for the outflow of ruble deposits of the population. On average, queries expressing worry about the ruble exchange rate and calls for action caused the fewest prediction mistakes. Dynamics queries aimed at searching for information also had

Table 4

Dynamics of Foreign Currency Deposits

Period	Increase in foreign currency deposits of the population, nominated in dollars	Increase in foreign currency deposits of the population, nominated in rubles
01.02.22–01.03.22	–21.5%	18.9%
01.03.22–01.04.22	–0.2%	–11.5%
01.04.22–01.05.22	–1.3%	–16.1%

Source: Calculated by the authors based on data from the Bank of Russia. URL: www.cbr.ru

Table 5

Model for the Dynamics of Foreign Currency Deposits of the Population Using Information on the Search Queries

Search query	St. forecast error in the pseudo-sample period (July 2021 — March 2022)	MAE for the pseudo-sample period (July 2021 — March 2022)	The significance of the regressor in the dynamics of search queries	Akaike Criterion
–	6.58%	2.91%	–	–410
Deposits	6.57%	2.87%	–	–409
Inflation	6.56%	2.92%	–	–409
Ruble exchange rate	5.91%	2.72%	***	–432
Exchange rate	6.47%	2.91%	–	–408
Default	6.53%	2.93%	–	–409
What will happen to the ruble?	6.50%	2.91%	–	–408
What will happen in Russia?	5.91%	2.71%	***	–435
Withdraw dollars	5.46%	2.57%	***	–464
Withdraw euros	7.19%	3.22%	***	–422
Where to buy currency?	6.62%	2.93%	–	–408

Source: calculated by the authors.

Note: * significant at 10%; ** significant at 5%; *** significant at 1%.

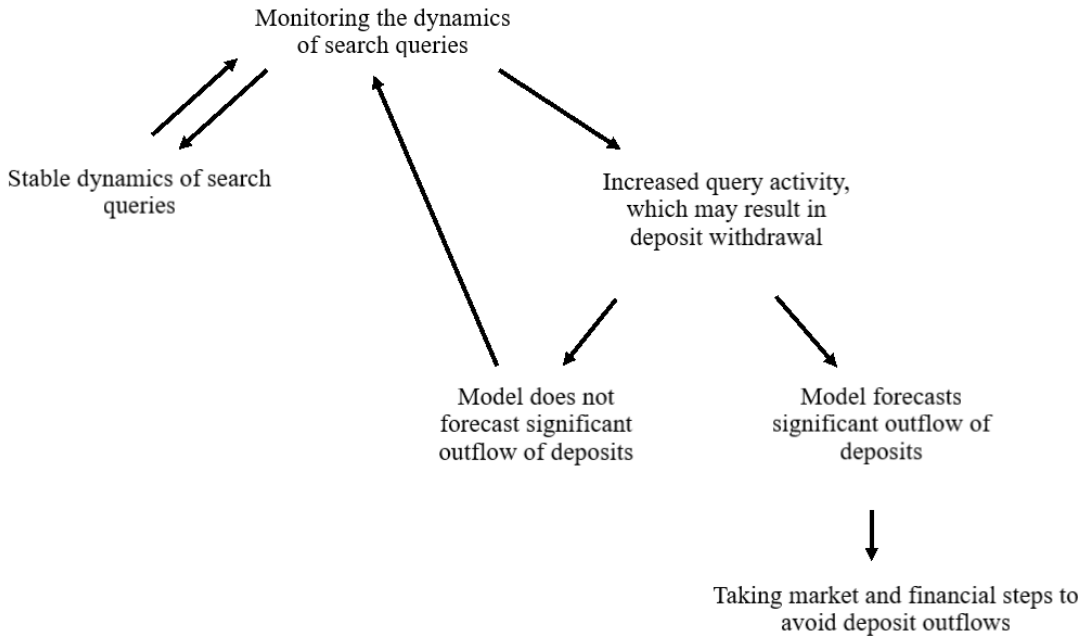

Fig. 3. **Operational Monitoring of the Intensity of Search Queries**

Source: Compiled by the authors.

a negative impact on the dynamics of ruble deposits.

The analysis of the impact of the intensity of search queries on the dynamics of foreign currency deposits was conducted. Statistics on the volume of foreign currency deposits are published in ruble. However, for the present research, it is important to analyse the evolution of foreign currency deposits expressed in a major foreign currency. Indeed, *Table 4* shows that in February 2022 the volume of foreign currency deposits, expressed in rubles, increased, which, however, is connected with the weakening of the ruble. The outflow of foreign currency deposits almost stopped in March-April, but the volume of foreign currency deposits, expressed in rubles, declined in these months, due to the appreciation of the ruble.

Table 5 presents forecasts of currency deposits expressed in US dollars. Similar results are obtained with the use of a bicurrency basket consisting of 50% of US dollars and 50% of euros. Forecasting of the dynamics of currency deposits of the population is comparatively less accurate (the standard error of the forecast is about 5 times higher, and the average absolute error of the forecast is about 2.5 times higher than when forecasting the dynamics of ruble deposits of the population). However, the inclusion of search queries, especially those expressing concern about the exchange rate of the ruble, allows to increase the accuracy of the monthly forecast of the dynamics of currency deposits of the population by 0.20–0.34 p.p. The improvement of forecasting accuracy is observed when using indicators that directly or indirectly express concern about the exchange rate of the ruble in the future and are also action-oriented. At the same time, the inclusion of some requests, such as those indicating a desire to exit from the euro, reduces prediction accuracy.

The study examined the prediction ability of models for various off-sample intervals. The inclusion of information on the intensity of search queries allowed to increase the accuracy of forecasting ruble deposits of the population not only at the beginning of March 2022, but also in the following months — at the beginning of April and May 2022. Foreign currency deposit forecasts for early April and May 2022 were less accurate compared to early March 2022. This

might be because, by April, aggressive efforts had been taken to halt the outflow of cash from bank deposits: the refinancing rate had been raised, and limitations on the withdrawal of foreign currency from settlement accounts had been imposed.

Comparable results of forecasting of rouble and foreign currency deposits were also obtained using MNCs with the addition of indicators of intensity of search queries, control variables, lagged dependent variable (with lags 1 and 12 months).

Thus, the main research hypothesis is confirmed, the data search queries allow to increase the accuracy and efficiency of forecasting the dynamics of ruble and currency deposits of the population and at the same time can be used to prevent undesirable outflow of deposits. Online monitoring of search queries can be organized as follows to avoid deposit outflow (*Fig. 3*).

The study was conducted using monthly observations. Within the month, the impact of search queries on deposit dynamics is even more significant. High performance of textual information to predict household financial decisions can be observed in nowcasting for short periods (within one week). In conditions of macroeconomic instability, it is efficient forecasting on such a horizon that is especially important, in order to manage to undertake necessary measures. Banks will be able to generate such estimates over any short-term horizon since they have immediate access to their own information on the evolution of deposits.

CONCLUSION

An increase in the frequency of search inquiries reflecting households' plan to withdraw money from ruble deposits or convert money into currencies precedes active household activities. Information on the intensity of search queries determines the possibility to anticipate the outflow of deposits and, based on the projected potential change, to take measures aimed at preventing undesirable outflow.

The results of the study lead to the conclusion that in the innovative model of development of fintech-directions in the banking sector of the Russian Federation it is advisable to distinguish one of them, in the framework of which methodological bases of formation of leading indicators of population behavior as a reaction to macroeconomic instability will be created, based on analysis of big data. It is vital to continuously monitor the risks of unwanted outflows of deposits of persons from commercial banks based on changes in the frequency of targeted search queries of the public. To build forecasts it is advisable to use data on the frequency of search queries from search Yandex and Google systems. It was revealed that among the search queries have the greatest predictive ability, those in which directly or indirectly express concern about the future rate of the ruble. To assess the potential change in the volume of ruble deposits of the population, it is advisable to use the following formulations: "default", "what will happen in Russia", "what will happen with ruble", "exchange rate of ruble", "withdraw dollars", "withdraw euro". For currency deposits the most predictive ability are the requests of "ruble exchange rate", "what will happen in Russia", "withdraw dollars". The use of data on the intensity of such requests makes it possible to increase the accuracy of forecasts of outflow of ruble deposits on a 1-month horizon by 0.05–0.25 p.p., currency deposits — by 0.2–0.34 p.p.

To guarantee the bank's financial stability, prompt action is required to avoid undesirable outflows of deposits. Monetary authorities and commercial banks can utilize data on the intensity of search searches as part of nowcasting, predicting deposit cash outs, and taking rapid and early action based on collected projections to avoid undesirable deposit outflows.

It is recommended to monitor the dynamics of search queries in online. When there is a rise in the number of searches that directly or indirectly signal the desire of economic agents

to withdraw funds from deposits targeted at retaining bank deposits, marketing and financial actions (depending on the sources of prospective outflows) are suggested.

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REFERENCES

1. Bollen J., Mao H., Zeng X. Twitter mood predicts the stock market. *Journal of Computational Science*. 2011;2(1):1–8. DOI: 10.1016/j.jocs.2010.12.007
2. Goloshchapova I., Andreev M. Measuring inflation expectations of the Russian population with the help of machine learning. *Voprosy ekonomiki.* 2017;(6):71–93. (In Russ.). DOI: 10.32609/0042–8736–2017–6–71–93
3. Kurovskiy G.S. Using textual information to predict in macroeconomics. *Vestnik Moskovskogo universiteta. Seriya 6: Ekonomika = Moscow University Economics Bulletin.* 2019;(6):39–58. (In Russ.).
4. Dong Y., Yan D., Almudaifer A.I., Yan S., Jiang Z., Zhou Y. BELT: A pipeline for stock price prediction using news. In: 2020 IEEE Int. conf. on Big Data (Big Data). (Atlanta, GA, 10–13 December 2020). Piscataway, NJ: IEEE; 2020:1137–1146. DOI: 10.1109/BigData50022.2020.9378345
5. Korivi N., Naveen K.S., Keerthi G.C., Manikandan V.M. A novel stock price prediction scheme from Twitter data by using weighted sentiment analysis. In: 2022 12th Int. conf. on cloud computing, data science & engineering (Confluence). (Noida, 27–28 January 2022). Piscataway, NJ: IEEE; 2022:623–628. DOI: 10.1109/Confluence52989.2022.9734139
6. Trofimov D. Changes in household deposits structure: Liquidity and stability of bank liabilities. *Voprosy ekonomiki.* 2017;11:152–160. 2017;(11):152–160. (In Russ.). DOI: 10.32609/0042–8736–2017–11–152–160
7. Ilyunina D.A., Lunyakov O.V. The essence and role of deposit resources in commercial banks. *Finansy i kredit = Finance and Credit.* 017;23(32):1894–1910. (In Russ.). DOI: 10.24891/fc.23.32.1894
8. Kuznetsov A. The impact of real interest rates on household savings. *Den'gi i kredit = Russian Journal of Money and Finance.* 2017;(5):22–27. (In Russ.).
9. Gurov I.N. Consequences of household deposit income taxation changes: Results of 2020–2021. *Vestnik Instituta ekonomiki Rossiiskoi akademii nauk = Bulletin of the Institute of Economics of the Russian Academy of Sciences.* 2022;(1):112–132. (In Russ.). DOI: 10.52180/2073–6487_2022_1_112_132
10. Diamond D.W., Dybvig P.H. Bank runs, deposit insurance, and liquidity. *Journal of Political Economy.* 1983;91(3):401–419. URL: https://www.bu.edu/econ/files/2012/01/DD 83jpe.pdf
11. Chang R., Velasco A. The Asian liquidity crisis. NBER Working Paper. 1998;(6796). URL: https://www.nber.org/system/files/working_papers/w6796/w6796.pdf
12. Postlewaite A., Vives X. Bank runs as an equilibrium phenomenon. *Journal of Political Economy*. 1987;95(3):485–491. DOI: 10.1086/261468
13. Kindleberger C.P. Manias, panics and crashes: A history of financial crises. New York, NY: Basic Books; 1978. 365 p.
14. Allen F., Gale D. Optimal financial crises. *The Journal of Finance.* 1998;53(4):1245–1284. DOI: 10.1111/0022–1082.00052
15. Chari V.V. Banking without deposit insurance or bank panics: Lessons from a model of the U.S. National Banking System. *Federal Reserve Bank of Minneapolis Quarterly Review.* 1989;13(3):3–19.

16. Pestova A., Pankova V., Akhmetov R., Goloshchapova I. Developing a system of financial instability indices based on high frequency data. *Den'gi i kredit = Russian Journal of Money and Finance.* 2017;(6):49–58. (In Russ.).
17. Preis T., Moat H.S., Stanley H.E. Quantifying trading behavior in financial markets using Google Trends. *Scientific reports.* 2013;3:1684. DOI: 10.1038/srep01684
18. Garcia J., Werner T. Inflation risks and inflation risk premia. European Central Bank. Working Paper Series. 2010;(1162). URL: https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1162.pdf
19. Abildgren K., Kuchler A. Revisiting the inflation perception conundrum. *Journal of Macroeconomics.* 2021;67:103264. DOI: 10.1016/j.jmacro.2020.103264

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F.S. Kartaev — problem statement, development of article methodology, formation of research conclusions.
O.S. Vinogradova — critical analysis of the literature, development of proposals based on the findings, formation of the conclusions of the study.

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