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Modeling of deposit operations as an element of managing resource potential in a banking institution

The article examines the issues of modeling of deposit operations of commercial banks as the main source of resources on the materials of one of the systemically important banks of the Republic of Halyk Bank of Kazakhstan JSC. The population becomes the dominant source of funding for Kazakhstani banks. There is a mutually beneficial tandem in the sector: consumers do not yet have an alternative to deposits for storing money, and banks have limited sources of funding. As a result, a steady growth of the market. Increasing the efficiency of the banking institution and strengthening its resource potential is possible due to the improvement of the process of formation of the deposit portfolio. Primarily by ensuring the inflow of more stable resources to the bank and targeting the reduction of their weighted average cost, ensuring the profitability of each operation to attract new or service the old customer. Relatively new, but until the end has not yet been studied and not approved by the method of modeling the bank's deposit operations is the technology of fuzzy modeling. Fuzzy modeling most corresponds to the requirements of universality, the inclusion of multi-criteria choice in conditions of uncertainty from a discrete or continuous set of alternatives, the simplicity of preparation and processing of expert information.

Keywords: banking system, deposit operations, financial resources, modeling, management, expert information.

Deposit resources are the main sources of investment for banks. They reveal the content of the activities of a commercial bank that functions as an intermediary agent in the acquisition of resources at the free capital market.

People are becoming the dominant source of funding for Kazakhstani banks. In this sector a mutually profitable tandem has been formed: consumers have no other alternatives to the deposits for storing their money, and banks, in their turn, have limited sources of funding. As a result, there is a steady growth of the market. The volume of deposits increased by 22% over the year and amounted to 7,187,752 tenge in January 2016.

Bank demand for the population's money is mostly formed in accordance with the situation at the credit market. With the deficit of good borrowers at regulated banks, it is possible to face the risk of getting overabundant and expensive liquid funds. Therefore, financial institutions reduce deposit rates. So far, there is no perceptible buoyancy at the credit market, therefore in the following couple of months it is unlikely to expect that deposit rates would increase.

However, in the coming year people's free money will remain the main resource for the majority of universal banks. If the real economy sector revitalizes, businesses will not keep their money on bank accounts. Term deposits of legal entities decreased by 7 % during the year, and their volume has already decreased compared to those of individuals by 200 billion tenge. In the medium-term perspective, approximately in the second quarter of this year, banks will have to raise deposit rates in the competition for available funds of the population.

According to the growth rate in the sphere of retail deposits Sberbank holds the leading position among the top ten banks. In January it attracted individuals' deposits in the amount of 4.1 billion tenge which makes 5.8 % out of its retail portfolio. Tsesnabank also attracted significant individual funds – 5.1 billion tenge in January and showed an increase in its retail deposits by 5.2 %. Market leaders Narodnyi Bank and Kazkom also increased the volume of deposits from individuals by 2.4 and 1.8 % correspondingly.

Among the regions in terms of growth of individuals' deposits Astana takes the first position. Deposit portfolio makes 96090 million tenge. Next comes South Kazakhstani region, whose deposit portfolio makes 53684 million tenge. About half of the individuals' deposits are made in Almaty city, and the overall deposit number of the remaining 13 regions is slightly more than a third of the market (Table 1).

To solve the task of increasing profits at the weighted risks, the bank will inevitably face the problem of increasing the efficiency of formation of its resource base. This problem acquired a particular relevance during the global financial and economic crisis which inflicted a heavy blow on the global banking system. Both in Kazakhstan and overseas, deposit portfolio is a significant component of the resource base for the credit

institution. Profitability and liquidity, the most significant indicators of the bank activities, depend largely on the effective management of deposits of individuals and legal entities. In this regard, there is an urgent need to find effective methods of analyzing and forecasting economic indicators of bank activities in order to timely adjust national monetary policy and prevent the destruction of financial capacity and real sectors of economy.

Table 1

Deposits of individuals excluding non-resident accounts

Region	Million tenge		
	01.01.2015	01.01.2016	Actual change
Akmola	6 289	12 194	5905
Aktyubinsk	14 485	32 220	17735
Almaty	8 633	14 309	5976
Atyrau	11 829	22 545	10716
East Kazakhstan	22 634	37 740	11106
Zhambyl	6 506	26 022	19516
West Kazakhstan	10 000	14 176	4176
Karaganda	25 571	47 243	21672
Kostanay	13 013	25 425	12412
Kyzylorda	6 200	11 779	5579
Mangistau	11 895	20 716	8821
Pavlodar	15 776	33 608	17832
North Kazakhstan	7 567	13 993	6426
South Kazakhstan	24 532	78 216	53684
Almaty city	302 915	589 537	286622
Astana city	59 394	155 484	96090

The ways of harmonizing and regulating common fluctuating socio-economic processes and, in particular, their financial components present a particular interest in the deposit-resource bank potential link. The specificity of their dynamics is that almost any complex operation can be represented as a collection of relatively independent but interacting fluctuating processes (resource flows). In this context, mathematical modeling serves as an effective method of assessing the quality of deposit policy and eventually the resource potential of a bank.

Improving the efficiency of a bank activity and strengthening its resource potential is possible through improving the process of formation of the deposit portfolio, primarily by providing the inflow of more stable resources and reducing their average cost alongside with the ensurance of the profitability of each transaction to attract new customers and keep the old ones. In terms of bank activities dynamics, transactions which attract deposits can be considered as primary (analytical) resource flow [1]. The bulk of primary flows arranged in a logical and chronological sequence, is a synthetic resource flow. Currently, there exist different approaches to solve the problem of modeling bank deposit base.

Sometimes, the main goal is stated as «to attract the customer», i.e., a bank gives priority to the main marketing principle «a bank for a customer» and it serves the basis for modeling deposit flows. Issuing from the goal of optimizing deposit portfolio, the main results of modeling are to provide a stable flow of available funds and to attract new customers. However, attracting a large number of customers and the constant influx of deposits will not contribute to the stability of the resource base. Traditional methods of modeling the stability of income and deposits consist in computing two or three main indices or their modifications: the average storage time of funds, the level of funds settling and the value of fund balance available for use (transformation) [2]. Sometimes it uses another way to determine the constancy of deposit resources - evaluation by a factor of stability balance. This indicator measures the amplitude of fluctuations of raised funds remains.

Bank managers, modeling the deposit portfolio of the bank, sometimes use the technique of regulating the relations between assets and liabilities based on the time factor by means of employing special ratios assessing these relations [3]. However, this method is not suitable for the analysis of the customer base and identification of the stable deposit resources. It does not answer a number of pressing issues that arise in the implementation of deposit policy: what types of resources, which customers and how many of them the bank needs to attract in order to ensure the stability of the resource base.

A relatively new, but yet not fully studied and proven method of modeling bank deposit operations is the technology of fuzzy modeling. The relevance of this new technique is stipulated by the increasing complexity of formal and mathematical models of banking activities which is caused by the desire to increase their significance and to take into account the increasing number of different factors influencing the decision-making processes. The quality of the formation of the deposit portfolio can be evaluated in accordance with a large number of criteria and factors. For some of them there are direct mathematical methods that allow to give a qualitative assessment. However, there are a number of criteria, such as competitiveness, practicality, mobility, maintainability and customer loyalty, which are rather difficult to assess. In this case, the best suited methods are those of fuzzy modeling, based on the use of expert estimates resorting to fuzzy ranges, which make it possible to take into account multicriteriality and indefiniteness, as well as enables the selection of solutions from a variety of alternatives of different types having certain criteria and scales of measurement. Fuzzy modeling meets best the requirements of flexibility, multi-criteria selection in the conditions of indefiniteness of continuous or discrete range of alternatives, simplicity of preparation and processing of expert information. Nevertheless, despite its progressive nature, fuzzy modeling is not devoid of drawbacks. First, they are connected with the expert approach. Difficulties may arise due to the lack of information, low competence and consistency of experts, the influence of subjective factors on the specialists' conclusions. Moreover, there arise certain difficulties connected with the organization of work of the expert group, lack of adequate evaluation systems, imperfection of the technology of expert investigation and data processing as well as relatively high cost of such research.

So, the results of the analysis show that the most comprehensive of all is A. Buri's approach to modeling bank deposit operations [4]. It specifies the allocation of customer groups; calculation of coefficients defining the stability of remains of each group; assessment of the current state of the customer base; exposure of existing tendencies of changes in the customer base; forecasting.

Thus, basing on common logic (and supposition concerning the correctness of the applied approaches) we can define the initial data for modeling the deposit operations:

1. The main objective of the model development is the analysis of attracted resources dynamics, the formation of the self-costs and profits.

2. Method of modeling is a means of presenting the economic process as an interaction of elementary resource flows in the form of a linear multiple regression equations.

3. The volume of the resource at the moment of time **t** in monetary terms is called mass of resources.

4. The results of modelling should be highly correlated, however, the direct comparison of numerical values is rather arbitrary.

Therefore, proceeding directly to the development of the model, it should be noted that one of the multiple regression equations reflects the dynamics of increase of deposits in tenge, the other reflects similar dynamics of deposits increase in foreign currency. Taking into account the strong inverse dependence between the deposit increases in tenge and in foreign currency (correlation coefficient equals to 0.92), an explained variable of each equation functions at the same time as an explanatory variable one of the other. Other variables included in the model are shown in Table 2.

Table 2

Factors of model and notation

Notations	Factors
$\Delta D^t\ tg$	Increase in the value of the aggregate tenge deposits in bank accounts during period t compared to period t-1
$\Delta D^t\ iv$	Increase in the value of the aggregate deposits in foreign currency in the bank accounts during period t compared to period t-1
REV^t	The overall income of the ppopulation during period t
$TURN^t$	Retail trade turnover at current prices (volume of consumer market) during period t
$RATE^t\ iv$	The average interest rate of new deposits in foreign currency for the period of up to one year during period t
$RATE^t\ tg$	The average interest rate of new deposits attracted for a term of up to one year in the national currency during period t
Rt Exch	The index of the real exchange rate of tenge against the US dollar

To display the resource flow of deposits it is efficient to use flux function, which is the function of time reflected in the following equation:

S(t)=Y(t)-Z(t);

where S(t) is flux function;

Y(t) is the mass of the input resource at the moment of time t;

Z(t) is the mass of the output resource at the moment of time t

Using these concepts, we can present the process of attracting deposits in the form of a range of elementary processes.

Thus, the model can be put in the following way:

$$\Delta D^t\, tg = a_1 \Delta D^t iv + b_1 (REV^t - TURN^t) + c_1 RATE^t tg + d_1 Rt\ Exch + \delta_1.$$

Now we will try to apply the above model to the activity of JSC «Halyk Bank». To this end let us consider all the necessary factors for the model (Table 3).

Table 3

Computation of factors essential for modeling deposit policy of JSC «Halyk Bank»

Notations	Factors	Money terms
$\Delta D^{2016}\, tg$	Increase in the value of aggregate tenge deposits in bank accounts during the period of 2012 compared to the year 2011	127217,4 mln tg.
$\Delta D^{2016}\, iv$	Increase in value of aggregate deposits in foreign currency in bank accounts during the period of 2012 compared to the year 2011	2544,3 mln tg.
REV^{2016}	The overall income of the population in the year 2012	51755 tenge or 0,051 mln tg.
$TURN^{2016}$	Retail trade turnover at current prices (volume of consumer market) in the year 2012	4319940,6 mln tg.
$RATE^{2016} iv$	The average interest rate of new deposits attracted for a term of up to one year in foreign currency in 2012	2,4
$RATE^{2016} tg$	The average interest rate of new deposits attracted for a term of up to one year in the national currency in 2012	2,7
Rt Exch	The index of the real exchange rate of tenge against the US dollar	340

Thus, the model of the deposit policy of JSC «Halyk Bank» will look as follows:

$$127217{,}4 = a_1 \times 2544{,}3 + b_1 \times (0{,}051 - 4319940{,}6) + c_1 \times 2{,}7 + d_1 \times 340 + \delta_1 \text{ or}$$
$$127217{,}4 = 2544{,}3a_1 - 4319940b_1 + 2{,}7c_1 + 340d_1 + \delta_1.$$

All of the above elements are to be implemented with the ability to visualize the dynamics of any flow. Thus, the attraction of deposits is the key element in the mathematical modeling of the deposit base, identifying the following sequence of development of the model of the resource potential of the institution.

1. The collection of primary resource deposit flows.
2. The collection of deposits, representing a total resource flow of banking institution (Figure).

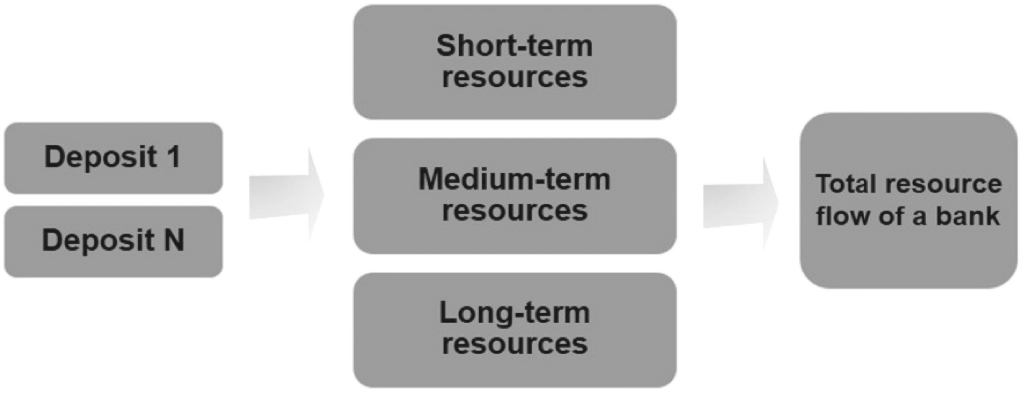

Figure. Deposit flow of a bank

A noteworthy fact is that the whole process of formation the model is to determine the conditions under which the result is correct. In this context, it is appropriate to note that a logical addition to the constructed model will be a quantitative account of the impact of different kinds of crises that will reduce the standard error.

Conclusion. Thus, the presented above econometric model may be useful in the management of the deposit base of a bank. Changing either side factors, the model can predict changes in the bank's resource potential.

In addition, it will allow to plan how to attract customers, and due to the calculation of flexibility determine how it will be possible to change the exchange rate component of deposits, what impact retail sales can have on the deposit growth, how a change in income of people will affect its ability to accumulate resources, what would entail an increase index of the real exchange rate of the national currency and to what extent it will affect the dynamics of the resource base of the bank, and how changes in interest rates will affect the deposits in tenge and in foreign currency. A more adequate perception of how and by what the resource potential of the bank will help to exactly segment customers and products. However, depending on the data in specific analytic expressions it is not fixed and universal. It is necessary to make their periodic updating and adjustment, as over time there is an increase in the turnover, production growth and prices.

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Банк мекемесінің қор әлеуетін басқару элементі ретіндегі депозиттік операцияларды модельдеу

Мақалада екінші деңгейлі банктің негізгі қор құру көздерінің бірі депозиттік операцияларды модельдеу мәселелері талқыланып, еліміздегі жүйеқұрушы банктердің бірі «Қазақстан Халық банкі» АҚ мысалында есептелді. Қазақстан Республикасы банктері үшін халық қорландыру көздерінің басым бөлігін құрап отыр, себебі жеке тұлғалардың қаражаттарын сақтаудың баламалы кірісті әдістері жоқ болса, банктердің қорлану көздері де шектеулі жағдайда болғандықтан, аталған нарық көлемі соңғы жылдары артуда. Банк мекемесінің қызметінің тиімділігін жоғарылату және оның ресурстық әлеуетін нығайту депозиттік қоржынды қалыптастыру үрдісін жетілдіру есебінен және, ең алдымен, банкке тұрақты ресурстардың ағымын қамтамасыз ету және олардың орташа өлшенген құнын төмендетуге бағдар алу, сонымен қатар жаңа клиентті тарту немесе ескі клиентке қызмет көрсету бойынша әрбір операцияның кірістілігін қамтамасыз ету жолымен жүзеге асырылуы мүмкін. Банктің депозиттік операцияларын модельдеудің салыстырмалы түрде жаңа, бірақ әлі толық зерттелмеген әдістерінің бірі ретсіз модельдеу технологиясы болып табылады. Ретсіз модельдеу ең көп мөлшерде әмбебаптылық, сараптама ақпараттың дайындалуы мен өңделуі, дискретті немесе баламалардың үзіліссіз көп бөлігінен белгісіздік жағдайында көп белгілі таңдау есебі талаптарына сәйкес келеді.

Кілт сөздер: банк жүйесі, депозиттік операциялар, қаржы ресурстары, модельдеу, басқару, сараптамалық ақпарат.

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Моделирование депозитных операций как элемент управления ресурсным потенциалом банковского учреждения

В статье исследованы вопросы моделирования депозитных операций банков второго уровня, как основного источника ресурсов, на материалах одного из системообразующих банков республики АО «Народный банк Казахстана». Население становится доминирующим источником фондирования для казахстанских банков. В секторе сформировался взаимовыгодный, по необходимости, тандем: у потребителей пока нет альтернативы депозитам для хранения денег, а у банков ограничены источники фондирования. Как результат — устойчивый рост рынка. Повышение эффективности деятельности банковского учреждения и укрепление его ресурсного потенциала возможно за счет совершенствования процесса формирования депозитного портфеля, прежде всего путем обеспечения притока в банк более стабильных ресурсов и ориентации на снижение их средневзвешенной стоимости с обеспечением рентабельности каждой операции по привлечению нового или обслуживанию старого клиента. Относительно новым, но пока до конца еще не изученным и не апробированным методом моделирования депозитных операций банка является технология нечеткого моделирования. Нечеткое моделирование в наибольшей степени соответствует требованиям универсальности, учета многокритериального выбора в условиях неопределенности из дискретного или непрерывного множества альтернатив, простоты подготовки и переработки экспертной информации.

Ключевые слова: банковская система, депозитные операции, финансовые ресурсы, моделирование, управление, экспертная информация.

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