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WORKING OUT METHODS OF THE CONSTRUCTION OF A RATING OF LIQUIDITY WHILE FUNCTIONING COMMERCIAL BANKS OF UZBEKISTAN

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Abstract

Article is devoted to a technique of construction while rating the liquidity of commercial banks functioning. In the article investigations of probability of event which consists that commercial bank during a certain interval of time will be liquid to function taking into account influence of random factors, i.e. regularly and in due time to carry out all functions. The special attention is given to questions of a problem of working out and introduction of a method of a rating of liquidity of commercial banks in Uzbekistan. By working out and research of the given problem, methods and receptions of probability theory, the mathematical statistics and econometric modeling are used. The author comes to conclusion, that in article the technique of forecasting of a financial condition of commercial banks. Furthermore, according to which liquidity of commercial bank is defined by probability of the event, consisting is proved what to be during a certain interval of time in the near future will be liquid to function taking into account influence of casual parameters. By imitation of parameters of the equations, there is a possibility of monitoring, the control and the forecast of a rating of liquidity of commercial bank in the near future. By results of research are prepared corresponding prognosis recommendations and offers for the persons making of the decision. It will help to prepare better bank system for new calls.

Keywords: Probability of event, liquidity rating, forecasting technique, interval of time, Commercial bank

INTRODUCTION

For last ten years, positive tendencies were outlined in economy of Uzbekistan. Dynamics of recession of volume of manufacture and insolvency crisis are overcome, the financial condition of commercial banks has considerably improved. Stable growth of economy promoted, both to growth of incomes of the population, and improvement of an investment climate. Extra financing at the expense of large credits became the basic source of financing of new projects in the circumstances (Vakhabov & Bobakulov, 2009). For this period risks not return of bank resources and investments have essentially increased. Badly developed system of an estimation of liquidity of commercial banks can become causal occurrence of defaults, and as consequence lead to loss of potential investors and commercial banks for economy.

In the western practice, the role of independent appraisers of liquidity of commercial banks is carried out by rating agencies. Most known of them Standard and Poor's, Moody's. These agencies also actively conduct the activity and in our country, but the circle of their clients for the present is not great. Rating agencies are at present only at the initial stage of the development and their ratings yet have not received wide application among financial and investment institutes (De Nicoló, Honohan, & Ize, 2003).

Mostly such low activity explained by bad base of a financial condition of commercial banks and absence of history on defaults owing to what statistical methods of research, which use rating agencies, in practice, are difficultly applicable to the market. At the same time constantly growing economy demands more and financial and bank resources on development of new investment projects. The weak level of scrutiny financial and not the financial factors influencing liquidity of commercial banks, increases risk not return of bank resources and investments(A. V. Akimov & Dollery, 2006).

The liquidity - rating is the standardized value judgment of probability of full and timely performance by the debtor of obligations on payment of percent and repayment of the basic sum of a debt. It are a reference point not only for commercial banks and investors, but, and act as the tool of regulation of liquidity and stability of the market of promissory notes. By means of comparison of values of ratings for various commercial banks, it is possible to make lists of ratings of liquidity of commercial banks. (Our) purpose of definition of liquidity of bank much bigger value has probability of that commercial bank will be liquid to function and in the future.

In this connection, pressing questions are working out of a technique of a rating of liquidity of commercial banks. A problem of working out and introduction of a technique of construction of a rating of liquidity of commercial banks one of actual directions of research of commercial banks of the country. Working out of a technique of construction of a rating of liquidity of commercial banks and effective administrative decisions it is impossible without

application of the corresponding economic-mathematical toolkit, allowing to make the system analysis and to prove perspective developments of commercial bank (Beatty & Ritter, 1986).

The basic approach to working out of a technique of construction of a rating of liquidity of commercial banks

At construction of ratings, the author starts with the special importance for liquidity of commercial bank of observance of distribution of a random variable. This problem should be solved constantly to managers of bank. Therefore in the given work liquidity of commercial bank is defined by probability of event which consists that commercial bank during a certain interval of time will be liquid to function taking into account influence of random factors, i.e. regularly and in due time to carry out all functions (Vakhabov & Bobakulov, 2009).

The specified features of construction of a rating of liquidity of functioning of commercial banks allow to carry out mathematical formalization of its indicators (A. V. Akimov & Dollery, 2006; Sarathy & Banalieva, 2014). It is thus used three groups of parameters. Symbols of these parameters the following.

Indexes:

$\boldsymbol{i}$ **-** number of month of the accounting period;

$\boldsymbol{p}$ **-** number of month of the look-ahead period;

Exogenous parameters:

$\boldsymbol{P_i}$ –value of rating sizes;

$\boldsymbol{a_1}$ and $\boldsymbol{a_2}$ **–** value of factors in the equation for approximation of size $\boldsymbol{P}$**;**

$\boldsymbol{n}$ - quantity of values of size of rating $\boldsymbol{P}$**;**

$\boldsymbol{t_i}$ **-** Time moments, corresponding values $\boldsymbol{P}$**;**

$\boldsymbol{t_p}$ **-** Time moments (forecast date), corresponding values $\boldsymbol{P}$**;**

$\boldsymbol{a}$ - The bottom limit;

$\boldsymbol{b}$ - The top limit;

$\boldsymbol{P_k}$ - Some critical rating size;

Endogenous parameters:

$Д_р$ - A dispersion of random variable $\boldsymbol{P}$**;**

$\boldsymbol{\theta}$ - Value mean square deviation;

$\boldsymbol{\theta_s}$ **-** Value mean square deviation, prolonged on an interval of time $\Delta\boldsymbol{t}$ of size $\boldsymbol{P}$**;**

$\boldsymbol{r_m}$ **-** Factor of plural correlation;

$\boldsymbol{s}$ - Value of argument of function of integral of probability;

$\boldsymbol{\omega}$ -Probability of liquid functioning of bank;

$\boldsymbol{P_p}$ - Predicted value of size R for three months;

$\boldsymbol{\theta_p}$ - Predicted value of size mean square deviation for three months.

Let's define probability of liquid functioning of commercial bank as probability of that value of size of rating $\boldsymbol{P}$ at the moment of time $\boldsymbol{t}$ will be more than some critical size$\boldsymbol{P_k}$**.**

Size $\boldsymbol{P_k}$ is the bottom boundary value of a rating and characterizes a condition of the bank which completely has lost liquidity and solvency, i.e. settled own capital because of the suffered losses at a rate of own capital. Values of parameters of balance of the bank, corresponding to such condition, are calculated by means of model of bank for twelve months and then with use of numerical values of these parameters of balance under the formula (1) sizes of ratings for each month are calculated (A. Akimov & Dollery, 2009; Lindgren, Garcia, & Saal, 1996).

As size $\boldsymbol{P}$ is the sum of size $\boldsymbol{Q_i}$, and those in turn also are the sum enough the big number composed (the sum of the rests under various accounts of balance) with the sufficient basis it is possible to speak about normal distribution of random variable $\boldsymbol{P}$.

Normal distribution, as is known, is defined by two parameters, These parameters are the moments of the first and second order, or population mean $\boldsymbol{HP}$ and dispersion $Д_р$ of random variable $\boldsymbol{P}$**.**

In our case random variable $\boldsymbol{P}$ depends on time, i.e. $\boldsymbol{P = P(t)}$**.** Function of time ***P (t)***, accepting at everyone fixed casual values, is called as casual process. For example, if to settle an invoice size of rating $\boldsymbol{P}$ based on monthly balances of bank size $\boldsymbol{P}$ will accept casual values during the fixed moments of time $\boldsymbol{t_i}$, proper to last numbers of each month. For the decision of a problem of definition of probability of liquid functioning of bank during some time (from a present situation till the moment of time $\boldsymbol{t_p}$), it is necessary to predict value of random variable $\boldsymbol{P}$ at the moment of time $\boldsymbol{t_p}$ (for reception of value $\boldsymbol{P}(\boldsymbol{t_p})$).

Function ***P (t)*** is defined under the available information on values $\boldsymbol{P}$ for the last period of time as set of points $(\boldsymbol{P_1},\boldsymbol{t_1}),(\boldsymbol{P_2},\boldsymbol{t_2}),...,(\boldsymbol{P_n},\boldsymbol{t_n})$. The received function can be prolonged for certain time forward, i.e. to predict a random variable population mean in the future with a certain error.

With the help of a method of the least squares it is possible to solve a problem of carrying out of the best straight line through set of points $(\boldsymbol{P_1},\boldsymbol{t_1}),(\boldsymbol{P_2},\boldsymbol{t_2}),...,(\boldsymbol{P_n},\boldsymbol{t_n})$. If selective distribution is normal, the estimation of a method of the least squares coincides with an estimation of a method of the maximum credibility.

Really for sample $(\boldsymbol{P_1},\boldsymbol{t_1}),(\boldsymbol{P_2},\boldsymbol{t_2}),...,(\boldsymbol{P_n},\boldsymbol{t_n})$ $\boldsymbol{P_i}$ has normal distribution with a population mean:

$$\boldsymbol{HP = a_1 + a_2 t} \qquad \textbf{(1)}$$

and dispersion $Д_р$.

Theorem of Gauss-Markov says, that the estimation of a method of the least squares has the minimum dispersion in a class of all linear not displaced estimations of parameters a_1 and a_2.

For a finding of parameters a_1 and a_2 from the equation **(1)** the following matrix expression is used:

$$\begin{pmatrix} a_1 \\ a_2 \end{pmatrix} = \begin{pmatrix} n & \sum t_i \\ \sum t_i & \sum t_i^2 \end{pmatrix}^{-1} \begin{pmatrix} \sum P_i \\ \sum P_i t_i \end{pmatrix} \quad (2)$$

Solving the equation **(2)**, we will define values of parameters a_1 and a_2:

$$a_1 = \frac{\sum P_i \sum t_i^2 - \sum P_i t_i \sum t_i}{n \sum t_i^2 - (\sum t_i)^2} \quad (3)$$

$$a_2 = \frac{n \sum P_i t_i - \sum P_i \sum t_i}{n \sum t_i^2 - (\sum t_i)^2} \quad (4)$$

The dispersion of random variable P is defined under the formula:

$$Д_p = \frac{1}{n-1} \sum (HP_i - P_i)^2 \quad (5)$$

Size of mean square deviation of random variable P from its mathematical expectation HP is defined as:

$$\theta = \sqrt{Д_p} \quad (6)$$

The error of prolongation of function HP will be equal to a square root from a dispersion of random variable. Thus, the prediction error will be that more than more period of a prediction. The mean square deviation, prolonged on an interval of time Δt of size P is defined under the formula:

$$\theta_s = \sqrt{Д_p + Д_p (a_1 \Delta t)^2} \quad (7)$$

For definition of factor of plural correlation, it is necessary to use the following dependences:

$$r_m = \frac{\sum (a_1 + a_2 t_i)^2}{\sum P_i^2} \quad (8)$$

Now, knowing a population mean of size P and its dispersion at the moment of time t_p (Forecast date), i.e. the sizes completely defining normal distribution $H(P, HP, Д_p)$, it is possible to define probability (ω) that random variable P, distributed under the normal law, will be for the settlement moment of time in a certain interval of values:

$$\omega (a \le P \le b) = \frac{1}{\sqrt{2\pi\theta}} \int_a^b e^{-(P-HP)^2/2\theta^2} dP \quad (9)$$

The forecasting interval gets out of conditions of full loss by liquidity and solvency bank, i.e. a full exhaustion of its own capital.

Thus, the bottom limit of integration $a = P_k$, and top b - infinity.

Probability **((ω)** it is possible to express through integral of probabilities:

$\Phi(t) = \sqrt{\frac{2}{\pi}} \int_0^t e^{-\frac{s}{2}} ds$ **(10)**

For definition of values of this integral of probabilities, there are detailed tables (*) on which values of probability are defined (Sarathy & Banalieva, 2014; STEP, 2014; Vakhabov & Bobakulov, 2009). If in expression for definition of probability **(9)** to make the following substitution:

$s = \frac{P-HP}{\theta}$ or $s = \frac{a-HP}{\theta}$

Probability of a finding of random variable P in the range from ***(a)*** indefinitely (∞) it is possible to express that through tabular function $\Phi(t)$ as follows:

$\omega\ (a \le P \le \infty) = \Phi\left(\frac{\infty-HP)}{\theta}\right) - \Phi\left(\frac{a-HP)}{\theta}\right)$ **or** $\omega\ (a \le P \le \infty) = 0{,}5 - \Phi\left(\frac{a-HP)}{\theta}\right)$, **(11)**

where $\Phi\left(\frac{\infty-HP)}{\theta}\right) = 0{,}5$.

Thus, value of probability necessary for us is defined on a parity **(11)** with use of the table for definition of values of function$\Phi\left(\frac{a-HP)}{\theta}\right)$.

The received value of probability also will be that value which defines probability of preservation by bank of the solvency and liquidity, i.e. probability of liquid functioning (Abdukarimov B.A, 2013; A. V. Akimov & Dollery, 2006; Berger & Humphrey, 1991).

Probability **(ω)** that until the moment of time t_p the bank will be solvent, i.e. will not suffer bankruptcy, it is defined by substitution of tabular value of integral of probabilities in the formula **(11)**.

The rating approach to an estimation calculation of probability of liquidity of functioning of commercial banks

In table 1 the application example described techniques for probability definition is resulted is liquid functioning of six commercial banks and results of calculations of sizes:

Table 1. Calculation of probability of liquid functioning of commercial banks

	a_1	a_2	θ	r_m	P_p	θ_p	s	ω
Bank№ 1	0,6499	- 0,0063	0,1389	0,033	0,5491	0,1389	1,2892	0,9013
Bank№ 2	0,6826	- 0,0233	0,1520	0,280	0,3098	0,1524	- 0,3951	0,3464
Bank№ 3	0,6832	0,0046	0,1145	0,026	0,7568	0,1146	3,3778	0,9996
Bank№ 4	0,7401	- 0,0216	0,0555	0,714	0,3945	0,0556	0,4405	0,6702
Bank№ 5	0,4388	- 0,0037	0,0422	0,111	0,3796	0,0422	0,2274	0,5899
Bank№ 6	0,5376	0,0077	0,1790	0,030	0,06608	0,1791	1,6241	0,9478

In table 2 is given the list of commercial banks in process of decrease of size of probability of their liquid functioning within three months following December 31st, 2013.

Table 2. Rating of liquidity of commercial banks according to size of probability of their liquid functioning

Rating place	**1**	**2**	**3**	**4**	**5**	**6**
Bank №	Bank № 3	Bank № 6	Bank № 1	Bank № 4	Bank № 5	Bank № 2
Probability $\omega(a \leq P \leq \infty)$	0,9999	0,9878	0,9113	0,6702	0,5899	0,3464

From table 2 it is visible, that liquidity of functioning of the banks, which have taken places in a rating of liquidity with 1 on 3, does not raise the doubts; liquidity of the banks, which have taken places in a rating with 4 on 5, can cause fears. The banks taking in a rating of liquidity of a place 6, are in critical, From the point of view of liquidity, position (Vakhabov & Bobakulov, 2009).

Change of value of parameters in the equation **(1)** influences value of function $\boldsymbol{HP}$. When parameters $\boldsymbol{a_1}$ and $\boldsymbol{a_2}$ in this equation **(1)** grows on certain quantity, quantity $\boldsymbol{HP}$ grows accordingly. By means of imitation of parameters $\boldsymbol{a_1}$ and $\boldsymbol{a_2}$ during one time, change the data given to function will change at a time. If this process repeats sometimes the flexible (elastic) factor is formed.

For definition of flexible (elastic) factor of the equations relative growth of one of factors is defined by the relation of relative growth of liquidity of bank. We will assume, if parameter $\boldsymbol{a_1}$ has grown on 10 % function $\boldsymbol{HP}$ grows on relative quantity. However many was parameters participating in the equation, each of them and in the place is used in due time. As a result, on each parameter of the equations there is a flexible (elastic) factor.

Means, when the quantity of parameters participating in the equations grows and liquidity of commercial bank leads to high flexible (elastic) factor $\boldsymbol{\omega}$.. If volume of liquidity of bank below growth of factors, then $\boldsymbol{\omega}$<1. By check flexible (elastic) factor at once several parameters, it is possible to define the sum flexible (elastic) factors. If $\boldsymbol{\omega}$. > 1, on a number with the size of parameters, the size of liquidity of banks grows also.

By means of the equations **(1)** there is a possibility of the short-term, intermediate term and long-term forecast of liquidity of commercial bank. Here operating system $\boldsymbol{HP}$ by the analysis and synthesis of a supply with information of object, accepts the decision on liquidity of bank in the near future, operated system $\boldsymbol{a_1}$ and $\boldsymbol{a_2}$directly carries out execution of decisions accepted by operated system. By imitation of the equations **(1)**, there is a possibility of the control and the forecast of liquidity of bank in the near future (A. Akimov & Dollery, 2009, 2009; De Nicoló et al., 2003).

CONCLUSION

In the given work the technique of forecasting of a financial condition of commercial bank according to which liquidity of commercial bank is defined by probability of the event, consisting is proved what to be during a certain interval of time in the near future will be liquid to function taking into account influence of casual parameters (A. V. Akimov & Dollery, 2006; Sarathy & Banalieva, 2014).

Thus, the complex approach to consideration of commercial bank as the difficult dynamic system functioning in changing conditions of the market environment, has allowed to make the developed definition of liquidity of commercial bank, to open the maintenance of its liquidity and to apply the methods of research widely used in the theory of management by difficult systems. The complex approach has defined also to main principles of construction of a rating of liquidity, which gives to its users not only a comparative estimation of a current condition of banks, but also allows to judge liquidity of their financial position in the future.

Further research scope will cover economic perspectives of banks in Uzbekistan, Central Asia as well. On this way, this study will serve on the development of the region that could lead also to better life standard of people. The way of the deployment will be constructed under the policy of banking and finance.

To sum up, paper will be major instructive one while constructing banking facilities in the region. Working out methods of the construction of a liquidity in rating while functioning commercial banks of Uzbekistan will be diffused globally

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