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## INNOVATIONS IN MANAGEMENT OF BANKS DEPOSIT PORTFOLIO: STRUCTURE OF CUSTOMER DEPOSIT

**Abstract.** *The economic and statistical analysis of the bank's deposit portfolio by the structure of deposits has been performed. An algorithm for grouping deposits by type of client, amount, maturity and interest rate is proposed and tested. A technique is proposed for analysing the influence of the type of forming factors: the amount, term and interest rate on the change in the number of dividends on a bank deposit. The influence of each type of deposit on the overall increase in interest payments is determined. The purpose of the article is to improve the methodological approach to the effective management of the bank's deposit portfolio using the economic and statistical analysis of the structure of deposits. A study of the literature shows that insufficient attention is paid to the formation of an optimal deposit portfolio of the bank. The relevance of the article lies in need to use the mathematical apparatus to optimise the process of managing the borrowed funds of customers. The tendency of changes in the amounts of balances, volumes of inflow and subsidence of deposits of corporate clients and individuals in the bank is analysed. The methodology for grouping deposits by amounts, interest rates, and investment terms has been improved, which allows structural positioning changes in the total amount of the bank's deposit portfolio. A technique is proposed for studying the influence of factors on the structure of deposits in a bank. The methodology of index factor analysis has been improved to study the structure of deposits in the bank. For the analysis of cash flows, the average storage period and average deposit balances for a certain period are determined. The index of average duration of use of a variable composition deposit is calculated. The economic effect for the bank from increasing the terms of attracting financial resources is calculated. A set of indicators has been proposed for assessing the effectiveness of managing customer funds raised. The study is based on a combination of statistical and economic-mathematical methods of analysis, a system-structural approach (systematisation, grouping and ranking, analysis of time series, scientific abstraction). Presented various marketing tricks that bank depositors may meet. The developed methodological provisions of a statistical study of the structure of deposits can be used in modelling and forecasting the results of financial institutions. Practical recommendations allow us to give an objective assessment of the state of the resource base of the bank in terms of effective management of funds of individuals and corporate clients.*

**Keywords:** analysis, bank, monetary resources, deposit, efficiency, customers, portfolio, interest, amount, term, management.

**Introduction.** The current situation in the Ukrainian banking system is far from the positive comments expected from the government. The National Bank of Ukraine keeps the discount rate at a high level; this affects the management of interest rates on deposits. Rates on deposits depend on the current inflation rate, as well as on the bank's need for cash resources. The following factors influence the dynamics of the profitability of bank deposits: growth in lending rates, which requires the attraction of additional resources; hryvnia exchange rate volatility against foreign currencies; the rising cost of resources in the interbank market. The task of banks is to

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ensure a constant circulation of money and capital, to finance industrial and agricultural enterprises, as well as to provide a wide range of opportunities for investment funds with a view to their accumulation.

The peculiarity of the Ukrainian economy is that the primary legal money resources are attracted by banks in the process of working with clients (the so-called liabilities) owned by the population and large enterprises. In an unstable economy, when legal entities either hide their income or are really on the verge of bankruptcy, one of the main types of borrowed funds is deposits of individuals. The need for effective management, forecasting and support of the optimal structure of deposits of legal entities and individuals in banks (micro-level) in order to avoid social upheaval and "filling" the economy with real money in the form of bank loans (macro-level) determined the relevance of the article, its scientific and practical value.

**Literature Review.** Many models describe the reasons for the outflow of deposits from banks. The basic models that describe the nature of financial panic are: models in which destabilisation in the deposit market is associated with insolvency or bankruptcy of banks; models in which destabilisation in the deposit market is associated with the inability of banks to fulfil current obligations on time due to a loss of liquidity (Diamond and Dybvig, 1983). The causes and signals of changes in the expectations of economic agents for the return of deposits at any time were considered in (Bhattacharya et al., 1987; Chari and Jagannathan, 1988). Scientists had proven that crises in the deposit market arose precisely now when the demand for money was higher (Miron, 1986). The model of the monetary demand function, which includes the maximum level of interest rates as an exogenous variable, is presented in (Ajanthan, 2013; Andros, 2015). Scientists in their work used the difference between the current level of interest rates and the moving average of current and past interest rates for  $n$  periods (Simpson and Porter, 1980). Ratio "ratchet" was significant in the models. The equation showed fewer standard errors, better suitability than traditional models. A similar asymmetry in the functions of money demand was observed in empirical studies on countries with high inflation (Piterman, 1988; Melnick, 1990; Ahumada, 1992). Instead of the maximum interest rates, the effect of inflation management on real money was considered, the maximum inflation rate or the maximum depreciation of the exchange rate was used. The paper notes that a crisis occurs when the business cycle is close to its peak, and the scientist suggests that changes in the expected profitability of enterprises lead either to a reduction in lending or to a banking crisis (Polodoo et al., 2015). The formalisation of observational data using the short-term contribution management model is given in (Bostandzic et al., 2014). In the model presented in (Dash et al., 2017), the asymmetry of information between the bank and the depositor is indicated as a source of panic. As the economy moves toward a recession, depositors note a decline in business profits and expect a banking crisis to occur because banks have already invested in a troubled business (Kotenko et al. 2015). To avoid possible losses, investors withdraw their funds. In work, it was proved that instability is a «special event», and in this case, the statistical data that are observed in a stable period and period is characterised by an outflow of funds generated by various «economic systems» (Laeven et al., 2016). If various «economic systems generate the data», then the only way to evaluate such crises is the effective management and use of the Markov model (Bezborodova, 2015).

**Statement of a problem.** One of the fundamental goals of the bank is the formation of sources of cash resources, i.e. liabilities. To achieve these goals, the bank must have enough of its financial resources, as well as attract funds from various sources (Melnyk et al., 2017). The main objectives of the bank in the field of effective management of the deposit portfolio are attracting as large amounts of cheap and reliable resources as possible, as well as maintaining the optimal ratio between the size of own and borrowed funds. The bulk of the attracted resources of banks are customer deposits. The deposit plays an essential role in the bank's resource policy since the volume and structure of the bank's assets, and its profitability depend on the volume and quality of the funds raised.

**Results.** In the banking sector, economic and statistical analysis was used to determine the characteristics of the borrower, repay the loan on time, and split into a separate group those borrowers

who did not pay or repay the loan with a delay. The results of the study were used to make decisions on new borrowers according to the existing characteristics of the borrowers, repaid or did not repay the loan (Duca and Peltonen, 2013). The economic and statistical analysis of deposits using factor indices will make it possible to select the most informative financial ratios from the adopted sample and, on their basis, assign enterprises to a particular risk group (Fitri et al., 2016). It is advisable to start the analysis of the deposit portfolio with market segmentation according to individual characteristics of customers: legal entities by industry (small, medium, the large average balance in the client's account or total monthly turnover for the client's account) (Yegon et al., 2014). The information base for the analysis is the data of the annual financial statements of VS Bank (Interim Condensed Income Statement «VS Bank», 2018). Let us analyse the deposit portfolio of VS Bank by the composition and structure of deposits (Table 1).

**Table 1. The structure of the deposit portfolio of VS Bank, 2017-2018, mln UAH**

Type of deposit	For the period 31.12.2017			For the period 31.03.2018		
	The amount, mln UAH	Share by types of customers, %	The proportion of the portfolio as a whole, %	The amount, mln UAH	Share by types of customers, %	The proportion of the portfolio as a whole, %
Current accounts/demand accounts of individuals (I)	122,100	30,95	12,43	98,267	22,25	6,47
Term deposits I	272,425	69,05	27,75	343,350	77,75	22,62
Total funds of individuals	394,525	100	40,2	441,617	100	29,095
Current and settlement accounts of corporate clients (CC)	546,369	93,07	55,66	964,189	89,59	63,525
Term deposits CC	40,716	6,93	4,14	112,002	10,41	7,379
Total funds of corporate clients	587,085	100	59,8	1076,191	100	70,9
Total funds in the bank's portfolio	981,61	100	100	1517,808	100	100

Source: developed by the authors.

The data in table 1 show that in 2017, the largest share in the structure of term deposits is held by deposits of individuals (69.05%), and in the structure of current and settlement accounts – deposits of corporate clients (93.07%). In 2018, the structure of deposits as a whole did not undergo significant changes. Now such a structure of the portfolio of deposits is quite typical for domestic banks. For the period 2017-2018, the current and settlement accounts of corporate clients (55.7% and 63.5 respectively) and term deposits of individuals (27.8% and 22.6% in accordance) play a decisive role in the formation of VS Bank's deposit portfolio. The role of other types of deposits ranges from 4% to 13%. It cannot recognise this structure of deposits as optimal since most of the resources with indefinite terms of attraction. The movement of deposits in 2018 is shown in Table 2. The data in table 2 show that in 2018, the volume of attracted resources as a whole for the deposit portfolio decreased by 68.3% (100-31.7). Current accounts/demand accounts of individuals and current and settlement accounts of corporate clients of individuals significantly decreased by 41.1% (100-58.9) and 77.3% (100-22.7), respectively. The same applies to term deposits of individuals – the pace decreased by 73.16% (100-26.84).

The current dynamics, on the one hand, may indicate significant miscalculations of the bank in the management, control and monitoring of borrowed funds. However, on the other hand, the frequency of

attracting VS Bank deposits, their volume and value depend on factors directly or indirectly related to the state of the Ukrainian economy: inflation, the degree of investment activity of entities, and the monetary policy trends of the National Bank of Ukraine.

**Table 2. Movement of deposits of VS Bank, 2018, UAH million**

Type of deposit	The balance of deposits for the period 31.03.2018, mln UAH	The balance of deposits for the period 30.09.2018, mln UAH	Average deposit balance for 2018, mln UAH	The growth rate of deposit balances, %
Current accounts/demand accounts of individuals (I)	98,267	57,896	78,082	58,9
Term deposits I	343,350	92,160	217,76	26,84
Total funds of individuals	441,617	150,056	295,84	33,98
Current and settlement accounts of corporate clients (CC)	964,189	218,810	591,5	22,7
Term deposits CC	112,002	112,002	112,002	100,0
Total funds of corporate clients	1076,191	330,812	703,502	30,74
Total funds in the bank's portfolio	1517,808	480,868	999,338	31,68

Source: developed by the authors.

The above factors should be considered by top managers of the bank when making appropriate management decisions on the efficient use of customer resources. The data in Table 2 indicate that by the end of 2018, deposit balances decreased in the whole deposit portfolio by UAH 1 036.94 million (480.868-1517.808). The average deposit balance (D) for 2018 amounted to:  $D = (\text{balance of deposits for the period 31.03.2018} + \text{balance of deposits for the period 30.09.2018}) / 2 = (480.868 + 1517.808) / 2 = 999.338$  million UAH. The indicators of turnover of attracted resources of VS Bank in 2018 are presented in Table 3.

**Table 3. Indicators of turnover of deposits VS Bank, 2018, mln UAH**

Type of deposit	Average deposit balance for 2018, UAH mln	Deposits issued UAH mln	The average shelf life of deposits, days	The number of turns making deposits
Current accounts/demand accounts of individuals (I)	78,082	125,268	224,44	1,6
Term deposits I	217,76	641,488	122,2	2,95
Total funds of individuals	295,84	766,756	138,9	2,59
Current and settlement accounts of corporate clients (CC)	591,5	1329,443	160,17	2,25
Term deposits CC	112,002	185,432	217,48	1,66
Total funds of corporate clients	703,502	1514,875	167,19	2,15
Total funds in the bank's portfolio	999,338	2281,631	157,68	2,28

Source: developed by the authors.

Two indicators characterise the effectiveness of deposit operations: the number of deposits turnover in hryvnias and the duration of one turnover of deposits per period (shelf life of the deposit hryvnia) (Ghosh, 2015). The number of revolutions (n) that deposits will make:

$$n = TI_D \div D. \quad (1)$$

where  $TI_D$  – turnover on the issue of deposits (the number of issued deposits for the period).

The number of turnovers of deposits shows how many times the funds of depositors have been handled over the period. The number of deposits turnover is a direct characteristic of the turnover of deposits. The more turnover deposits are made over a certain period, the more efficiently the bank manages the borrowed funds of customers. The data in table 3 show that in 2018, the number of turns on term deposits of individuals and corporate clients was 2.95 and 1.66 turns, respectively. The number of turnover of deposits on current accounts of individuals and corporate clients amounted to 1.6 and 2.25 turnover, respectively. In general, for the deposit portfolio in 2018, the number of turnovers on deposits amounted to 2.28 turnovers (2.281.631/999.338). The current dynamics indicate that in 2018, VS Bank effectively managed the borrowed funds of customers. The average shelf life of deposits per year (T) is determined by the formula (Morris et al., 2016):

$$T = D \div (TI_D \div m). \quad (2)$$

where T – is the shelf life of deposits.

This indicator characterizes the average duration (in days or years) of one turnover of deposits and is an inverse characteristic of the velocity of circulation of deposits. As can be seen in Table 3, in general, for the deposit portfolio in 2018, the average deposit term at the bank is short and amounts to 157.68 days [999.338/(2281.631/360)]. The current dynamics indicate significant shortcomings of VS Bank in the management, control and monitoring of the shelf life of customer deposits. The deposit policy of the bank, in our opinion, requires significant adjustment. It determines the average storage periods of deposits by their types and the number of turns that they will make during the year. The turnover indicators of deposits are interconnected: if  $T = m / n$ , then  $n = m / t$ , then  $T = 360 / 2.28 = 157.7$  days and  $n = 360 / 157.7 = 2.28$  revolutions. The difference between the receipt and disposal of deposits, the value of the balance of deposits at the end of the period and the beginning of the period is called the sum of the inflow of deposits (Anghelache and Oanea, 2016). This indicator shows the absolute increase in the resource base of the bank and to some extent characterises the effectiveness of the bank in attracting financial resources (Table 4).

**Table 4. Inflow or outflow of deposits of VS Bank, 2018, mln UAH**

Type of deposit	The amount of inflow (outflow) of deposits	Over deposits for the period of 30.06.2018	Deposits were issued	The average shelf life of deposits, days	The average daily inflow of deposits
Current accounts/demand accounts of individuals (I)	-40,371	84,897	125,268	224,44	-0,17
Term deposits I	-251,19	390,298	641,488	122,2	-2,1
Total funds of individuals	-291,561	475,195	766,756	138,9	-2,06
Current and settlement accounts of corporate clients (CC)	-745,379	584,064	1329,443	160,17	-4,65
Term deposits CC	0	185,432	185,432	217,48	0
Total funds of corporate clients	-745,379	769,496	1514,875	167,19	-4,46
Total funds in the bank's portfolio	-1036,94	1244,691	2281,631	157,68	-6,58

Source: developed by the authors.

$$AD_{inflow} = BD_{end} - BD_{beginning} = I_D - D_D \quad (3)$$

where  $AD_{inflow}$  – is the amount of deposits inflow;  $BD_{end}$  – the balance of deposits at the end of the period;  $BD_{beginning}$  – the balance of deposits at the beginning of the period;  $I_D$  – inflow of deposits;  $D_D$  – disposal of deposits.

The data in table 4 show that for the analysed period of 2018, the amount of outflow of deposits from VS Bank amounted to UAH 1,036.94 million (1244,691-2281,631) or (480,868-1517,808). In particular, on deposits in current and settlement accounts of corporate clients, there was an outflow of deposits in total (-745.379 million UAH). At the same time, there is a massive outflow of term deposits of individuals (-251.19 million UAH) and deposits on current accounts of individuals (-40.371 million UAH).

For a more in-depth analysis of the effectiveness of managing banking operations on the receipt and disposal of deposits, it is proposed to use the tide and sedimentation coefficients of deposits.

The coefficient of deposit inflow is determined as the percentage of the amount of inflow of deposits for the reporting period to the balance of deposits at the beginning of the period.

$$C_{inflow} = (A_{inflow} \div B_{beginning}) \times 100\% \quad (4)$$

where  $C_{inflow}$  – is the coefficient of deposit inflow;  $A_{inflow}$  – the amount of inflow of deposits for the reporting period;  $B_{beginning}$  – the balance of deposits at the beginning of the period.

The sedimentation coefficient of deposits is obtained by comparing the amount of inflow of deposits with the total amount of inflow of deposits for the period:

$$C_{sedimentation} = (A_{inflow} \div I_D) \times 100\% \quad (5)$$

where  $C_{sedimentation}$  – is the sedimentation coefficient of deposits;  $A_{inflow}$  – the amount of inflow of deposits for the reporting period;  $I_D$  – inflow of deposits for the period.

The coefficient of deposit inflows shows an increase for deposits concerning their value at the beginning of the period, and the coefficient of deposits - concerning the value of the inflow of deposits for the period (Table 5).

**Table 5. The coefficients of inflow and sedimentation of deposits "VS Bank", 2018, mln UAH**

Type of deposit	Deposits received on 30.06.2018	Issued deposits	Deposit inflow ratio, %	Deposit settlement ratio, %
Current accounts / demand accounts of individuals (I)	84,897	125,268	-41,1	-47,6
Term deposits I	390,298	641,488	-73,2	-64,4
Total funds of individuals	475,195	766,756	-66,0	-61,4
Current and settlement accounts of corporate clients (CC)	584,064	1329,443	-77,3	-127,6
Term deposits CC	185,432	185,432	0	0
Total funds of corporate clients	769,496	1514,875	-69,3	-96,9
Total funds in the bank's portfolio	1244,691	2281,631	-68,3	-83,3

Source: developed by the authors.

The data in table 5 show that the coefficient of inflow (outflow) of deposits amounted to: -68.3% [(-1036.94/1517.808)\*100%]. The sedimentation coefficient of deposits was -83.3% [(-1036.94 / 1244.691) \*100%].

This trend indicates significant gaps of VS Bank in the management, control and monitoring of the use of attracted customer resources. The deposit policy of the analysed bank in this direction requires significant improvement. Top managers of the bank need to study the dynamics of balances carefully, the inflow and sedimentation of deposits for at least two to three years and associate it with a change in the overall economic situation in the country, the level of banking competition by the goals and specialisation of VS Bank.

The activity of depositors, the magnitude of the inflow (outflow) and precipitation of deposits depend on the level of interest rates, inflation expectations, and the possibility of alternative investments, the level of banking competition, public confidence in banks and other factors (Hautsch et al., 2015).

Banking specialists need to carefully study the terms of attraction, the dynamics of deposits and interest rates and associate it with a change in the general economic situation in the country, increased banking competition, and the level of qualification of banking management. The amount of interest on deposits can be represented as a product of the following indicators: the amount of the deposit, the term of the deposit (expressed in shares of the year) and the interest rate on the deposit, expressed in ratios. The interest rate on deposits can be expressed as the product of the interest rate on an annualised basis and the number of turnovers of deposits during the year (Driscoll and Judson, 2013).

The analyse of the deposit base of the bank according to the following parameters: amount, term and interest rate. As know, the amount of interest payments is determined by the formula (Trivedi, 2015):

$$IP = (A_D \times T \times I_R) \div (360 \times 100). \quad (6)$$

where  $IP$  – the sum of interest payments;  $A_D$  – is the deposit amount, mln UAH;  $T$  – the term of the deposit, days;  $I_R$  – the interest rate on the deposit in %; 360 – the number of days that make up the fiscal year.

To transform formula 6 as follows:

$$IP = (A_D \times T \times I_R). \quad (7)$$

where  $A_D$  – is the deposit amount, mln UAH;  $T$  – is the term of the deposit, in shares of the financial year, that is ( $T / 360$ );  $I_R$  – is the interest rate on the deposit, presented as a coefficient, that is ( $P / 100$ ).

Using formula 7, the index of change in interest payments ( $I_{IP}$ ) could be calculated:

$$I_{IP} = \sum \frac{D_1 T_1 P_1}{D_0 T_0 P_0} \times Y_{Ri}. \quad (8)$$

where  $D_0$  and  $D_1$  – the number of deposits in the base and reporting periods, mln UAH;  $T_0$  and  $T_1$  – the term of deposits in the base and reporting periods, in shares of the year;  $P_0$  and  $P_1$  – the interest rate on deposits, expressed in ratios;  $Y_{Ri}$  is the specific weight of each ( $D_1 T_1 P_1 / D_0 T_0 P_0$ ) element in the sum ( $D_1 T_1 P_1 / D_0 T_0 P_0$ ).

This formula allows comparing the interest payments of the reporting period with the base period and identifies the influence of the following factors: amounts, terms of attracting deposits and the level of interest rates (Table 6).

Table 6. Composition of the deposit portfolio of VS Bank, 2018, UAH mln

Type of deposit	For the period of 31.03.2018			For the period of 31.09.2018		
	Deposit amount, mln UAH	Term for attracting deposits, days / share	Interest rate, % (coefficient)	Deposit amount, mln UAH	Term for attracting deposits, days / share	Interest rate, % (coefficient)
Current accounts / demand accounts of individuals	98,267	31 (0,086)	12 (0,12)	57,896	92 (0,255)	14,5 (0,145)
Term deposits of individuals	343,350	122 (0,3388)	13 (0,13)	92,160	183 (0,508)	15 (0,15)
Current and settlement accounts of corporate clients	964,189	213 (0,5916)	14 (0,14)	218,810	274 (0,76)	15,5 (0,155)
Term deposits of corporate clients	112,002	304 (0,844)	15 (0,15)	112,002	365 (1,0138)	16 (0,16)

Source: developed by the authors.

We calculate interest payments by types of clients and years of the period, using formulas 6-8 (Table 7). Define the index of changes in interest payments in 2018:

$$I_{IP} = \frac{(57,896 \cdot 0,255 \cdot 0,145) / (98,267 \cdot 0,086 \cdot 0,12) \cdot Y_{R1} + (92,160 \cdot 0,508 \cdot 0,15) / (343,350 \cdot 0,3388 \cdot 0,13) \cdot Y_{R2} + (218,810 \cdot 0,76 \cdot 0,155) / (964,189 \cdot 0,5916 \cdot 0,14) \cdot Y_{R3} + (112,002 \cdot 1,0138 \cdot 0,16) / (112,002 \cdot 0,844 \cdot 0,15) \cdot Y_{R4}}{(2,1407 / 1,014) \cdot Y_{R1} + (7,022 / 15,12) \cdot Y_{R2} + (25,77 / 79,85) \cdot Y_{R3} + (18,167 / 14,179) \cdot Y_{R4}} = 2,11 \cdot Y_{R1} + 0,46 \cdot Y_{R2} + 0,32 \cdot Y_{R3} + 1,28 \cdot Y_{R4} = 2,11 \cdot 0,506 + 0,46 \cdot 0,1103 + 0,32 \cdot 0,077 + 1,28 \cdot 0,3069 = 1,0676 + 0,0507 + 0,0245 + 0,3929 = 1,54$$

According to our estimates, interest payments on deposits since the beginning of 2018 have increased by 1.5 times compared to the end of 2018, or by 53.6%. The increase in interest payments on deposits was affected by the increase in terms of attraction and the growth of interest rates since the amounts on deposits decreased significantly.

Traditionally, deposit rates rise at the end of the year, depending on the type of deposit, when banks try to increase the volume of balances and improve liquidity indicators. A financial instrument in this regard is special deposit programs with higher returns. Now widespread deposits for up to six months. To convince a client to place funds for a more extended period can only the impeccable reputation of the bank and its reliability. In this case, the interest rate does not play a decisive role - the preservation of funds and confidence in their return after the end of the deposit term come first.

We determine the effect of each type of deposit on the overall increase in interest payments.

1. Current accounts / demand accounts of individuals:  $1.0676 / 1.536 = 0.695$ , or 69.5%.
2. Term deposits of individuals:  $0.0507 / 1.536 = 0.033$ , or 3.3%.
3. Current and settlement accounts of corporate clients:  $0.0245 / 1.536 = 0.016$ , or 1.6%.
4. Time deposits of corporate clients:  $0.3929 / 1.536 = 0.256$ , or 25.6%.

Thus, the growth of the index of interest payments by 1.5 times (by 53.6%) was due to an increase in interest payments on deposits for 1.127 million UAH on current accounts of individuals and term deposits of corporate customers – 3.98 million UAH. In general, for the VS Bank's deposit portfolio, at the end of 2018, there was a significant decrease in interest payments by UAH 57.069 million compared to the beginning of 2018 (UAH 110.177 million). Given the above, the interest rate policy of the bank needs to be improved, since the deposit in the bank is an individual approach to the client, favourable interest rates and a reliable increase in the yield on the deposit.



**Table 7. Interest payments on deposits by types of clients of VS Bank, 2018, mln UAH**

Type of deposit	Interest amount as of 31.03.2018, mln UAH	Interest amount as of 30.09.2018, mln UAH	Interest growth, mln UAH
Current accounts/demand accounts of individuals (I)	1,014	2,141	+1,127
Term deposits I	15,123	7,023	-8,1
Total funds of individuals	16,137	9,164	-6,973
Current and settlement accounts of corporate clients (CC)	79,86	25,776	-54,084
Term deposits CC	14,18	18,168	+3,98
Total funds of corporate clients	94,04	43,944	-50,096
Total funds in the bank's portfolio	110,177	53,108	-57,069

Source: developed by the authors

The influence of factors on the change in the number of interest payments on deposits can be determined using the method of absolute differences. When using it, the magnitude of the influence of factors is calculated by multiplying the absolute increase in the studied factor by the base value of the factors that are to his right and the actual value of factors located to his left in the model (Sarath and Pham, 2015).

Consider a calculation algorithm for a multiplicative factorial model of the type:

$$Y = a \times b \times c. \quad (9)$$

Using basic and actual values for each factor indicator, we determine their absolute deviations:

$$\Delta a = a_1 - a_0, \quad (10)$$

$$\Delta b = b_1 - b_0, \quad (11)$$

$$\Delta c = c_1 - c_0. \quad (12)$$

The change in the value of the valid indicator for each of the factors is calculated using the following ratios:

$$\Delta Y_a = \Delta a \times b_0 \times c_0, \quad (13)$$

$$\Delta Y_b = a_1 \times \Delta b \times c_0, \quad (14)$$

$$\Delta Y_c = a_1 \times b_1 \times \Delta c. \quad (15)$$

In the formulas presented, the calculation is based on the consecutive replacement of the base values of factor indicators with their deviations, and then with the actual level of these indicators. Using the method of absolute differences, we determine the influence of factors (amount, term and interest rate) on the change in the number of interest payments on the deposit. As a result, we obtain the following.

1. The effect of increasing / decreasing the amount of attracted deposits:

$$\Delta IP_C = \sum (D_1 - D_0) \times T_{d0} \times P_0 = (57,896 - 98,267) * 0,086 * 0,12 + (92,160 - 343,350) * 0,3388 * 0,13 + (218,810 - 964,189) * 0,5916 * 0,14 + (112,002 - 112,002) * 0,844 * 0,15 = -0,4166 + (-11,06) + (-61,735) + 0 = -73,2 \text{ mln UAH.}$$

2. The effect of changing the timing of deposits:

$$\Delta IP_T = \sum D_1 \times (T_1 - T_0) \times P_0 = 57,896 \times (0,255 - 0,086) \times 0,12 + 92,160 \times (0,508 - 0,3388) \times 0,13 + 218,810 \times (0,76 - 0,5916) \times 0,14 + 112,002 \times (1,0138 - 0,844) \times 0,15 = 1,174 + 2,027 + 5,1586 + 2,853 = 11,212 \text{ mln UAH.}$$

3. The effect of bank interest rates:

$$\Delta IP_P = \sum D_1 \times T_1 \times (P_1 - P_0) = 57,896 \times 0,255 \times (0,145 - 0,12) + 92,160 \times 0,508 \times (0,15 - 0,13) + 218,810 \times 0,76 \times (0,155 - 0,14) + 112,002 \times 1,0138 \times (0,16 - 0,15) = 0,369 + 0,936 + 2,494 + 1,135 = 4,934 \text{ mln UAH.}$$

The decomposition of the number of interest payments into three factors amounted to -73.2; 11.212 and 4.934 million UAH. In total,  $\Delta R = -57.06$  million UAH. The total influence of these factors coincides with the result presented in Table 7. An analysis of the factor decomposition showed that a significant decrease caused the decisive influence on the decrease in interest payments in the amounts of attracted deposits on current and settlement accounts of corporate clients and term deposits of individuals: UAH 54.084 million and -8.1 million UAH, respectively. Due to this factor, interest payments decreased by 73.2 million UAH. An increase in the term of deposits and an increase in interest rates, on the contrary, led to an increase in interest payments by UAH 11.212 million and UAH 4.934 million, respectively.

Thus, in 2018, the bank experienced a significant decrease in interest payments on deposits. Because:

$$IP = (A_D \times T \times I_R) \div (360 \times 100) \quad (16)$$

then:

$$I_R = \left( \frac{IP}{A_D} \right) \times \left( \frac{360}{T} \right) \times 100\% \quad (17)$$

From here, we derive the index of changes in interest rates on deposits:

$$I_R = \sum \frac{(IP_1 / AD_1) \times n_1}{(IP_0 / AD_0) \times n_0} \times Y_{pi} \quad (18)$$

where  $IP_0$  and  $IP_1$  – the amount of interest on deposits in the base and reporting periods, mln UAH;  $n$  – is the number of turnovers of deposits during the year ( $360 / t$ );  $Y_{pi}$  – is the specific gravity of each element  $[(IP_1 / AD_1) \times n_1 / (IP_0 / AD_0) \times n_0]$  in the sum of  $[(IP_1 / AD_1) \times n_1 / (IP_0 / AD_0) \times n_0]$ .

The index of changes in interest rates in 2018 amounted to:

$$\left( \frac{(2,141/57,896) \times (360/92) / (1,014/98,267) \times (360/31)}{(7,023/92,160) \times (360/183) / (15,123/343,350) \times (360/122)} \right) \times Y_{P2} + \left( \frac{(25,776/218,810) \times (360/274) / (79,86/964,189) \times (360/213)}{(18,168/112,002) / (360/365) / (14,18/112,002) / (360/304)} \right) \times Y_{P4} = 1,349 \times Y_{P1} + 1,148 \times Y_{P2} + 1,106 \times Y_{P3} + 1,066 \times Y_{P4} = 0,29 + 0,25 + 0,24 + 0,23 = 1,01.$$

The results of the calculations show that interest rates have increased, but not significantly. Calculate the average deposit balances (O) (Sarath and Pham, 2015):

$$O_{average\ deposits\ balances} = \frac{0,5O_1 + O_2 + O_3 + \dots + O_{n-1} + 0,5O_n}{n-1} \quad (19)$$

where  $O_{adb}$  – the average balance of deposits for the period, UAH million;  $O_1, O_n$  – actual daily deposit balances at the beginning and end of the period, mln UAH;  $O_2, O_3, O_{n-1}$  – actual daily balances on other dates within the period, mln UAH;  $n$  – is the number of days in the period.

To analyse the cash turnover, we define the average storage period and average deposit balances for the year (Table 8).

**Table 8. Storage periods and deposit balances of VS Bank, 2018, UAH mln**

Type of deposit	The average shelf life of deposits for the year, days		2018	
	2017	2018	The average balance of deposits	Average daily deposit balance
Current accounts/demand accounts of individuals (I)	591,6	224,44	78,082	0,35
Term deposits I	890,9	122,2	217,76	1,78
Total funds of individuals	772,4	138,9	295,84	2,13
Current and settlement accounts of corporate clients (CC)	617,2	160,17	591,5	3,69
Term deposits CC	307,2	217,48	112,002	0,51
Total funds of corporate clients	529,9	167,19	703,502	4,21
Total funds in the bank's portfolio	620,3	157,68	999,338	6,34

Source: developed by the authors

According to table 8, there is a noticeable tendency to reduce the shelf life of deposits. The duration of the mobilisation of resources for the deposit portfolio in 2018 compared with 2017 decreased by 262.6 days (157.7-620.3) due to changes in the structure of deposits, as well as due to differences in the conditions of saving deposits. The terms for attracting deposits vary significantly by type of deposit and type of customer. It may be due to the goals of depositors and the attractiveness of deposit storage conditions for different customers, the specifics of the deposit policy of a particular bank, changes in the economic situation in the country, and other reasons. That is why the bank must study various factors of influence and trends manage them and act as an active participant in the deposit market. Define the index of the average duration of use of the deposit of variable composition:

$$I_t = \vec{t}_1 \div \vec{t}_0 \quad (13)$$

$$I_t = 157,7/620,3 = 0,254, \text{ or } 25,4\%.$$

The results of the analysis indicate that the terms for using deposits in 2018 compared to 2017 as a whole for the deposit portfolio decreased by 74.6% (100-25.4). Based on this, we consider the resource base of VS Bank to be unstable. The analysis carried out in the bank should be completed by calculating the reserves of growth of economic efficiency (Dash and Das, 2013). Using the indicator of the term for attracting deposits, we determine the economic effect of increasing the terms for attracting resources (ED) (Kjosevski and Petkovski, 2017). This indicator is calculated as the difference between the terms for attracting deposits in the reporting and base year times the amount of the average daily inflow of deposits in the reporting year. As a result, we get:

$$\vec{E}_D = (\vec{t}_1 - \vec{t}_0) \times C_{inflow.D} \quad (14)$$

where  $\vec{E}_D$  – economic effect;  $C_{inflow.D}$  – average daily inflow of deposits in the reporting year.

$$E_D = (157,7 - 620,3) \times (-6,58) = 3\,043,9 \text{ mln UAH.}$$

The economic effect (UAH 3,043.9 million) is associated with an increase in deposit settling and an increase in the terms for attracting deposits. Thus, using the index method could conduct a factor analysis of the deposit portfolio; determine the reserves of economic indicators. The technique presented in the article can help to identify most of the factors affecting the profitability of deposit operations and is a convenient addition to the classical financial analysis conducted in banks. In banking, the index method can be used not only in the analysis of deposit operations but also in the study of credit and foreign exchange transactions. The proposed methodology is relevant to the analytical work of banking personnel.

The recession of the economy, the fall in real incomes of the population and the withdrawal from the market of many banks have reduced the desire of the population and enterprises to keep deposits in banks. One of the reasons for the reluctance of the population to trust their funds to banks for a long time is the tight restrictions on their withdrawals. Customers are also unhappy with the limits. Limitations, indeed, psychologically affect all subjects, as they show that banks are not ready for the desired stability. Short-term investment in the bank allows customers to use their savings more efficiently. The bank needs to identify the causes of the situation and take appropriate management decisions to compensate for the outflow of deposits and adjust the level of interest rates. To keep customers, banks are forced to offer them high rates on deposits, even despite the reduction of inflation risks. Cash outflows can be prevented by introducing loyalty programs. It makes sense to open and place deposits in 2020, but at the same time give preference to short-term deposits. It needs to cooperate only with large reliable banks. Talking about lowering deposit rates as a trend is possible only in the case of the relative stability of the national currency and the absence of outflow of deposits. In banks, deposits are analysed using the usual methodology. Financiers calculate and analyse absolute deviations, growth and growth rates, the composition and structure of borrowed funds, including by type of customer, timing, and currency (Levchenko et al., 2019). At the same time, the turnover, inflow and draft ratios, reserves and the effectiveness of the use of deposits remain out of focus. However, it is the latest indicators that characterise the effectiveness of the deposit policy of the bank as a whole. Without calculating these indicators, the analysis will be purely superficial, many essential aspects of deposit management will escape the attention of managers, and the results of the resource policy will look quite safe, as volume indicators in the inflationary economy are growing. Meanwhile, in banks, the analysis of deposits should be carried out at the level of individual accounts, customers (counterparties), banking products, and market segments. The purpose of this analysis is to evaluate the deposit portfolio and formulate proposals for its optimisation by such parameters as least cost - maximum use - desired liquidity.

Many banks use various marketing tricks to attract investors. The staff in a conversation with a client knows well what needs to be emphasised and what to withhold. Recommendations: bank managers must ask direct and non-duplicative questions. Some banks offer a financial product that they, together with affiliated insurance companies, want to camouflage endowment insurance against a bank deposit. The uncertainty of words in advertising makes customers pay attention to a bank deposit. When it comes to the interest rate, customers should be aware that the right of the bank to change the interest rate unilaterally is prescribed in the conditions of the deposit. It is easy for the client to calculate the safe amount that can be deposited. Recommendations: if state guarantees are essential for the client, the client's bank accounts at a time in the same bank should not have amounts exceeding the insurance limit for the entire term of the deposit. Most banks offer deposits with a monthly capitalisation, that is, interest accrued during the month is added to the client's account. Some banks introduce daily capitalisation in order to draw attention to the deposit, emphasising the enormous profitability of the conditions for placing funds. When closing a deposit, the bank manager proposes to extend the contract on the same terms for the same period, and the interest rate on the client's deposit is higher than what is available in the bank at the time of closing. The tricks here lie in the fact that in case of early termination of the contract during the second term of the deposit, the client may lose interest accrued for both the first and second periods. Thus, customers should be able to evaluate the deposit conditions offered by banks critically.

**Conclusions.** As part of the study, based on economic and statistical analysis, it was found that in 2018 the number of attracted resources in the deposit portfolio of the bank decreased by 68.3%. Funds

on the accounts of individuals and corporate clients decreased by 41.1% and 77.3%, respectively. The number of revolutions on deposits amounted to 2.28 revolutions. The average shelf life of deposits is 157.68 days. The amount of the outflow of deposits from the bank amounted to 1036.94 million UAH. On deposits of corporate clients, there was an outflow of deposits in total (-745.379 million UAH). There is a massive outflow on deposits of individuals (-251.19 million UAH). The outflow ratio of deposits amounted to (-68.3%). The sedimentation rate of deposits amounted to (-83.3%) At the end of 2018, there was a significant decrease in interest payments (57.069 million UAH) compared with the beginning of 2018 (110.177 million UAH). A decisive influence on the decrease in interest payments (by 73.2 million UAH) was caused by a significant decrease in the amounts of attracted deposits of corporate clients and individuals: -54.084 million UAH and -8.1 million UAH, respectively. The terms for using deposits in 2018 compared to 2017 for the deposit portfolio decreased by 74.6%. The duration of the mobilisation of resources in general for the deposit portfolio in 2018 compared with 2017 decreased by 262.6 days due to changes in the structure of deposits, as well as due to differences in the conditions of deposit storage.

The economic effect (3,043.9 million UAH) is associated with an increase in precipitation and an increase in the terms for attracting deposits. In general, the bank's deposit portfolio by the structure of deposits for 2018 indicates the absence of relative stabilisation of deposits. The current dynamics, on the one hand, may indicate significant miscalculations of the bank in the management, control and monitoring of borrowed funds. On the other hand, the frequency of attracting VS Bank deposits, their volume and value depend on factors directly or indirectly related to the state of the Ukrainian economy: inflation, the degree of investment activity of entities, and the trends in the monetary policy of the National Bank of Ukraine. The listed factors must be considered by top managers of the bank when making appropriate management decisions on the efficient use of borrowed resources. The deposit policy of the bank requires a substantial adjustment.

**Author Contributions:** the analysis of the bank's deposit portfolio by the structure of deposits is carried out, S. A.; an algorithm is proposed for grouping deposits by type of client, amount, maturity and interest rate, A. L.; the influence of factors: the amount, term and interest rate on the change in the amount of interest payments on bank deposits is analysed, A. L.; the influence of each type of deposit on the overall increase in interest payments is determined, S. A.; the tendency of changes in the amounts of balances, volumes of inflow and subsidence of deposits of corporate clients and individuals in the bank is analysed, B. O.; the methodology for grouping deposits by the amounts, interest rates and terms of investment has been improved, S. A.; a technique is proposed for studying the influence of factors on the structure of deposits in a bank, B. O.; the technique of index factor analysis has been improved, S. A.; the average storage period and average deposit balances for a certain period are determined, A. L.; the index of average duration of use of a variable composition deposit is calculated, B. O.; the economic effect for the bank by increasing the terms of raising funds is calculated, B. O.; a set of indicators is proposed for assessing the effectiveness of managing clients' borrowed funds, A. L.; various marketing tricks that bank depositors may encounter are described, S. A.

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**S., Andros, L., Akimova, O., Butkevich. Innovations in Management of Banks Deposit Portfolio: Structure of Customer Deposit**

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**Інновації в управлінні депозитним портфелем банку: структура вкладів клієнтів**

Виконано економіко-статистичний аналіз депозитного портфеля банку за структурою вкладів. Запропоновано і апробовано алгоритм угрупування вкладів за типами клієнтів, сумах, строках та процентних ставках. Запропоновано методику аналізу впливу тип формуючих факторів: суми, терміну і процентної ставки на зміну суми процентних виплат за банківським вкладом. Визначено вплив кожного виду депозиту на загальне збільшення процентних виплат. Мета статті полягає в удосконаленні методологічного підходу до ефективного управління депозитним портфелем банку за допомогою економіко-статистичного аналізу структури вкладів. Дослідження літератури показує, що недостатньо уваги приділяється формуванню оптимального депозитного портфеля банку і управління ним. Актуальність статті полягає в необхідності застосування математичного апарату для оптимізації процесу управління залученими коштами клієнтів. Проаналізовано тенденція зміни сум залишків, обсяги припливу й осідання депозитів корпоративних клієнтів та фізичних осіб у банку. Удосконалено методику угрупування вкладів за сумами, відсотковими ставками і термінами вкладення коштів, яка дозволяє позиціонувати структурні зміни в загальній сумі депозитного портфеля банку. Запропоновано методику дослідження впливу чинників на структуру вкладів у банку. Удосконалено методику індексного факторного аналізу для управління структурою вкладів у банку. Для аналізу оборотності грошових коштів визначено середній термін зберігання і середні залишки депозитів за певний період. Розраховано індекс середньої тривалості користування депозитом змінного складу. Розраховано економічний ефект для банку від збільшення термінів залучення грошових коштів клієнтів. Запропоновано набір індикаторів для оцінки ефективності управління залученими коштами клієнтів. Дослідження базується на поєднанні статистичних і економіко-математичних методів аналізу, системно-структурному підході (систематизація, угрупування і ранжування, аналіз динамічних рядів, наукова абстракція). Представлені різні маркетингові хитрощі, з якими можуть стикатися банківські вкладники. Розроблені методологічні положення статистичного дослідження структури вкладів можуть бути використані при моделюванні і прогнозуванні результатів діяльності фінансово-кредитних установ. Практичні рекомендації дозволяють дати об'єктивну оцінку стану ресурсної бази банку в частині ефективного управління грошовими коштами фізичних осіб та корпоративних клієнтів.

**Ключові слова:** аналіз, банк, грошові ресурси, депозит, ефективність, клієнти, портфель, відсотки, сума, термін, управління.

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