

“Search for statistically approved criteria for identifying money laundering risk”

AUTHORS

Olesia Lebid  <https://orcid.org/0000-0002-6584-8390>

 <https://publons.com/researcher/M-5920-2018>

Oleksandr Veits  <https://orcid.org/0000-0003-3798-3816>

ARTICLE INFO

Olesia Lebid and Oleksandr Veits (2020). Search for statistically approved criteria for identifying money laundering risk. *Banks and Bank Systems*, 15(4), 150-163. doi:[10.21511/bbs.15\(4\).2020.13](https://doi.org/10.21511/bbs.15(4).2020.13)

DOI

[http://dx.doi.org/10.21511/bbs.15\(4\).2020.13](http://dx.doi.org/10.21511/bbs.15(4).2020.13)

RELEASED ON

Thursday, 17 December 2020

RECEIVED ON

Friday, 20 November 2020

ACCEPTED ON

Tuesday, 15 December 2020

LICENSE



This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

JOURNAL

"Banks and Bank Systems"

ISSN PRINT

1816-7403

ISSN ONLINE

1991-7074

PUBLISHER

LLC “Consulting Publishing Company “Business Perspectives”

FOUNDER

LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

46



NUMBER OF FIGURES

0



NUMBER OF TABLES

6

© The author(s) 2025. This publication is an open access article.



BUSINESS PERSPECTIVES



LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine
www.businessperspectives.org

Received on: 20th of November, 2020
Accepted on: 15th of December, 2020
Published on: 17th of December, 2020

© Olesia Lebid, Oleksandr Veits, 2020

Olesia Lebid, Ph.D., Professor, Banking and Financial Services Department, Simon Kuznets Kharkiv National University of Economics, Ukraine. (Corresponding author)

Oleksandr Veits, Ph.D., Junior Research Fellow, Research Sector, Simon Kuznets Kharkiv National University of Economics, Ukraine.



This is an Open Access article, distributed under the terms of the [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted re-use, distribution, and reproduction in any medium, provided the original work is properly cited.

Conflict of interest statement:
Author(s) reported no conflict of interest

Olesia Lebid (Ukraine), Oleksandr Veits (Ukraine)

SEARCH FOR STATISTICALLY APPROVED CRITERIA FOR IDENTIFYING MONEY LAUNDERING RISK

Abstract

The paper focuses on the theoretical justification and theoretical foundations of using statistical criteria for identifying money laundering risk as a tool to prevent and counteract the legalization of bank clients' proceeds.

The hypothesis is that the coefficient of variation can be appropriately used as an identifier for money laundering risk. To prove this hypothesis, a special methodology was used: generalization, grouping, statistical analysis of time series, and correlation analysis – to identify and analyze the hidden signs of the customer income legalization in the financial activities of a bank; mathematical statistics and scaling – to determine the quantitative values of risk levels for the use of bank services for legalizing customer income. The analysis of financial activities of 32 Ukrainian banks aimed at identifying money-laundering risks showed that banks in which the National Bank of Ukraine revealed suspicious transactions with money-laundering features (16 operating banks) had much higher coefficients of variation in the volume of cash flows, in cash flows for on-demand accounts of economic entities, in cash flows of on-demand accounts for individuals, compared with banks in which violations of legislation in the field of financial monitoring were revealed (eight banks), and with banks where violations were not found (eight banks). This proves that sudden changes in customer transaction volume can be a sign of money laundering risk.

Keywords money laundering, risk, risk-oriented approach, coefficient of variation, criteria of money laundering risk

JEL Classification G21, O17

INTRODUCTION

Legalization of proceeds of crime is a serious threat to the stability of any country's economy; it significantly reduces the financial security of the state and increases the risk of global socio-economic and political instability. Awareness of this fact prompts the international community to develop and take appropriate measures to limit and prevent money laundering. In Ukraine, such aspirations are enshrined in the "Strategy for the Development of the System of Prevention and Counteraction to Legalization (Laundering) of the Proceeds of Crime, Financing of Terrorism and Financing of Proliferation of Weapons of Mass Destruction until 2020" (Kordik & Kurilovska, 2017) and in the terms of measures to implement this strategy (JSC CB "PRIVATBANK", 2018). However, the rapid development of information technology, increased mobility of financial resources, virtualization of certain types of business activities require constant improvement of processes and tools to prevent and combat money laundering. Leading professionals, specialists and experts in money laundering realize that most counteraction mechanisms are performed ex post facto, that is, after the identification and definition of typological schemes and methods of legalization, and often after a series of specially conducted investiga-

tions and relevant court decisions. In this regard, it is almost impossible to talk about the existence of effective and well-functioning precautionary or preventive measures: when the public becomes aware of an improved or new scheme or method of money laundering, criminals find new ways to withdraw funds from the shadow economy. The process of combating money laundering is further complicated by the fact that criminal money laundering schemes usually involve a significant number of participants subordinate to various agencies, ministries, and often states. Therefore, the state system of financial monitoring, which is designed to combat money laundering and coordinate the activities of various entities, includes public authorities of various branches and a wide range of primary level entities.

1. LITERATURE REVIEW

Banking institutions play one of the leading roles among the subjects of primary financial monitoring. They carry out the vast majority of cash transactions in Ukraine and provide 96% or more of information about suspicious financial transactions. In 2017–2018 alone, UAH 33.26 billion was legalized with the help of bank services. For these reasons, the issue of preventing and counteracting the legalization of income of bank customers is constantly relevant, and for the proper implementation of the functions of internal financial monitoring, it is necessary to create effective systems for preventing and combating money laundering. Risk assessment is one of the important functions of such systems. For its proper implementation, it is necessary to collect and process a large array of information, turn it into data that is the basis for identifying and measuring the level of money laundering risk. The set of initial data for analysis also depends on what the analyst or employee of the internal banking system of financial monitoring wants to receive after completion of the identification and measurement of risk.

Levi et al. (2018, p. 310) noted that in terms of evaluation, the ideal result would be the amount of money laundered over a period of time. However, no official document, either internationally or nationally, contains such information. In this regard, a risk-oriented approach is used to counter money laundering, that is, to determine a certain probability that funds received as a result of illegal activities will be legalized in a certain way.

In the study of risk assessment and management of the use of services for legalizing criminal proceeds or financing of terrorism in a bank, it was

found that the risk of using the bank's services to legalize proceeds of crime included two main components (Dmytrov et al., 2011, p. 51): the risk of suspicious transactions and the risk of violating the requirements of relevant legislation.

According to the Ukrainian law (Ministry of Finance of Ukraine, 2016), the level of risk of using a bank for money laundering is determined by the bank itself. In accordance with these components of the methodology for assessing such risk, banks can focus on the risk of violating the law more than on the risk of suspicious transactions. In addition, the high level of risk of using the bank's services to legalize proceeds of crime may be grounds for including the bank in the plan of on-site inspections of the NBU, so banks may consciously develop risk assessment techniques that will not work well, and, therefore, may be inadequate. Consequently, there is a need to develop methods for objective assessment and analysis of the risks of using banking services for money laundering.

According to the Report on the National Risk Assessment in the Field of Prevention and Counteraction to Legalization (Laundering) of the Proceeds of Crime and Financing of Terrorism (Academy of Financial Monitoring, 2019), in the total number of notifications registered by the SFSMU from banks during the period of validity of the Law No. 2258 (from August 21, 2010 to February 5, 2015), the largest share was created by financial transactions with cash (67%), during the period of validity of the Law No. 1702 (from February 6, 2015 to December 31, 2015) – financial transactions with cash (41%) and financial transactions conducted by persons at high risk (politically exposed persons) (41%). According to the Report, in terms of money laundering, the most risky are financial transactions

related to the receipt or provision of financial assistance and cash financial transactions. In April 2019, Priazhentseva, Head of the Compliance Department of the Financial Monitoring Department of the NBU (NBU, 2019) noted in her presentation that, firstly, among the main national risks of money laundering is the high cash flow in Ukraine, and, secondly, the focus of the risk-oriented approach is: cash and scheme operations, fictitious entrepreneurship, politically exposed persons, identification of ultimate beneficial owners and terrorism financing. Thus, when analyzing the risk of money laundering through banking institutions in Ukraine, it is advisable to pay attention to the banks' cash transactions.

2. DATA AND METHODOLOGY

To assess the risk of money laundering using the bank's services, in particular transactions related to cash and non-cash movement of funds through customer accounts, the following hypothesis was put forward and tested:

H1: Sharp changes in the amount of crediting and debiting funds at the request of bank customers can serve as an indicator that the bank's services are used in money laundering schemes.

To test the hypothesis, the coefficient of variation of the amounts of crediting and writing off the funds of the bank's clients was chosen as a statistical indicator of money laundering risk. It is well known that the coefficient of variation of a random variable is a standardized measure of risk. Statistics show that the risk is low if the coefficient of variation does not exceed 0.1, moderate – from 0.1 to 0.25 and high if it is more than 0.25.

In addition, a certain predictability of the turnover, and, accordingly, the controllability of this process can be determined by the correspondence of the distribution of the time series to normal. It is believed that the normal distribution indicates that the random variable depends on the systematic action of certain factors that can be detected and evaluated, and statistical procedures are the most developed for the normal distribution of the random variable.

To verify the compliance of data on cash turnover and funds on current accounts of customers with the normal law of data distribution, the kurtosis coefficients, asymmetry and the value of the Shapiro-Wilk test were analyzed. The Shapiro-Wilk criterion was chosen due to the fact that the sample size of each indicator does not exceed 20. All calculations were performed in the software package Statistica.

The initial data for testing the hypothesis were the volumes of turnover on cash accounts and demand accounts of existing Ukrainian banks. The choice of banks for further analysis is due to the presence of proven involvement in money laundering processes based on the results of inspections carried out by the National Bank of Ukraine. Detailed information on the results of such inspections is given in Table 1.

Table 1. Generalized information on inspections of banks by the NBU and enforcement measures applied to them for violation of legal requirements on financial monitoring

| Parameter | Parameter values by years | | | |
|--|---------------------------|---------|-------|-------------------|
| | 2016 | 2017 | 2018 | 2019 ² |
| Number of violating banks | 21 ¹ | 40 | 24 | 11 |
| Number of cautions | 28 | 37 | 23 | 11 |
| Number of penalties | 28 | 15 | 13 | 9 |
| Amount of penalties, UAH million | 9.3 | 67.6 | 114.9 | 27.9 |
| Number of restrictions on certain types of bank transactions | 1 | 0 | 0 | 0 |
| Number of shutdowns of a certain bank's transactions | 1 | 1 | 0 | 0 |
| Number of persons suspended from office | 2 | 0 | 3 | 0 |
| Number of decisions to revoke banking license and liquidate banks | 4 | 0 | 0 | 0 |
| Number of violations of legal requirements by types, pcs. | | | | |
| Failure to comply with legal requirements for public figures, including improper identification of politically exposed persons | 3 | 15 | 19 | 6 |
| Violation of the procedure for analysis, detection, registration of financial transactions subject to financial monitoring | 2 | 12 | 16 | 5 |
| Violation of certain requirements for customer identification, verification and study | 2 | 9 | 16 | 3 |
| Failure to refuse to serve customers in cases provided by the legislation on financial monitoring | No data | No data | 1 | 1 |

Table 1 (cont.). Generalized information on inspections of banks by the NBU and enforcement measures applied to them for violation of legal requirements on financial monitoring

| Parameter | Parameter values by years | | | |
|--|---------------------------|------|------|-------------------|
| | 2016 | 2017 | 2018 | 2019 ² |
| Violation of the procedure for suspension of financial transactions | No data | 2 | 5 | 1 |
| Violation of the procedure for submitting information/documents to a specially authorized body and at the request of the NBU, including the submission of unreliable statistical reporting on financial monitoring | No data | 9 | 8 | 4 |
| Implementation of risky activities in the field of financial monitoring | No data | 8 | 12 | 5 |
| Lack of proper functioning of the risk management system, including improper fulfillment of the obligation to ensure risk management and reassessment of customer risks | No data | 7 | 8 | 3 |
| Use of software that does not provide automatic detection and stopping in cases of a financial transaction established by law before its implementation | No data | 3 | 1 | 0 |

Note: 1 – Data starting from August 2016; 2 – data as of May 2019.

To assess the money laundering risk using the bank's services, in particular cash transactions, the amounts of depositing and withdrawing cash, as well as the volume of transactions with the on-demand accounts (with the meaning of demand accounts of individuals and accounts of funds at the request of business entities) in the Ukrainian banks, which at the time of the NBU inspection had significant deficiencies, were analyzed. Inspections carried out by the NBU during 2016–2019 revealed banks violating the legislation on financial monitoring (see Table 1), as well as identified the most vulnerable components operating in banks with systems of preventing and countering money laundering.

By summarizing (Table 1), it was found that the total number of banks with problems in the field of preventing and combating money laundering of their clients during 2016–2019 is 39 banks. However, after an in-depth analysis of the activities of each of the 39 banks, the most significant

violations in the field of financial monitoring were revealed. On this basis, the final sample of banks was reduced.

Out of 39 banks, 16 were selected, which identified and documented by the National Bank of Ukraine schemes of money laundering operations or significant violations in the field of financial monitoring, for which they paid significant fines, and therefore are priority in terms of minimizing the risk of money laundering. For further analysis, the data of these 16 banks were used, which is 20.78% of the total number of banks operating in Ukraine. This sample is statistically representative.

The source of statistical data was the website of the National Bank of Ukraine, which, since August 2017, has been publishing data on the amounts of withdrawals and credits to various accounts of banks in Ukraine (NBU, 2017b). Thus, the amount of data available for analysis as of May 2019 was 20 periods (monthly data).

3. RESULTS

The analysis of the obtained statistical characteristics of the time series on the amounts of deposits and withdrawals of cash and non-cash funds from the accounts of bank customers allows identifying an increased risk of money laundering.

Necessary static characteristics of the time series were obtained after performing the calculations of cash deposits to the bank's cash desk, volumes of cash withdrawals from the bank's cash desk, amounts of crediting and debiting funds at the request of individuals, volumes of crediting and debiting funds at the request of business entities of 32 operating banks of Ukraine. Table 2 gives detailed information on statistical indicators of crediting and writing off funds of PJSC "JSCB "CONCORD".

Table 2 indicates a high risk of money laundering by customers of JSC "JSCB "CONCORD", as the value of the coefficient of variation for the entire analyzed period in all respects was not less than 0.28, and variation was more than 0.75 on the accounts of individuals in foreign currency. The asymmetry is positive for all values, which indi-

Table 2. Statistical characteristics of the dynamics of cash turnover and funds on on-demand accounts from September 1, 2017 to April 1, 2019 for JSC “JSCB “CONCORD”

| Parameter | Cash | | | | Funds on demand of economic entities | |
|----------------------------------|--------------|-----------|-----------------|-----------|--------------------------------------|---------------|
| | Cash deposit | | Cash withdrawal | | Depositing of funds | |
| | NC | FC | NC | FC | NC | FC |
| Average value | 386,271 | 133,077 | 382,655 | 128,806 | 18,43766 | 449,892 |
| Median | 357,635 | 96,336 | 356,903 | 94,313 | 1,728,895 | 343,768 |
| Minimum value | 245,716.5 | 20,529.0 | 255,489.0 | 21,681.3 | 955,925.1 | 237,911.7 |
| Maximum value | 743,074 | 485,005 | 677,605 | 428,716 | 2,967,277 | 1,276,587 |
| Standard deviation | 123,292.0 | 125,477.2 | 110,547.1 | 117,684.9 | 624,436.6 | 257,171.8 |
| Coefficient of variation | 0.3192 | 0.9429 | 0.2889 | 0.9137 | 0.3387 | 0.5716 |
| Coefficient of asymmetry | 2.08 | 1.70 | 1.94 | 1.50 | 0.39 | 1.98 |
| Standard asymmetric error | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |
| Kurtosis | 4.35 | 2.48 | 3.76 | 1.50 | -1.16 | 4.70 |
| Standard error of kurtosis | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Shapiro-Wilk test | 0.74995 | 0.79438 | 0.76486 | 0.80685 | 0.93057 | 0.78332 |
| P-value of the Shapiro-Wilk test | 0.00017 | 0.00071 | 0.00027 | 0.0011 | 0.15835 | 0.00049 |

| Parameter | Funds on demand of economic entities | | Funds on demand of individuals | | | |
|----------------------------------|--------------------------------------|-----------|--------------------------------|----------|------------|---------------|
| | Withdrawal | | Withdrawal | | Deposition | |
| | NC | FC | NC | FC | NC | FC |
| Average value | 1,849,656 | 451,068 | 136,572 | 55,410 | 138,458 | 58,249 |
| Median | 1,709,254 | 345,769 | 128,810 | 43,129 | 129,269 | 47,689 |
| Minimum value | 978,754.6 | 220,542.9 | 68,190.2 | 7,051.1 | 67,401.2 | 8,037.5 |
| Maximum value | 2,934,153 | 1,287,751 | 242,675 | 169,643 | 242,746 | 185,532 |
| Standard deviation | 622486.7 | 257,164.0 | 47,929.4 | 41,669.2 | 48,603.7 | 45,571.5 |
| Coefficient of variation | 0.3365 | 0.5701 | 0.3509 | 0.7520 | 0.3510 | 0.7824 |
| Coefficient of asymmetry | 0.41 | 2.05 | 0.47 | 1.44 | 0.41 | 1.66 |
| Standard asymmetric error | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |
| Kurtosis | -1.17 | 5.08 | -0.25 | 1.97 | -0.20 | 2.69 |
| Standard error of kurtosis | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Shapiro-Wilk test | 0.92551 | 0.78482 | 0.96059 | 0.86482 | 0.96072 | 0.8294 |
| P-value of the Shapiro-Wilk test | 0.12654 | 0.00052 | 0.55573 | 0.00954 | 0.55831 | 0.00245 |

Note: NC – national currency, FC – foreign currency.

cates the location of most of the data to the right of the mathematical expectation. According to the statistics (Bashina et al., 2003; Husarov, 2002), phenomena for which kurtosis is maximum are burdened with minimal risk. For JSC “JSCB “CONCORD” (Table 2), this means that the lowest risk of money laundering has transactions related to withdrawal (or write-off) and crediting funds in foreign currency to the accounts of economic entities.

To compare the calculated values (Table 2) of the Shapiro-Wilk test with the tabular ones, the appropriate calculations have been performed, the results of which are shown in Table 3.

Table 3. Shapiro-Wilk test value for 20 observations

| Parameter | Test significance | | |
|---------------------------------------|-------------------|--------|--------|
| | 0.01 | 0.05 | 0.1 |
| Shapiro-Wilk test for 20 observations | 0.2167 | 0.4230 | 0.5422 |

If the calculated value of the criterion is greater than the value from the table (see Table 3), it is considered that the analyzed value is normally distributed.

Thus, according to the Shapiro-Wilk test, the values of cash and non-cash turnover of clients of JSC “JSCB “CONCORD” are normally distributed, which allows applying parametric methods for analyzing bank data.

Table 4. Coefficients of pairwise correlation between indicators of cash and non-cash flows of clients of JSC “JSCB “CONCORD”

| Parameter | Cash deposit | Cash withdrawal | Depositing funds to accounts on demand of economic entities | Withdrawal of funds from accounts on demand of economic entities | Depositing funds to accounts on demand of individuals | Withdrawal of funds from accounts on demand of individuals |
|--|--------------|-----------------|---|--|---|--|
| Cash deposit | 1.0000 | 0.9940 | 0.5756 | 0.5769 | 0.7983 | 0.8368 |
| Cash withdrawal | 0.9940 | 1.0000 | 0.5910 | 0.5944 | 0.7887 | 0.8278 |
| Depositing funds to accounts on demand of economic entities | 0.5756 | 0.5910 | 1.0000 | 0.9980 | 0.4793 | 0.4881 |
| Withdrawal of funds from accounts on demand of economic entities | 0.5769 | 0.5944 | 0.9980 | 1.0000 | 0.4823 | 0.4922 |
| Depositing funds to accounts on demand of individuals | 0.7983 | 0.7887 | 0.4793 | 0.4823 | 1.0000 | 0.9900 |
| Withdrawal of funds from accounts on demand of individuals | 0.8368 | 0.8278 | 0.4881 | 0.4922 | 0.9900 | 1.0000 |

To check the closeness of the relationship between depositing funds to accounts and withdrawals, the coefficient of pairwise correlation between the amounts of depositing funds to the respective accounts and the amounts of withdrawals from the accounts of clients of JSC “JSCB “CONCORD” is used. Table 4 shows the results of calculations.

Table 4 shows that depositing and withdrawing funds are closely related, because the pairwise correlation coefficients between the indicators of one group are 0.99 or more. In addition, the data from Table 4 show that the cash flow in JSC “JSCB “CONCORD” is linked with the accounts of individuals much more closely than with the cash flow of enterprises and organizations.

The calculations of statistical characteristics of the series of dynamics of cash turnover and funds in the accounts of bank customers – economic entities and individuals – showed that banks in which the scheme operations are detected have mostly high values of the coefficient of variation (average 25%).

To confirm the hypothesis that banks with a higher risk of money laundering have higher values of the coefficient of data variation, the statistical characteristics of the series of dynamics of cash flows in bank accounts are calculated, which in their activities have shortcomings in the system of prevention and counteraction to legalization cli-

ents' proceeds, which, however, is not observed in scheme operations.

The second group of banks is the banks to which the NBU applied enforcement measures for non-compliance with the requirements in the field of financial monitoring, except for those in the activities of which scheme operations were identified; it starts with JSC “ASVIO BANK” (Table 5).

Table 5 confirms that for all analyzed accounts, JSC “ASVIO BANK” has a high or moderate level of risk of exposure to non-systemic factors, including money laundering. The highest values of the coefficients of variation are withdrawals in foreign currency and withdrawals from accounts on demand of individuals. All deposits and withdrawals in foreign currency have a right-wing asymmetry in the distribution of data, therefore, the most likely will be deviations of further revenues in the direction of increase from the mathematical expectation. Interestingly, the asymmetry of data on the deposit and withdrawal of cash and accounts on demand of economic entities is negative. This indicates a more likely decrease in the inflow of funds on these accounts. The Shapiro-Wilk test shows that the data on the accounts of JSC “ASVIO BANK” are distributed according to the normal law. This is also evidenced by the values of the kurtosis, which, under conditions of normal distribution or close to it, have values in the range from 2 to 4. Although the asymmetry

Table 5. Statistical characteristics of the dynamics of cash turnover and funds on the on-demand accounts from September 1, 2017 to April 1, 2019 for JSC “ASVIO BANK”

| Parameter | Cash | | | | Funds on demand of economic entities | |
|----------------------------------|--------------|-----------|-----------------|-----------|--------------------------------------|---------------|
| | Cash deposit | | Cash withdrawal | | Fund deposit | |
| | NC | FC | NC | FC | NC | FC |
| Average value | 232,140.45 | 17,681.96 | 231,539.90 | 17,306.83 | 1,558,490.31 | 101,542.07 |
| Median | 223,377.82 | 16,394.74 | 226,386.22 | 14,409.18 | 1,550,831.67 | 92,828.88 |
| Minimum value | 132,207.42 | 4,411.97 | 131,745.85 | 6,619.59 | 1,104,658.53 | 67,382.77 |
| Maximum value | 307,204.14 | 46,196.55 | 304,301.92 | 38,761.60 | 1,938,814.81 | 202,916.94 |
| Standard deviation | 41,497.45 | 10,214.76 | 41,455.32 | 9,691.99 | 222,117.19 | 32,045.35 |
| Coefficient of variation | 0.1788 | 0.5777 | 0.1790 | 0.5600 | 0.1425 | 0.3156 |
| Coefficient of asymmetry | -0.1821 | 1.3010 | -0.2036 | 0.8837 | -0.1009 | 2.1317 |
| Standard asymmetric error | 0.5121 | 0.5121 | 0.5121 | 0.5121 | 0.5121 | 0.5121 |
| Kurtosis | 0.5067 | 2.1187 | 0.6235 | -0.3497 | -0.2279 | 5.1622 |
| Standard error of kurtosis | 0.9924 | 0.9924 | 0.9924 | 0.9924 | 0.9924 | 0.9924 |
| Shapiro-Wilk test | 0.9507 | 0.9006 | 0.9702 | 0.8875 | 0.9812 | 0.7692 |
| P-value of the Shapiro-Wilk test | 0.3780 | 0.0424 | 0.7580 | 0.0242 | 0.9481 | 0.0003 |

| Parameter | Funds on demand of economic entities | | Funds on demand of individuals | | | |
|----------------------------------|--------------------------------------|------------|--------------------------------|-----------|------------|---------------|
| | Withdrawal | | Fund deposit | | Withdrawal | |
| | NC | FC | NC | FC | NC | FC |
| Average value | 1,559,145.58 | 102,204.58 | 212,894.56 | 12,114.80 | 209,448.65 | 12,453.98 |
| Median | 1,527,437.72 | 93,191.15 | 169,512.92 | 9,052.87 | 168,520.84 | 10,400.32 |
| Minimum value | 1,082,025.79 | 66,650.62 | 119,268.16 | 3,515.87 | 109,443.71 | 3,661.16 |
| Maximum value | 1,906,785.16 | 206,787.91 | 502,074.21 | 29,864.90 | 544,904.63 | 29,204.32 |
| Standard deviation | 210277.53 | 33334.49 | 107106.70 | 8225.95 | 108694.06 | 7855.12 |
| Coefficient of variation | 0.1349 | 0.3262 | 0.5031 | 0.6790 | 0.5190 | 0.6307 |
| Coefficient of asymmetry | -0.1625 | 2.0775 | 1.4937 | 1.0719 | 1.7346 | 1.0929 |
| Standard asymmetric error | 0.5121 | 0.5121 | 0.5121 | 0.5121 | 0.5121 | 0.5121 |
| Kurtosis | 0.0754 | 4.9145 | 1.6275 | 0.0203 | 3.5824 | 0.1870 |
| Standard error of kurtosis | 0.9924 | 0.9924 | 0.9924 | 0.9924 | 0.9924 | 0.9924 |
| Shapiro-Wilk test | 0.9711 | 0.7766 | 0.8104 | 0.8567 | 0.8165 | 0.8637 |
| P-value of the Shapiro-Wilk test | 0.7782 | 0.0004 | 0.0012 | 0.0069 | 0.0015 | 0.0091 |

coefficients for all foreign currency accounts are above 0.5, which indicates a significant asymmetry that cannot be ignored in further calculations.

If one compares the results of calculations of JSC “JSCB “CONCORD” (Table 4), as a representative of a group of banks in the activities of which scheme operations have been identified, and JSC “ASVIO BANK” (Table 5), as a representative of a group of banks with shortcomings in the system of prevention and counteraction to legalization clients’ proceeds without scheme operations, it becomes clear that the risk of money laundering in terms of data variation is much higher in the first group.

To validate the conclusions, similar calculations of statistical characteristics of time series were performed for all analyzed banks – 32 banks for 20

periods, from August 2017 to April 2019. The summarized data are presented in Table 6.

Table 6 summarizes the results of the analysis of the statistical characteristics of data on cash flows through cash registers and accounts on demand of bank customers. It can be seen from Table 6 that the average values of the coefficient of variation are much higher among the banks in the activities of which the scheme operations are detected. Thus, according to the cash flow in the national currency (Table 6), the coefficient of variation averages 24.68%, the movement of funds of economic entities is 27, 69%, and the movement of funds on accounts on demand of individuals in the national currency is 38.63%. Regarding the movement of funds in foreign currency, the value of the coefficient of variation is slightly higher – 33.00% for cash transactions, 22.44% for transactions of

Table 6. Generalized results of calculating the coefficient of variation of cash flow by cash registers and accounts on demand of bank customers for the period August 2017 – May 2019

| Bank category | Bank | Coefficient of variation, % | | | | | | | | | | | | Correspondence of the data distribution to the normal law according to the Shapiro-Wilk test |
|---|---------------------------------|-----------------------------|--------|------------|--------|--------------------------------------|--------|------------|--------|--------------------------------|--------|------------|--------------|--|
| | | Cash | | | | Funds on demand of economic entities | | | | Funds on demand of individuals | | | | |
| | | Deposition | | Withdrawal | | Crediting | | Withdrawal | | Crediting | | Withdrawal | | |
| | | NC | FC | NC | FC | NC | FC | NC | FC | NC | FC | NC | FC | |
| Banks in the activities of which the NBU found scheme operations with signs of money laundering | ALPARI BANK | 341.66 | 104.21 | 342.42 | 117.45 | 61.74 | 126.85 | 61.30 | 128.77 | 198.75 | 306.64 | 197.18 | 211,49 | Partially |
| | BANK FOR INVESTMENT AND SAVINGS | 33.76 | 27.28 | 33.84 | 25.55 | 26.24 | 47.10 | 26.30 | 47.27 | 17.41 | 29.73 | 17.80 | 30,42 | Compliant |
| | BANK SICH | 22.54 | 41.52 | 22.22 | 41.67 | 27.21 | 96.13 | 27.04 | 97.17 | 26.63 | 59.21 | 26.15 | 76,09 | Compliant |
| | GLOBUS | 15.18 | 31.56 | 15.22 | 31.39 | 13.60 | 16.26 | 14.40 | 15.99 | 27.99 | 55.92 | 28.37 | 52,45 | Compliant |
| | CONCORD | 31.92 | 94.29 | 28.89 | 91.37 | 33.87 | 57.16 | 33.65 | 57.01 | 35.09 | 75.20 | 35.10 | 78,24 | Compliant |
| | MEGABANK | 17.04 | 13.26 | 17.02 | 12.27 | 24.09 | 23.38 | 23.77 | 22.72 | 14.91 | 22.93 | 15.98 | 19,23 | Compliant |
| | MISTO BANK | 89.22 | 60.44 | 88.99 | 64.67 | 55.76 | 87.66 | 56.64 | 85.95 | 83.35 | 119.99 | 84.51 | 124,53 | Compliant |
| | MTB BANKV | 7.45 | 19.99 | 7.85 | 20.03 | 20.18 | 21.66 | 20.25 | 21.52 | 19.26 | 25.79 | 19.16 | 23,01 | Compliant |
| | OTPI BANK | 10.33 | 18.53 | 10.67 | 17.47 | 11.06 | 14.29 | 11.35 | 13.67 | 20.90 | 23.57 | 21.13 | 21,44 | Compliant |
| | PIVDENNYI | 11.47 | 9.82 | 11.36 | 9.68 | 14.00 | 16.44 | 14.27 | 16.98 | 23.46 | 28.56 | 22.54 | 25,50 | Compliant |
| | RWS BANK | 53.28 | 65.75 | 52.41 | 65.91 | 53.77 | 70.42 | 52.90 | 70.80 | 96.12 | 95.54 | 95.77 | 100,28 | Compliant |
| | SBERBANK | 7.78 | 21.84 | 7.79 | 19.89 | 12.85 | 21.55 | 12.96 | 20.48 | 16.98 | 32.98 | 17.58 | 30,72 | Compliant |
| | TASCOMBANK | 16.29 | 41.53 | 16.50 | 41.76 | 11.03 | 25.29 | 11.13 | 25.57 | 26.02 | 41.68 | 27.89 | 39,52 | Compliant |
| | UKRAINIAN CAPITAL | 17.85 | 17.26 | 17.75 | 17.70 | 41.74 | 42.72 | 41.64 | 41.88 | 31.02 | 64.58 | 30.11 | 70,99 | Compliant |
| | UKRSOTSBANK | 15.95 | 32.58 | 15.83 | 32.50 | 50.66 | 56.41 | 51.15 | 57.70 | 61.87 | 58.60 | 63.92 | 65,16 | Compliant |
| | UNIVERSAL BANK | 21.85 | 29.24 | 22.01 | 30.03 | 18.30 | 20.04 | 18.99 | 19.26 | 75.45 | 40.09 | 76.29 | 46,22 | Compliant |
| Average values by group (excluding data from Alpari Bank) | | 24.79 | 34.99 | 24.56 | 34.79 | 27.62 | 41.10 | 27.76 | 40.93 | 38.43 | 51.62 | 38.82 | 53.59 | – |

Table 6 (cont.). Generalized results of calculating the coefficient of variation of cash flow by cash registers and accounts on demand of bank customers for the period August 2017 – May 2019

| Bank category | Bank | Coefficient of variation, % | | | | | | | | | | | | Correspondence of the data distribution to the normal law according to the Shapiro-Wilk test |
|---|--|-----------------------------|--------|------------|--------|--------------------------------------|-------|------------|-------|--------------------------------|--------|------------|--------------|--|
| | | Cash | | | | Funds on demand of economic entities | | | | Funds on demand of individuals | | | | |
| | | Deposition | | Withdrawal | | Crediting | | Withdrawal | | Crediting | | Withdrawal | | |
| | | NC | FC | NC | FC | NC | FC | NC | FC | NC | FC | NC | FC | |
| Banks to which the NBU applied enforcement measures for non-compliance with the requirements in the field of financial monitoring, except for those, in whose activities the scheme operations have been revealed | ASVIO BANK | 17.88 | 57.77 | 17.90 | 56.00 | 14.25 | 31.56 | 13.49 | 32.62 | 50.31 | 67.90 | 51.90 | 63.07 | Compliant |
| | BANK 3/4 | 41.23 | 59.56 | 41.23 | 59.65 | 19.22 | 57.29 | 19.25 | 57.73 | 64.49 | 110.52 | 65.65 | 103.25 | Compliant |
| | OSCHADBANK | 10.01 | 9.55 | 9.97 | 9.16 | 13.95 | 13.59 | 14.01 | 11.31 | 18.45 | 32.13 | 18.62 | 32.93 | Compliant |
| | CREDOBANK | 7.18 | 16.82 | 7.40 | 16.84 | 9.69 | 11.57 | 10.08 | 11.51 | 23.04 | 34.15 | 22.30 | 32.45 | Compliant |
| | PROMINVEST-BANK | 10.75 | 23.26 | 10.65 | 22.92 | 28.37 | 34.24 | 27.07 | 37.89 | 27.22 | 35.31 | 28.12 | 35.93 | Compliant |
| | SEB BANK | 102.02 | 204.91 | 165.86 | 163.28 | 22.14 | 19.40 | 24.62 | 19.44 | 27.65 | 0.00 | 32.18 | 0.00 | Partially |
| | UKRCONINVESTBANK | 32.33 | 52.08 | 32.38 | 53.51 | 23.47 | 47.28 | 25.23 | 43.94 | 35.08 | 103.83 | 35.21 | 112.92 | Compliant |
| | UKRSIBBANK | 7.02 | 12.32 | 7.01 | 12.50 | 9.22 | 10.48 | 9.55 | 11.08 | 20.08 | 23.61 | 20.01 | 23.55 | Compliant |
| | Average values by group (excluding data from SEB Bank) | 18.06 | 33.05 | 18.08 | 32.94 | 16.88 | 29.43 | 16.95 | 29.44 | 34.10 | 58.21 | 34.54 | 57.73 | – |
| Banks to which the NBU did not apply enforcement measures for non-compliance with financial monitoring requirements | BANK AALLIANCE | 26.76 | 82.89 | 26.88 | 83.14 | 74.51 | 56.73 | 75.45 | 54.83 | 74.89 | 62.15 | 74.33 | 63.47 | Compliant |
| | GRANT | 18.68 | 65.86 | 19.14 | 69.32 | 12.07 | 13.38 | 12.38 | 13.05 | 26.96 | 128.47 | 25.83 | 114.77 | Compliant |
| | CREDIT AGRICOLE BANK | 8.30 | 18.74 | 8.67 | 17.79 | 14.81 | 23.08 | 14.80 | 22.80 | 19.95 | 30.15 | 19.72 | 23.05 | Compliant |
| | POLICOMBANK | 13.38 | 21.08 | 13.77 | 20.93 | 15.37 | 39.97 | 15.46 | 40.81 | 27.18 | 62.92 | 30.02 | 55.83 | Compliant |
| | PRAVEX BANK | 10.46 | 18.29 | 10.20 | 20.24 | 11.88 | 26.25 | 12.90 | 26.95 | 13.46 | 26.84 | 14.12 | 28.64 | Compliant |
| | RAIFFEISEN BANK AVAL | 7.18 | 22.31 | 6.91 | 20.53 | 9.01 | 16.00 | 9.25 | 16.47 | 16.78 | 23.62 | 16.55 | 27.22 | Compliant |
| | UKRGASBANK | 21.84 | 20.24 | 22.00 | 19.76 | 26.42 | 18.78 | 26.63 | 15.69 | 19.25 | 20.51 | 20.84 | 20.95 | Compliant |
| | UKREXIMBANK | 6.37 | 17.96 | 6.23 | 15.87 | 12.63 | 15.23 | 12.93 | 13.22 | 15.28 | 29.67 | 15.58 | 27.33 | Compliant |
| | Average values by group | 14.12 | 33.42 | 14.23 | 33.45 | 22.09 | 26.18 | 22.48 | 25.48 | 26.72 | 48.04 | 27.12 | 45.16 | – |

economic entities, and 57.97% for transactions on accounts of individuals.

Thus, for a group of banks with identified scheme operations, the coefficient of variation indicates the presence of a high risk of exposure to non-systemic factors, including money laundering using the operations of these banks.

The group of banks with shortcomings in the financial monitoring system identified by the NBU has a coefficient of variation, which indicates the average risk of money laundering: in most cases in the range from 16.00% to 35.00% for cash flows in UAH and within 29-58% for cash flows in foreign currency.

The third group of banks includes banks that did not have comments from the NBU on the

functioning of their systems to prevent and combat money laundering. The calculated values of the coefficients of variation of cash flows on the accounts of these banks confirm this in most cases, and the average values for this group are the lowest: 14.18% in cash flows in national currency and 33.43% in foreign currency; coefficient of variation of 22.29% on the movement of funds on the accounts of economic entities in the national currency, and 25.83% in foreign currency; the coefficient of variation is 26.92% for the movement of funds on the accounts of individuals in national currency and 46.60% in foreign currency.

The analysis showed that the coefficient of variation of cash flows in bank accounts and cash can be used as an indicator of the money laundering risk.

CONCLUSION

An important group of factors of legalization of income and processes of prevention and counteraction to this are transactions of bank customers with cash and non-cash funds. Analysis of the turnover of 32 banks on cash accounts and on demand accounts of individuals and businesses showed that the coefficient of variation of these indicators could be used to identify an increased risk of legalization of customers' incomes. Banks are divided into three groups to reduce the risk of using their services for money laundering:

- the first group includes banks in which the NBU has identified scheme operations with signs of legalization (16 banks);
- the second group includes banks to which the NBU has applied enforcement measures in the field of financial monitoring, except for those in which scheme operations are detected (8 banks);
- the third group includes banks to which the NBU did not apply enforcement measures for non-compliance with financial monitoring requirements, i.e. banks with the lowest risk of legalization (8 banks).

The study has proven that the first group of banks with the highest (actually detected) risk of legalization has the highest values of variation coefficients – up to 120%; the second group of banks with an average risk of using their services for money laundering has significantly lower values of variation coefficients – on average 18-58%. The third group of banks without NBU remarks has the lowest values of the variation coefficients of the turnover of cash and non-cash clients' funds.

AUTHOR CONTRIBUTIONS

Conceptualization: Olesia Lebid.
 Data curation: Oleksandr Veits.
 Formal analysis: Oleksandr Veits.

Investigation: Oleksandr Veits.
Methodology: Olesia Lebid.
Project administration: Olesia Lebid.
Software: Olesia Lebid.
Validation: Olesia Lebid.
Visualization: Olesia Lebid.
Writing – original draft: Oleksandr Veits.
Writing – reviewing & editing: Olesia Lebid.

ACKNOWLEDGMENT

State grant for fundamental scientific research “Risk-oriented approach in countering money laundering, terrorist financing and proliferation of weapons of mass destruction” (state registration number 0118U000058).

REFERENCES

1. Academy of Financial Monitoring. (2019). *Zvit pro provedennia natsionalnoi otsinky ryzykiv u sferi zapobihannia ta protydii lehalizatsii (vidmyvanniu) dokhodiv, oderzhanykh zlochynnym shliakhom, ta finansuvanniu terorizmu* [Report on the national risk assessment on prevention and counteraction to legalization (laundering) of the proceeds of crime and financing of terrorism]. (In Ukrainian). Retrieved from <https://finmonitoring.in.ua/NRA2019.pdf>
2. Bashina, O. E., Spirin, A. A., Baburin, V. T., & Ionsen, I. A. (2003). *Obshchaya teoriia statistiki: Statisticheskaya metodologiya v izuchenii kommercheskoy deyatel'nosti* [General theory of statistics: Statistical methodology for examining the commercial activity] (5th ed.) (440 p.). Moscow: Finansy i statistika. (In Russian).
3. BIS. (1988). *Prevention of criminal use of the banking system for the purpose of money-laundering*. Basel Committee publications. Retrieved from <https://www.bis.org/publ/bcbsc137.pdf>
4. Cabinet of Ministers of Ukraine. (2015). *Rozporiadzhenniam Kabinetu ministriv Ukrainy vid 30.12.2015 № 1407-r “Stratehiia rozvytku systemy zapobihannia ta protydii lehalizatsii (vidmyvanniu) dokhodiv, oderzhanykh zlochynnym shliakhom, finansuvanniu terorizmu ta finansuvanniu rozpovsiudzhennia zbroi masovoho znyshchennia na period do 2020 roku* [By Order of the Cabinet of Ministers of Ukraine dated December 30, 2015 No. 1407-r “Strategy for the Development of the System of Prevention and Counteraction to Legalization (Laundering) of the Proceeds of Crime, Financing of Terrorism and Financing of Proliferation of Weapons of Mass Destruction until 2020”]. (In Ukrainian). Retrieved from <http://zakon5.rada.gov.ua/laws/show/1407-2015-%D1%80/paran9#n9> (accessed 18 November 2019).
5. Cabinet of Ministers of Ukraine. (2017). *Plan zakhodiv na 2017–2019 roky z realizatsii Stratehii rozvytku systemy zapobihannia ta protydii lehalizatsii (vidmyvanniu) dokhodiv, oderzhanykh zlochynnym shliakhom, finansuvanniu terorizmu ta finansuvanniu rozpovsiudzhennia zbroi masovoho znyshchennia na period do 2020 roku* [Activity plan for 2017–2019 on realization of the system of prevention and counteraction to legalization (laundering) of the proceeds of crime, financing of terrorism and financing of proliferation of weapons of mass destruction until 2020] approved by the Resolution of the Cabinet of Ministers of Ukraine dated August 30, 2017. (In Ukrainian). Retrieved from <https://zakon.rada.gov.ua/laws/show/601-2017-%D1%80#n9> (accessed 27 November 2019).
6. Dmytrov, S. O., Cherniak, V. M., & Kuzmenko, O. V. (2011). *Systema skorynhu na osnovi indykatoriv ryzyku yak efektyvna skladova finansovoho monitorynhu v banku* [Scoring system of the basis of the risk indicators as an effective element of the financial monitoring of the bank]. *Visnyk NBU – NBU Bulletin*, 1, 26-32. (In Ukrainian).
7. Dmytrov, S. O., Merenkova, O. V., Medvid, T. A., & Vashchenko, O. M. (2010). *Assessment and risk management services for the use of money laundering or terrorist financing in commercial bank* (114 p.). Sumy: SHEI “UAB NBU”. (In Ukrainian). Retrieved from <http://essuir.sumdu.edu.ua/handle/123456789/50092>
8. FATF. (2014). *Risk-based Approach. Guidance for the Banking Sector*. Financial Action Task Force. <http://www.fatf-gafi.org/publications/fatfrecommendations/documents/risk-based-approach-banking-sector.html>
9. FATF. (2019). *Procedures for the FATF Fourth Round of AML/CFT Mutual Evaluation*. Financial Action Task Force. Retrieved from <http://www.fatf-gafi.org/media/fatf/documents/methodology/FATF-4th-Round-Procedures.pdf>

10. FATF. (2020). *International Standards on Combating Money Laundering and the Financing of Terrorism and Proliferation* (The FATF Recommendations). Financial Action Task Force. Retrieved from <http://www.fatf-gafi.org/publications/fatfrec-ommendations/documents/fatf-recommendations.html>
11. FATF. (n.d.). *Money Laundering*. Official website. Retrieved from <http://www.fatf-gafi.org/faq/moneylaundering> (accessed 23 November 2019).
12. Hlushchenko, O. O., & Semehen, I. B. (2014). *Antylehalizatsiyni finansovyi monitorynh: ryzyk-oriientovanyi pidhid: monohrafiia [Antilegalization financial monitoring: risk-based approach: monograph]* (386 p.). Kyiv: UBS NBU. (In Ukrainian). Retrieved from http://finmonitoring.in.ua/wp-content/uploads/2016/06/afm_risk-oriented.pdf
13. Honcharenko, I. H., Berezina, O. Yu., & Shevchenko, A. M. (2017). The problem of corruption and legalization of money laundering. *Scientific Bulletin of Polissia*, 3(11), 127-135. Retrieved from <http://ir.stu.cn.ua/123456789/15182>
14. Honcharenko, I. H. (2019). Analyzing the Risk of Legalization of Proceeds of Crime through Ukrainian Banks. *Business Inform*, 9, 245-251. <https://doi.org/10.32983/2222-4459-2019-9-245-251>
15. Husarov, V. M. (2002). *Statistika [Statistics]* (463 p.). Moscow: UNITY-DANA. (In Russian). Retrieved from <https://instituti-ones.com/download/books/1290-statistika-gusarov.html>
16. JSC CB "PRIVATBANK" (2018). *Polityka PAT KB "PRYVATBANK" z pytan dotrymannia vymoh zakonodavstva u sferi zapobihannia ta protydzii lehalizatsii (vidmyvanniu) dokhodiv, oderzhanykh zlochynnym shliakhom, finansuvanniu teroryzmu ta finansuvanniu rozpovsiudzhennia zbroi masovoho znyshchennia [The policy of JSC CB PRIVATBANK on complying with legal requirements in the sphere of prevention and counteraction to legalization (laundering) of the proceeds of crime, financing of terrorism and financing of proliferation of weapons of mass destruction]*. (In Ukrainian). Retrieved from https://static.privatbank.ua/files/politics-new-16_06.pdf (accessed 18 September 2019).
17. Kolodiziev, O. M., Lebid, O. V., & Zuieva, O. V. (2018). *Finansovyi potentsial banku: sutnist, metody otsiniuvannia, instrumenty protydzii lehalizatsii dokhodiv, otrymannykh zlochynnym shliakhom: monohrafiia [Financial potential of the bank: essence, methods of evaluation, tools for combating legalization of proceeds of crime: monograph]* (246 p.). Kharkiv: Simon Kuznets Kharkiv National University of Economics. (In Ukrainian). Retrieved from http://repository.hneu.edu.ua/bitstream/123456789/19081/1/%D0%9A%D0%BE%D0%BB%D0%BE%D0%B4_%D0%9B%D0%B5%D0%B1_%D0%97%D1%83%D1%94_%D0%9C%D0%9E%D0%9D%D0%9E%D0%93%D0%A0%D0%90%D0%A4_260418.pdf
18. Kordik, M., & Kurilovska, L. (2017). Protection of the National Financial System From the Money Laundering and Terrorism Financing. *Entrepreneurship and Sustainability Issues*, 5(2), 243-262. [https://doi.org/10.9770/jesi.2017.5.2\(7\)](https://doi.org/10.9770/jesi.2017.5.2(7))
19. Lebid, O. V., Chmutova, I. M., Zuieva, O. V., & Veits, O. I. (2018). Risk Assessment of the Bank's Involvement to Legalization of Questionable Income Considering the Influence of FinTech Innovations Implementation. *Marketing and Management of Innovations*, 2, 232-346. <https://doi.org/10.21272/mmi.2018.2-19>
20. Levi, M., Reuter, P., & Halliday, T. (2018). Can the AML system be evaluated without better data? *Crime Law and Social Change*, 69(2), 307-328. <https://doi.org/10.1007/s10611-017-9757-4>
21. Lyeonov, S., Kuzmenko, O., Yarovenko, H., & Dotsenko, T. (2019). The Innovative Approach to Increasing Cybersecurity of Transactions Through Counteraction to Money Laundering. *Marketing and Management of Innovations*, 3, 308-326. <http://doi.org/10.21272/mmi.2019.3-24>
22. Malyarets, L., Dorokhov, O., Koybichuk, V., & Dorokhova, L. (2019). Obtaining a Generalized Index of Bank Competitiveness Using a Fuzzy Approach. *Journal of Central Banking Theory and Practice*, 8(1), 163-182. <http://doi.org/10.2478/jcbtp-2019-0008>
23. Ministry of Finance of Ukraine. (2016). Nakaz vid 08.07.2016 No. 584 "Pro zatverdzhennia Kryteriiv ryzyku lehalizatsii (vidmyvannia) dokhodiv, oderzhanykh zlochynnym shliakhom, finansuvannia teroryzmu, finansuvannia rozpovsiudzhennia zbroi masovoho znyshchennia" [Order dated July 8, 2016 No. 584 On Approval of the Risk Criteria of Legalization (Laundering) of the Proceeds of Crime, financing of Terrorism and Financing of Proliferation of Weapons of Mass Destruction.] (In Ukrainian). Retrieved from <http://zakon2.rada.gov.ua/laws/show/z1047-16> (accessed 28 November 2019).
24. National Commission for State Regulation of Financial Services Markets. (n.d.). *Richni zvyty Natskomfinposluh [Annual reports of the National Commission Performing State Regulation in the sphere of the Markets of Financial Services]*. (In Ukrainian). Retrieved from <https://www.nfp.gov.ua/ua/Richni-zvity-Nats-komfinposluh.html> (accessed 18 November 2019).
25. NBU. (2017a). Postanova Pravlinnia NBU vid 26.06.2015 No 417 "Pro zatverdzhennia Polozhennia pro zdiisnennia bankamy finansovoho monitorynhu: postanova Pravlinnia NBU" [Resolution of the NBU Board dated June 26, 2015 No. 417 On Approval of the Procedure on Performing of the Financial Monitoring of Banks]. (In Ukrainian). Retrieved from <http://zakon5.rada.gov.ua/laws/show/v0417500-15> (accessed 18 November 2019).
26. NBU. (2017b). Postanova Pravlinnia NBU vid 31.08.2017

- No. 85 “Pro opublikuvannia okremoi informatsii pro diialnist bankiv Ukrainy” [Resolution of the NBU Board dated August 31, 2017 No. 85 About publication of separate information on activity of banks of Ukraine]. (In Ukrainian). Retrieved from <https://zakon.rada.gov.ua/laws/show/v0085500-17#Text>
27. NBU. (2018). *Natsionalnyi bank roziasnyv prychny zastosuvannia zakhodu vplyvu do banku “Pivdennyi”* [The National Bank explained the reasons for taking enforcement measures to the bank “Pivdennyi”]. (In Ukrainian). Retrieved from https://old.bank.gov.ua/control/uk/publish/article?art_id=76661355 (accessed 23 May 2019).
28. NBU. (2019). *Ryzik-orientovanyi pidkhid u finansovomu monitoringhu* [Risk-based approach to the financial monitoring]. Presentation of I. Priazhentseva, Head of the office of compliance of the department of financial monitoring. (In Ukrainian). Retrieved from <https://old.bank.gov.ua/doccatalog/document?id=95699408>
29. Omelchenko, O. I., & Ostrovskiy, D. M. (2019). The Ways to Minimize the Risks of Legalization of the Bank’s Customers’ Incomes. *Business Inform*, 6, 239-245. <https://doi.org/10.32983/2222-4459-2019-6-239-245>
30. Omelchenko, O. I., & Rats, O. M. (2018). Leveling the Financial Risks of Banking System with Use of Monitoring Instruments. *Business Inform*, 12, 379-385. Retrieved from http://www.business-inform.net/export_pdf/business-inform-2018-12_0-pages-379_385.pdf
31. PAT “KREDOBANK” (2018). *Polityka protydyi vidmyvanniu kryminalnykh dokhodiv, finansuvanniu teroryzmu ta zbroi masovoho znyshchennia* [Policy on counteracting laundering of the proceeds of crime, financing terrorism and weapons of mass destruction]. (In Ukrainian). Retrieved from <https://kredobank.com.ua/public/upload/f463af1b-16670fe332a0571502816c5c.pdf> (accessed 18 September 2019).
32. Ponomarenko, V. S., & Maliarets, L. M. (2009). *Analiz danykh u doslidzhenniakh sotsialno-ekonomichnykh system* [Analysis of data from researches of social and economic systems] (432 p.). Kharkiv: Publishing house “INZHEK”. (In Ukrainian).
33. Ponomarenko, V. S., Vnukova, N. M., Kolodiziev, O. M., & Achkasova, S. A. (2019). The Influence of Governmental Regulation and Supervision on the Development of The Risk-Oriented System of Financial Monitoring of Ukraine. *Financial and Credit Activity: problems of theory and practice*, 2(29), 419-429. <https://doi.org/10.18371/fcaptp.v2i29.171986>
34. Pryimak, V. M. (2017). *Upravlinnia proektamy* [Project management] (464 p.). Kyiv: Taras Shevchenko Kyiv National University. (In Ukrainian). Retrieved from https://www.researchgate.net/publication/324704189_Upravlinna_proektami_navcalnij_posibnik
35. Samorodov, B. V., & Utkina, O. V. (2018). Klasyfikatsiini oznaky ryzyku bankivskoi ustanovy u sferi vidmyvannia koshtiv abo finansuvannia teroryzmu [Classification features of the banking institution risk in the sphere of money laundering or financing terrorism]. *Banking University Bulletin*, 2(32), 47-51. (In Ukrainian). Retrieved from http://nbuv.gov.ua/UJRN/VUbsNbU_2018_2_8
36. Shtal, T., & Proskurnina, N. (2018). Trends of structural dynamic changes in retail trade. *Economics of Development*, 17(3), 64-73. [https://doi.org/10.21511/ed.17\(3\).2018.06](https://doi.org/10.21511/ed.17(3).2018.06)
37. Smaglo, O. V. (2015). Otsinka ryzyku lehalizatsii zlochynnykh dokhodiv subiektiv pervynnoho finansovoho monitoringhu [Evaluation of the risk of legalization of proceeds of crime of the subjects of primary financial monitoring]. *The Journal of Zhytomyr State Technological University. Series: Economic Sciences*, 4(74), 201-212. (In Ukrainian). Retrieved from <http://ven.ztu.edu.ua/article/view/59727>
38. Soshnikova, L. A., Tamashevich, V. N., Uebe, G., & Sheffer, M. (1999). *Mnogomernyi statisticheskii analiz v ekonomike: ucheb. posobie dlia vuzov* [Multivariate Statistical Analysis in Economics: textbook] (598 p.). Moscow: UNITY-DANA. (In Russian).
39. State Financial Monitoring Service of Ukraine. (2018). *Ryzyky vykorystannia subiektiv z neprozoroiu strukturoiu vlasnosti u skhemakh vidmyvannia kryminalnykh dokhodiv: typolohichne doslidzhennia; Derzhavna sluzhba finansovoho monitoringhu Ukrainy* [Risks of the using of subjects with non-transparent ownership structure in the schemes of laundering money of crime]. (In Ukrainian). Retrieved from http://finmonitoring.in.ua/wp-content/uploads/2018/12/fiu_typology-2018.pdf (accessed 18 November 2019).
40. The Verkhovna Rada of Ukraine. (2014). *Zakon Ukrainy vid 14.10.2014 No. 1700-VII “Pro zapobihannia koruptsii”* [Law of Ukraine dated October 14, 2014 No. 1700-VII On Preventing Corruption] (In Ukrainian). Retrieved from <https://zakon.rada.gov.ua/laws/show/1700-18/page#Text> (accessed 24 September 2019).
41. The Verkhovna Rada of Ukraine. (2020). *Zakon Ukrainy zi zminamy vid 19.06.2020 No. 361-IX “Pro zapobihannia ta protydyii lehalizatsii (vidmyvanniu) dokhodiv, oderzhanykh zlochynnym shliakhom, finansuvanniu teroryzmu ta finansuvanniu rozpovsiudzhennia zbroi masovoho znyshchennia”* [Law of Ukraine with changes dated June 19, 2020 No. 361-IX On Prevention and Counteraction to Legalization (Laundering) of the Proceeds of Crime, Financing of Terrorism and Financing of Proliferation of Weapons of Mass Destruction]. (In Ukrainian). Retrieved from <https://zakon.rada.gov.ua/laws/show/361-20#Text> (accessed 26 September 2019).

42. Vasylieva, T. A., & Zarutska, A. B. (2013). Rozvytok strukturno-funktsionalnoho pidhodu do analizu finansovoi stiiikosti v systemi bankivskoho nahliadu [Development of structural and functional approach to the analysis of financial firmness in the system of financial supervision]. *Visnyk of the National Bank of Ukraine*, 10(212), 28-35. (In Ukrainian). Retrieved from http://nbuv.gov.ua/UJRN/Vnbu_2013_10_19
43. Vitlinskyi, V. V., & Velykoivanenko, H. I. (2004). *Ryzykolohiia v ekonomitsi ta pidpriemnytstvi: monohrafiia [Riskology in the economics and entrepreneurship: monograph]* (480 p.). Kyiv: KNEU. (In Ukrainian). Retrieved from https://kneu.edu.ua/ua/science_kneu/scientific_schools/mtrve/mtrve_praci/mtrve_prazi/ruzvecontp/
44. Vnukova, N. M., Andriichenko, Zh. O., & Hontar, D. D. (2018a). Kontseptualni zasady formuvannia ryzyk-orientovanoi systemy protydii vidmyvanniu koshtiv, finansuvanniu teroryzmu ta rozpovsiudzhennia zbroi massovoho znyshchennia [Conceptual bases for formation of risk-based system of counteraction to money laundering, financing of terrorism and proliferation of weapons of mass destruction]. *The Problems of Economy*, 4, 201-215. (In Ukrainian). <https://doi.org/10.32983/2222-0712-2018-4-201-215>
45. Vnukova, N., Hontar, D., & Andriichenko, Zh. (2018b). International Preconditions for Development the Basics of a Concept of Risk-oriented System on Combating Money Laundering and the Financing of Terrorism and Proliferation. In *Modern Management: Economy and Administration* (pp. 37-43). Opole: The Academy of Management and Administration in Opole.
46. Xue, Y.-W., & Zhang, Y.-H. (2016). Research on money laundering risk assessment of customers – based on the empirical research of China. *Journal of Money Laundering Control*, 19(3), 249-263. <https://doi.org/10.1108/JMLC-01-2015-0004>