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## THE INFLUENCE OF THE FINANCIAL INCLUSION OF THE POPULATION ON THE LEVEL OF ILLEGALLY INCOME IN COUNTRIES WITH DIFFERENT LEVELS OF ECONOMIC DEVELOPMENT

**Abstract.** The importance of understanding why and how vital financial inclusion is is recognizing that finance or financial development plays an essential role in shaping economic stability. According to the current international assessment, finance has a positive impact on the economy. Essential functions perform information production; distribution of capital for production use; investment control and corporate control; mobilization and consolidation of savings; trade facilitation, diversification, risk management; and facilitating the exchange of goods and services. Thus, we can determine that the country's financial development depends on the implementation of the above functions. For regulators and the state as a whole, financial inclusion is a tool to reduce the level of the «shadow» economy, through which there is money laundering, tax evasion, and so on. It is important to note that low levels of financial inclusion are mainly a problem in the economies of developing countries, although developed countries also face such challenges. The article sets and substantiates the impact of financial inclusion of the population on the level of illegally obtained income of countries with different levels of economic development. The study is conducted in several stages: the formation of an array of indicators that characterize the financial inclusion of the population and the level of illicit income for 91 countries with different levels of economic development, determination of the integrated index of financial inclusion based on factor analysis, correlation and regression analysis the Financial Inclusion Index and its components and the Basel Laundering Index. In general, it was found that the level of financial involvement of the population has a positive effect on the fight against money laundering in all countries studied. The construction of multiple regression with the inclusion as independent variable components of the financial inclusion index (activation of consumers in the financial services market, which is manifested through more active use of banking services and Internet resources to buy and pay for necessary goods or services, allows money laundering) confirm the result.

*Keywords*: financial inclusion, financial literacy, illicit income, Basel laundering index, economic development.
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## ВПЛИВ ФІНАНСОВОЇ ІНКЛЮЗІЇ НАСЕЛЕННЯ НА РІВЕНЬ НЕЗАКОННО ОТРИМАНИХ ДОХОДІВ КРАЇН З РІЗНИМ РІВНЕМ ЕКОНОМІЧНОГО РОЗВИТКУ

**Анотація.** Вагомість розуміння того, чому і наскільки важливою є фінансова інклюзія, полягає у визнанні факту, що фінанси або фінансовий розвиток відіграють важливу роль під час формування економічної стабільності. За міжнародною оцінкою, фінанси здійснюють позитивний вплив на економіку через найважливіші функції, які вони виконують: виробництво інформації; розподіл капіталу для виробничого використання; контроль інвестицій і корпоративний контроль; мобілізація та об'єднання заощаджень; сприяння торгівлі, диверсифікації та управлінню ризиками; полегшення обміну товарами та послугами. Таким чином, можна визначити, що фінансовий розвиток країни залежить від виконання вищезазначених функцій. Для регуляторів і держави в цілому фінансова інклюзія є інструментом зменшення рівня «тіньової» економіки, через яку відбувається відмивання незаконно отриманих доходів, уникнення сплати податків тощо. Важливо зазначити, що низький рівень фінансової інклюзії переважно є проблемою економік держав, що розвиваються, хоча розвинуті країни також зіштовхуються з такими викликами. Розроблено та обґрунтовано вплив фінансової інклюзії населення на рівень незаконно отриманих доходів країн із різним рівнем економічного розвитку. Дослідження проводилося в кілька етапів: формування масиву показників, які характеризують фінансову інклюзію населення та рівень незаконно отриманих доходів для 91 країни із різним рівнем економічного розвитку, визначення інтегрального індексу фінансової інклюзії населення на основі використання факторного аналізу, проведення кореляційно-регресійного аналізу функціональної залежності між інтегральним індексом фінансової інклюзії та його складовими і Базельським індексом відмивання коштів. У цілому, було виявлено, що рівень фінансової залученості населення позитивно впливає на боротьбу з відмиванням коштів у всіх досліджуваних країнах. Побудова множинної регресії із включенням до неї як незалежних змінних складових частин індексу фінансової інклюзії (активізація споживачів на ринку фінансових послуг, яка проявляється через активніше використання банківських послуг і Інтернет-ресурсів для купівлі та оплати необхідних товарів чи послуг, дозволяє скоротити обсяг відмивання коштів) дозволило підтвердити отриманий результат.

***Ключові слова***: фінансова інклюзія, фінансова грамотність, незаконно отримані доходи, Базельський індекс відмивання коштів, економічний розвиток.

Формул: 6; рис.: 3; табл.: 6; бібл.: 22.

**Introduction.** Recent developments related to the COVID-19 crisis pose threats and open up new opportunities for increasing the financial inclusion of the population in the future. On the one hand, the severe failures of the world economy, both directly from the virus and due to quarantine and other social distancing measures, have weakened the wide range of borrowers' ability to repay loans and created problems for many financial institutions. Institutions in the microfinance sector and Fintech startups suffered the most from all these measures, as venture

capital and investors were forced to withdraw their funds. On the other hand, however, there was a need for rapid deployment of government transfers to households and firms and an accelerated transition from cash to bank accounts and digital payments, as money became a means of transmitting COVID-19.

Central banks and other regulators of the financial services market, international organizations emphasize the importance of increasing financial inclusion as one of the main factors of economic development. At the present stage of economic growth, almost a third of the world's population does not have access to a basic bank account. It encourages leading international organizations to define financial inclusion as one of the goals of their activities.

For regulators and the state as a whole, financial inclusion is a tool to reduce the shadow economy. There is money laundering, tax evasion, and so on.

It is important to note that levels of financial inclusion are mainly a problem in the economies of developing countries, although developed countries also face such challenges.

**Analysis of research and problem statement.** Studying the relationship between the level of illicit income and the level of financial inclusion of the population is relevant around the world. The work of the following scientists evidences it: S. B. Yegorycheva [19], J. Smoliy [14], N. Gospik, G. Murik [1], A. Hoque [8], M. King [7], M. Mohamad, T. Wood-Harper [10], G. Vincent, S. Sivakumar [18]. Thus, in particular, in the works of Vasylieva et al. [16], F. D. Tommaso [3], A. Moskovicz [11], H. D. Kaya [5] analyzes the advantages and disadvantages of information disclosure and its role in the management of innovative development and economic security of Ukraine. Paskevicius and Keliuotyte-Staniuleniene [12], in their work, investigate the riskiness of financial innovations and their impact on quantitative indicators of financial technology efficiency. Decentralization and its effect on the qualitative transformation of the country's economic system to increase the competitiveness of financial institutions and highlight the main financial flows are considered in the works of Vasylieva et al. [17]. Masharsky et al. [9] proposed a methodological approach to assessing the level of financial security on the example of the energy sector. Using structural and functional analysis of the banking system, Zarutska et al. [21] proposed dividing banks into separate homogeneous functional groups, which accordingly allows better tracking of flows of illegally obtained financial resources. Other scientists, Juarez-Garcia [4], Zolkover, and Terziev [22], Kaya and Engkuchik [6], Yoshimori [20], made similar conclusions, but on the example of other financial institutions. The concept of financial inclusion in its various manifestations was considered in the scientific works of Didenko and Sidelnyk [2], Sau-Wai Law [13].

The article's purpose is to formalize the functional interaction between financial inclusion and the level of illicit income on the example of countries with different levels of economic development.

**Research results.** To formalize the functional interaction between financial inclusion and the level of illegally obtained income, we will build an appropriate econometric model. As inputs, we use World Bank statistics, including the Global Findex database, which contains a set of indicators that characterize the level of financial inclusion of the population (*Table 1*), and the Basel Anti-Money Laundering Index.

Table 1

**List of indicators that characterize the financial inclusion of the population**

| № | Indicator | Symbol of the indicator |
|---|---|---|
| 1 | People with open bank accounts,% of adult population | BANK_AC |
| 2 | Number of ATMs, units per 100 thousand people. adult population | ATM |
| 3 | Number of bank branches, units per 100 thousand people. adult population | BANK_BR |
| 4 | Number of deposit accounts, units per 100 thousand people. adult population | DEPOS_AC |
| 5 | Number of POS-terminals, units per 100 thousand people, adult population | POS |
| 6 | Volume of outstanding loans, units per 100 thousand people, adult population | OUT_LOANS |
| 7 | Use of the Internet for shopping,% of the adult population | INTER |
| 8 | Credit card holders,% of adult population | CRED_CARD |
| 9 | Making online payments,% of adult population | ONLINE |

*Source*: compiled according to statistical reporting [15].

A total of 91 countries with different levels of economic development participate in the analysis: 27 countries with a high level of economic growth, 50 countries with a medium level of development, and 14 countries with economies in transition.

One of the effective ways to build an integrated index, which accumulates the value of several statistical indicators, is factor analysis. Factor analysis is a universal statistical method that allows you to identify related factors through discreet relationships.

The factor analysis allows the identification of hidden relationships between actual variables. The relationship between real variables and selected factors is as follows (1).

$$z_i = \sum_1^m a_{ij} G_j, \tag{1}$$

where $z_i$ — standardized values of the i-th feature with unit variances;

$m$ — the total number of studied features;

$a_{ij}$ — factor load of the j-th factor on the *i*-th sign.

Factor load is a correlation coefficient and reflects the closeness of the relationship between the *j*-th factor and the *i*-th trait. Traditionally, the first factors account for a larger share of the total variance, ie, those indicators that fall into these dominant factors and determine the phenomenon under study.

The sum of the squares of the factor loads for all selected factors forms the total variance of the total number of studied features *m* (2):

$$\lambda_j = \sum_1^m a^2{}_{ij}. \tag{2}$$

Since, in this case, factor analysis is used to obtain an integrated index of financial inclusion of the population, before including the studied statistics in the calculations, they need to be normalized, taking into account the direction of influence — stabilizing or destabilizing.

Based on normalized values, the population's integral index of financial involvement is determined by the following formula (3):

$$I_{lm} = \sum \bar{y}_{ij} \cdot w_i, \tag{3}$$

where $w_{ij}$ — weight of the *i*-th indicator.

$$w_i = \frac{\alpha_{ij} \cdot \lambda_j}{\sum_j \alpha_{ij} \cdot \lambda_j}. \tag{4}$$

Factor analysis was performed in the STATISTICA program using the appropriate module. Given the obtained graph of the talus (*Fig. 1*), the optimal number of factors for determining the integrated index of financial inclusion of the population are two factors.
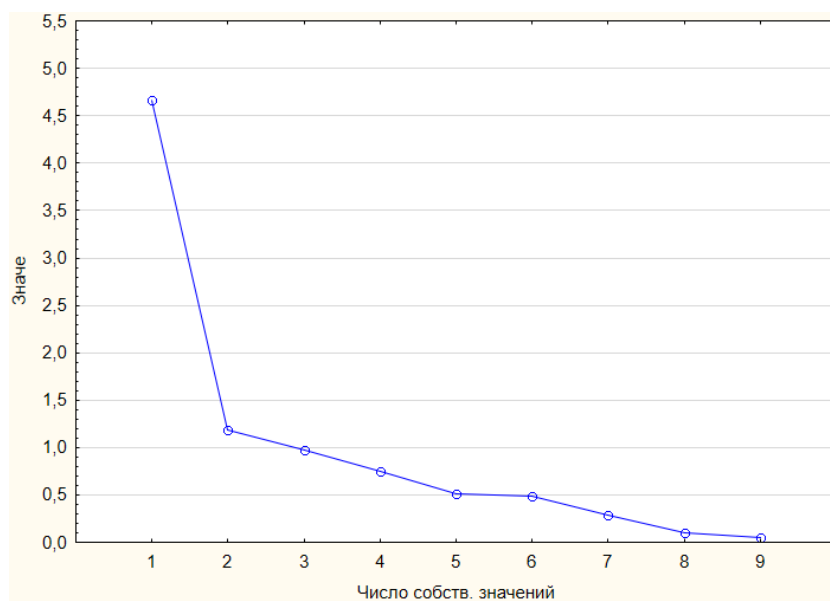


Fig. 1. **Schedule of scree**

*Source*: authors' own calculations.

According to the presented chart, the abscissa indicates nine factors that correspond to the total number of financial inclusion indicators of the population. However, the slowdown of factors eigenvalues is observed at the mark «2», which indicates the appropriate number of factors that need to be considered for further analysis. *Table 2* presents the eigenvalues of the factors and the proportion of variance allocated by each factor.

Table 2

**Eigenvalues and share of total variance for factors formed by financial inclusion indicators**

| Factors | Eigenvalues | % of total variance | Cumulative % of total variance |
|---|---|---|---|
| Factor 1 | 4,67 | 51,84 | 51,84 |
| Factor 2 | 1,19 | 13,19 | 65,03 |

*Source*: authors' own calculations.

The cumulative percentage of the total variance allocated by the factors is more than 65%: the first factor explains 51.84% of the total variance and the second — 13.19%. It suggests that the variables included in the first factor have a more substantial impact on the formation of an integrated index of financial inclusion. The eigenvalues of these two factors exceed the unit value.

The next step to determine the index weights is the allocation of factor loads (*Table 3*).

Table 3

**Factor loads of indicators as a part of the selected factors**

| Indicator | Factors | |
|---|---|---|
| | Factor 1 | Factor 2 |
| BANK_AC | -0,91 | 0,07 |
| ATM | -0,68 | -0,40 |
| BANK_BR | -0,40 | -0,78 |
| DEPOS_AC | -0,50 | -0,37 |
| POS | -0,72 | -0,06 |
| OUT_LOANS | 0,26 | 0,11 |
| INTER | -0,86 | 0,38 |
| CRED_CARD | -0,87 | 0,27 |
| ONLINE | -0,93 | 0,22 |

*Source*: authors' own calculations.

The first factor includes those indicators that have the most substantial impact on the phenomenon: People with open bank accounts (BANK_AC), Number of POS-terminals (POS), Use of the Internet for shopping (INTER), Credit cardholders (CRED_CARD), and Making online payments (ONLINE).

There is the value of the integrated index of financial involvement of the population in the following table (*Table 4*).

Table 4

**Integral index of financial involvement of the population of the studied countries**

| Country | Index | Country | Index | Country | Index | Country | Index | Country | Index |
|---|---|---|---|---|---|---|---|---|---|
| Canada | 0,90 | Austria | 0,67 | Malaysia | 0,44 | Dom. Rep. | 0,28 | India | 0,20 |
| Australia | 0,88 | Portugal | 0,65 | Chile | 0,43 | Georgia | 0,27 | Bolivia | 0,20 |
| Un. King | 0,84 | Italy | 0,65 | Hungary | 0,43 | Mexico | 0,26 | Moldova | 0,19 |
| Norway | 0,83 | Korea | 0,63 | Bulgaria | 0,42 | Guatemala | 0,26 | Lesotho | 0,18 |
| Spain | 0,81 | Slovenia | 0,62 | Mauritius | 0,40 | Colombia | 0,26 | Paraguay | 0,18 |
| Finland | 0,81 | Latvia | 0,60 | Ukraine | 0,40 | Uzbekist. | 0,25 | Indonesia | 0,17 |
| Switzer. | 0,80 | Croatia | 0,60 | South Afr. | 0,40 | Ecuador | 0,25 | Kyrg.Rep. | 0,17 |
| Japan | 0,80 | Singapore | 0,58 | Belarus | 0,39 | Sri Lanka | 0,25 | Tanzania | 0,17 |
| Sweden | 0,79 | UAE | 0,56 | Uruguay | 0,38 | Lebanon | 0,25 | Rwanda | 0,17 |
| Denmark | 0,74 | Czec.Rep | 0,56 | China | 0,37 | El Salvad. | 0,24 | Tajikistan | 0,16 |
| Belgium | 0,73 | Turkey | 0,53 | Kenya | 0,36 | Uganda | 0,24 | Armenia | 0,16 |
| France | 0,73 | Slov. Rep | 0,51 | Argentina | 0,35 | Algeria | 0,22 | Zambia | 0,16 |
| Israel | 0,72 | Poland | 0,50 | Romania | 0,34 | Albania | 0,22 | Philippines | 0,16 |
| USA | 0,72 | Brazil | 0,50 | Thailand | 0,34 | Peru | 0,22 | Nicaragua | 0,16 |
| Estonia | 0,72 | Russia | 0,48 | Namibia | 0,33 | Nigeria | 0,22 | Vietnam | 0,11 |

*Table 4 (continued)*

| Country | Index | Country | Index | Country | Index | Country | Index | Country | Index |
|---------|-------|---------|-------|---------|-------|---------|-------|---------|-------|
| Nether. | 0,71 | Lithuania | 0,48 | Kazakh. | 0,30 | Gambia | 0,21 | Cambodia | 0,10 |
| Germany | 0,70 | C-Rica | 0,46 | Panama | 0,30 | Honduras | 0,21 | Madagascar | 0,09 |
| Ireland | 0,69 | Greece | 0,45 | Bos. & Her | 0,30 | Ghana | 0,20 | Pakistan | 0,07 |
|  |  |  |  |  |  |  |  | Afghan. | 0,05 |

*Source*: authors' own calculations.

The highest level of financial inclusion of the population in 2017 was observed in countries with a high level of economic development: Canada, Australia, Great Britain, Norway, Spain, Finland, Switzerland, Japan. The index value for these countries varies from 0.9 to 0.8, taking into account that the maximum value of the index is 1. The level of financial inclusion in Ukraine is 0.4 and in the overall ranking with similar values are Mauritania and South Africa. Let's talk about Ukraine's closest geographical neighbors, then, for example, in Slovakia. The level of financial inclusion is 0.51, in Poland — 0.5, in Russia — 0.48, in Hungary — 0.43, which is higher than in Ukraine. However, in Belarus, Romania, and Moldova, this index is lower than in Ukraine and is 0.39, 0.34, and 0.19, respectively.

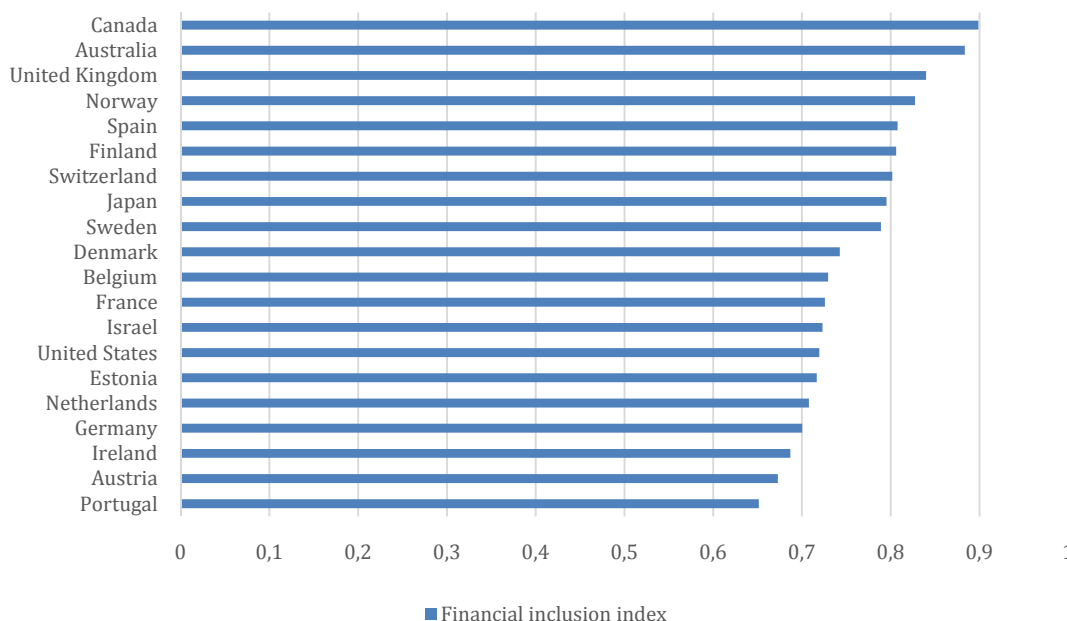The visualized result of the obtained index of financial inclusion is presented in the following graph (*Fig. 2*).



Fig. 2. **Top-20 countries in terms of the index of financial inclusion of the population**
*Source*: authors' own calculations.

We will perform a correlation analysis for two indicators: the Financial Inclusion Index (IFI) and the Basel Laundering Index (ALM). Correlation analysis will determine the tightness and strength of the relationship between these variables. As a result of this analysis, a correlation matrix with a dimension of two was obtained (*Table 5*).

Table 5

**Correlation matrix for the Financial Inclusion Index and the Basel Laundering Index**

| Variables | Variables | |
|-----------|-----------|-----|
|  | **AML** | **IFI** |
| AML | 1,00 | -0,71 |
| IFI | -0,71 | 1,00 |

*Source*: authors' own calculations.

Given the obtained correlation matrix, there is a close linear inverse relationship between these indicators because the correlation coefficient is -0.71, also confirmed graphically (*Fig. 3*). Clusters of points around a straight line pointing down indicate a tight and inverse relationship.
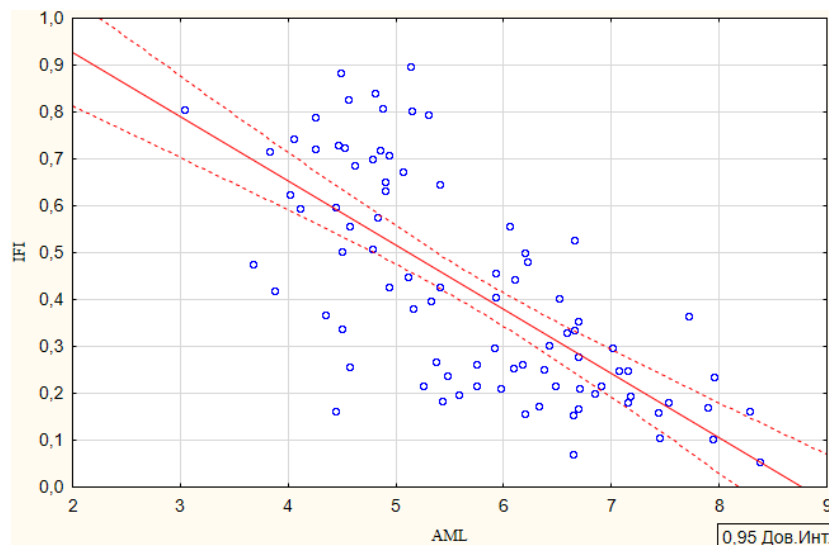
Fig. 3. **Scattering chart of the Financial Inclusion Index and the Basel Laundering Index**
*Source*: authors' own calculations.

At the next stage of the study, we will build a one-factor regression model of the type, formalizing the functional relationship between the presented indices. In particular, the regression model should be used to check the extent to which the level of illegally obtained income is determined by the level of financial inclusion of the population.

The regression model built based on the obtained regression parameters (*Table 6*) has the following form (5).

$$AML = 7{,}23 - 0{,}7 IFI + 0{,}0001. \qquad (5)$$

Table 6

**The results of regression analysis, where the Basel index of money laundering acts as a dependent variable**

| Variable | Parameter | *t*-statistics | *p*-level |
|---|---|---|---|
| Free parameter | 7,23 | 38,68 | 0,00 |
| IFI | -0,70 | -9,28 | 0,00 |
| $R^2 = 0{,}7$ $F(1{,}87) = 86{,}161\ p < 0{,}00000$ | | | |

[**)] at a given level of significance of 0.05.
*Source*: authors' own calculations.

After analyzing the results of regression analysis from the *Table 6*, the following conclusions can be drawn:

- with an increase in the index of financial inclusion per unit value of the Basel index of money laundering decreases by 0.7;
- the coefficient of determination R2 is equal to 0.7. It indicates a high level of reliability of the results (70% of the variation of the Basel index of money laundering is determined by a change in the index of financial inclusion of the population);
- the calculated value of the Fisher criterion for the given degrees of freedom and level of trust is equal to 86.161, which is much higher than the corresponding tabular value — 3.95. This result confirms the statistical significance of the regression model;
- the calculated values of the Student's criterion for the free member and the financial inclusion index significantly exceed the corresponding tabular value of 1.66, and the probability level p in two cases is less than 0.05.

Thus, the model is adequate, and the results can be used in further research.

It is necessary to build a multiple regression model. The independent variables will be nine indicators that identify the level of financial inclusion of the population. The variables ONLINE and CRED_CARD were excluded from further study because they revealed multicollinearity. The result is the following regression multifactor model (6).

$$AML = 7,05 - 0,38BANK\ AC + 0,02ATM - 0,23BANK\ BR -$$
$$- 0,08DEPOS\ AC + 0,03POS + 0,12OUT\ LOANS - 0,75INTER + 0,0001. \qquad (6)$$

After analyzing the results of regression equation 6, we can draw the following conclusions:

- the coefficient of determination R2 is equal to 0.75, which indicates a high level of reliability of the results (75% of the variation of the Basel index of money laundering is determined by changing the data of seven indicators of financial inclusion of the population);

- the calculated value of the Fisher criterion for the given degrees of freedom and level of trust is equal to 11,431, which significantly exceeds the corresponding tabular value — 2,00. This result confirms the statistical significance of the regression model;

- the calculated values of the Student's criterion for a free member, the indicators «People with open bank accounts», «Number of bank branches» and «Use of the Internet for shopping,» significantly exceed the corresponding tabular value of 1.66, and the probability p in two cases is lower than 0.05.

**Conclusions**. Thus, in general, the level of financial involvement of the population has a positive effect on the fight against money laundering in all countries studied.

Based on the correlation-regression analysis, a close, inverse, functionally confirmed relationship between the population's financial inclusion index and the Basel index of money laundering was revealed. The construction of multiple regression with the inclusion of independent variable components of the financial inclusion index allowed to confirmation the obtained result. In particular, the activation of consumers in the financial services market, which is manifested through the more active use of banking services and Internet resources to purchase and pay for the necessary goods or services, can reduce money laundering.

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