Oleg Pidkhomnyi (Ukraine), **Mariya Rubakha** (Ukraine)

FINANCIAL FACTORS FOR RESTRAINING THE UNDERGROUND ECONOMY: CASE OF UKRAINE

Abstract

The underground economy in Ukraine is one of the major obstacles on the way to accelerative eco-nomic growth and European integration processes. The high level of undergrounding leads to the weakening of the regulatory impact of fiscal and monetary policy instruments on the development of the national economy. Against this background, the financial and economic processes underground-ing is a major challenge and a top priority problem for Ukraine today.

The article aims to determine the financial levers to restrict economy's undergrounding and justify measures to reduce the risk of undergrounding by certain monetary and budgetary parameters regu-lation. The research methodological basis is the methods of scientific abstraction, induction, deduc-tion, generalization, logical method. For analytical calculations there are used coefficient analysis, mathematical methods, including correlation analysis, comparison and grouping methods, synthesis, tabular and graphical methods. The Ukraine underground economy is selected as the study object example with this methods' system using.

Therefore the study, based on the calculation of the Fechner correlation coefficient, has revealed the presence, closeness and direction of the relationship between monetary indicators (values of changes in monetary aggregates M0, M2 and M3, CPI, changes in the official hryvnia rate to the US dollar), budgetary parameters (changes in intergovernmental transfers, changes in external public debt, tak-ing into account inflation) and the underground economy level. Thus, according to the results of the analysis, the main directions of the relevant regulatory bodies influence on the national economy unshadowing have been determined.

О. М. Підхомний (Україна), **М. В. Рубаха** (Україна)

ФІНАНСОВІ ЧИННИКИ СТРИМУВАННЯ ТІНІЗАЦІЇ НАЦІОНАЛЬНОЇ ЕКОНОМІКИ УКРАЇНИ

Анотація

Тіньова економіка в Україні є однією з вагомих перешкод на шляху прискорення економічного зростання та євроінтеграційних процесів. Високий рівень тінізації призводить до ослаблення регуляторного впливу інструментів фіскальної та грошово-кредитної політики на розвиток національної економіки. Враховуючи це, детінізація фінансово-економічних процесів є на сьогодні серйозним викликом та першочерговим завданням України. Метою статті є визначення фінансових важелів детінізації економіки та обґрунтування заходів зменшення рівня ризику тінізації через регулювання визначених монетарних та бюджетних параметрів. Методологічною основою дослідження є методи наукової абстракції, індукції, дедукції, узагальнення, логічний метод. Для аналітичних розрахунків використано коефіцієнтний аналіз, математичні методи, зокрема кореляційного аналізу, методи порівняння та групування, синтезу, табличний та графічний методи. Об'єктом дослідження є тіньовий сектор економіки України. У результаті дослідження на основі розрахунку коефіцієнта кореляції Фехнера виявлена наявність, тіснота та напрям взаємозв'язків між монетарними показниками (значеннями зміни грошових агрегатів М0, М2 та М3, ІСЦ, зміни офіційного курсу гривні до долара США) і бюджетними параметрами (зміни міжбюджетних трансфертів і зміни зовнішнього державного боргу з врахуванням інфляції) та рівнем тіньової економіки. Таким чином, за результатами проведеного аналізу визначено основні напрями впливу відповідних регулюючих органів на детінізацію національної економіки.

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INTRODUCTION

In the context of the global and national transformation trends combination with the necessity to ensure Ukraine economic stability and ability to due socio-economic development, there is an urgent need to study the system of principles, methods and factors to provide a financial and economic processes' transparency. After all, the rate of economic growth is directly dependent on such a system's application. At the same time, minimizing the underground economy level is one of the key factors to ensure state economic security. Improving the national economy situation by reducing the underground sector share in Ukraine is extremely important and a priority for achieving economic stability.

1. LITERATURE REVIEW

Problems of the state mechanism of for economic relations undergrounding's regulation in Ukraine have been thoroughly studied by Baranov (2015), Bochi and Povoroznyk (2014), Kharazishvili (2017), Mazur (2006), Tyshchuk et. al. (2011), Iurchyk (2013) and others.

Many aspects of the public expenditures financial monitoring problem have been thoroughly studied by several domestic economists: Hlushchenko and Semehen (2014), Kulchytskyi and Demchyshak (2015), Pikhotskyi (2014) and others.

Methodological and methodological aspects of the underground economy's level regulation by means of monetary levers are outlined in the scientific works of Dernova (2010), Holovotiuk (2008), Reikin and Makara (2017), Tymoshchuk (2013).

The methodology for measuring the underground economy size and properties is proposed by Solis-Garcia and Xie (2018). Energy based underground economy estimation is studied by Psychoyios et al. (2019). The impact of informal economy on income inequality by using a panel data set of 19 Asian countries during the period 1990–2015 is examined by Huynh and Nguyen (2020).

Chengelova summarized the basic theoretical issues discussed by Bulgarian sociologists to measure and explain the underground economy in this country (2016). Bejaković (2015) analyzed causes and effects of the underground economy in Croatia. Impact of underground economy on life quality is investigates by Kireenko and Nevzorova (2015). Dell'Annoa and Davidescu have estimated underground economy and tax evasion in Romania (2019). The underground economy in transition countries is studied by Eilat and Zinnes (2002).

The interconnection between the economic growth–inflation–underground economy trilogy by including the role of political stability for a sample of 33 developed and 14 developing countries over the 2005–2016 period are researched by Baklouti and Boujelbene (2019).

Weng et al. (2018) explore the nonlinear relationship between underground economy and income inequality and determine whether the size of informal economy can influence the income inequality level.

2. AIMS

The economic processes shadowing in a state is a multidimensional phenomenon, which is determined by the internal and external state's environment factors combination. The article focuses on exploring the possibilities to minimize the economy shadowing level by regulating individual budgetary and monetary parameters.

3. METHODS

Correlation is the common statistical concept to research the relationship between two or more random variables. The Pearson Linear Correlation Coefficient proved to be the most popular among the various correlation

coefficients. However, there are some necessary conditions for using this measure of relations' tightness. One of the mandatory condition for its using is a normal distribution law of both variables the interrelation tightness for which is investigated. In other words, the asymmetry and the kurtosis values of the related data series should be close to zero.

But, regarding the economic indicators involved in this research accordant data's characteristic are hardly met. Therefore, we have resorted to the use of nonparametric correlation coefficients, namely the Fechner correlation coefficient, in this study. Moreover, Fechner correlation coefficient is appropriate to measure relationship for small data series. This analytical instrument is based on the comparison of two indicators' parallel series deviations' signs from their average values. As any other correlation indicator the Fechner coefficient varies from 0 to ± 1. If the signs of all deviations coincide and consequently the Fechner coefficient is equal to 1, this indicates direct tight two phenomena connection. If all deviations' signs are different then Fechner coefficient is –1, indicating the inverse connection between indicators. At the same time, in practice, intermediate values of this coefficient are more likely to occur.

Note that all the absolute monetary indicators have been adjusted to the inflation rate and their annual changes are calculated in this research to further correlation investigation. Structural indicators have been taken without adjustment. The logical method has been used to formulate hypotheses and to explain the revealed phenomena relations. The graphical method complements the scientific findings revealed by analytical methods by visualizing the study results.

4. RESULTS

Almost all economies in the world face the problem of underground cash flows and financial and economic processes in general. In some countries, the underground relations volume is fixed at a level that does not have a significant impact on the economy, while in others it is an evidence of the black economic relations' reproductive system existence. Unfortunately, Ukraine belongs to the second category.

According to official data, the Ukraine informal economy level has declined in recent years (Figure 1).
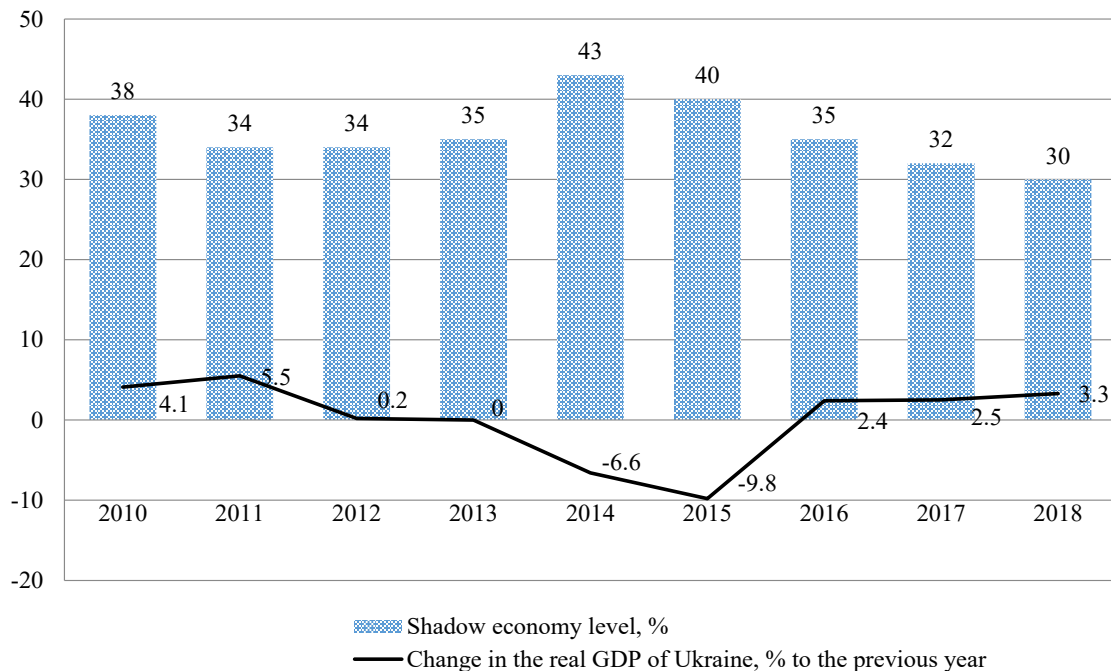
Source: Created by the authors according to the National Risk Assessment Report (State financial monitoring service of Ukraine, 2019).

Figure 1. Integral indicator of the underground economy level in Ukraine (in % of official GDP) and the rate of real GDP growth / decline (in % to the previous year)

Alternative (non-governmental) studies of Ukraine underground economy indicate its higher level. Thus, experts from the Institute of Social and Economic Transformation claim that, unlike in other countries, the Ukraine underground economy structure is not concentrated in the field of unregistered business or small services and trade. The largest tax evasion schemes in Ukraine are implemented by large enterprises that dominate their industries and, as a rule, have political protection and immunity from fiscal and law enforcement control. Based on state statistics, experts from the Institute of Social and Economic Transformation have analyzed the 8 most popular tax avoidance schemes in Ukraine, which result in total budgetary losses of more than 180 bln UAH per year (State financial monitoring service of Ukraine, 2020; Institute of Social and Economic Transformation, 2020).

The black economy level is calculated by different methods. Therefore, this indicator may vary depending on the organization calculating it and the evaluation method used. As can be seen from Figure 2, all the methods used to assess the underground economy level have shown a decrease in its level in recent years.

The tendency to reduce the informal economy size is due to the following factors: an increase in sales of consumer goods at the legal sector over the growth rate of adjusted spending on consumer goods; reduction of domestic electricity consumption minus utility consumption; the Ukraine foreign exchange market relative stabilization.

According to the results obtained, the level of the underground economy in Ukraine, calculated by different methods, shows generally the same dynamics. There are some differences, which are mostly manifested in a much higher informal economy level calculated by the cost method than by others. In general, the level of the black economy in Ukraine ranges from 26% to 58% depending on its calculation method. Such divergence of the underground economy level estimates by different methods indicates that each calculation method covers a specific sphere of the national economy. Of course, in the case of such discrepancies, the informal economy indicators
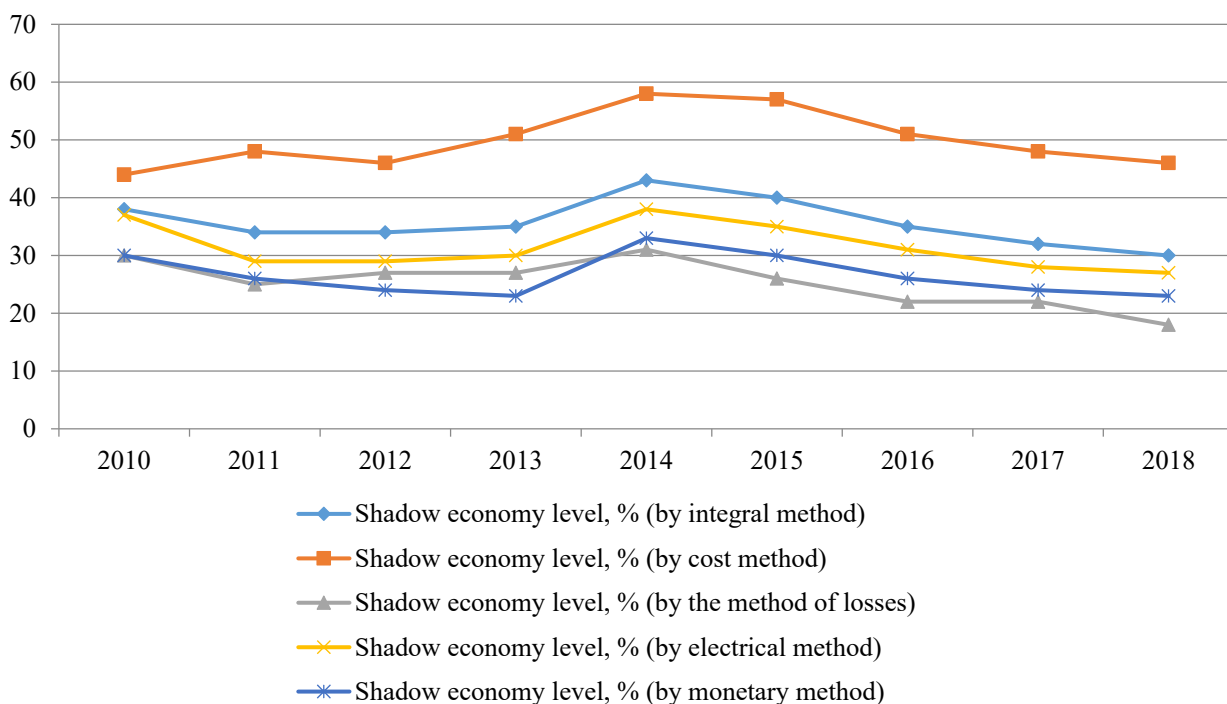
Source: Created by the authors according to the Ministry for Development of Economy, Trade and Agriculture of Ukraine (2020) and the State Statistics Service of Ukraine (2020).

Figure 2. Dynamics of the underground economy level calculated by individual methods, % of official GDP, 2010−2018

calculated using one of the methods cannot serve as an accurate measure for the financial and economic processes shadowing spread. The article uses the integral indicator of the underground economy level in Ukraine (as a percentage of official GDP) to justify the use of financial levers in the state regulation system in order to limit the national economy undergrounding.

To study stochastic relations, in particular, to estimate the relationships' closeness and to determine its direction, between the determined indicators of monetary and budgetary spheres and the underground economy level, there is used the method of the Fechner correlation coefficient calculation (Chernavyn, 2018). During the analyzed period 2007–2018, a number of correlation interdependencies between the indicators given in the following table are revealed (Table 1).

Table 1. Macroeconomic indicators affecting the informal economy level

Source: Formed by the authors according to the data of the Ministry of Finance of Ukraine (2020) and the State Statistics Service of Ukraine (2020).

Year	The underground economy level, %	Official exchange rate of hryvnia to US dollar (for 100 units), UAH	Consumer Price Index, %	Transfers to local budgets, UAH mln	Government external debt, bln UAH	Inflation-adjusted transfers to local budgets, UAH mln	Inflation-adjusted government external debt, UAH bln	M0 monetary aggregate, bln UAH	M2 monetary aggregate, bln UAH	M3 monetary aggregate, bln UAH
2007	28.8	505	116.6	44.655,9	53.488	44.655,9	53.488	111.119	391.273	369.156
2008	31.1	770.00	122.3	59.112,70	86.023	48.334,18	70.337,69	154.759	512.527	515.727
2009	39	800.12	112.3	62.180,10	135.926	45.273,62	98.968,35	157.029	484.772	487.298
2010	38	794.00	109.1	77.766,20	181.813	51.899,11	121.337,2	182.990	596.841	597.872
2011	34	798.97	104.6	94.875,00	195.806	60.532,57	124.929	192.665	681.801	685.515
2012	34	799.30	99.8	124.459,60	208.919	79.567,41	133.562,6	203.200	771.126	773.200
2013	35	799.30	100.5	115.848,3	223.016	73.693,71	141.865,5	237.800	906.236	909.100
2014	43	1.615,78	124.9	130.600,7	486.027	66.515,65	247.536,2	282.900	955.349	956.700
2015	40	2.515,18	143.3	173.980	826.270	61.834,58	293.666,3	282.670	771.100	994.060
2016	35	2.711,90	112.4	195.395,3	980.185	61.784,55	309.937,3	314.390	906.300	110.270,0
2017	32	2.801,61	113.7	272.602,9	108.031,0	75.811,63	300.437,2	332.546	120.885,9	120.755,0
2018	30	2.815,00	109.8	298.939,7	139.721,7	75.715,81	353.888,8	363.629	125.645,0	127.764,0
Average (2008–2018)	35.6	1.565,6	113.9	14.5978,2	527.410,2	63.723,9	199.678,7	234.641,4	786.886,2	823.043,2

There are analyzed the presence, closeness and direction of the relationship between some indicators. Those indicators include the values of changes in the monetary aggregates M0, M2 and M3, consumer price index, changes in the official hryvnia rate to the US dollar, changes in intergovernmental transfers and changes in the public external debt taking into account inflation and the level of the underground economy (Table 2).

Table 2. Adapted data on macroeconomic indicators affecting the level of the underground economy

Source: Calculated by the authors according to the data of the Ministry of Finance of Ukraine (2020) and the State Statistics Service of Ukraine (2020).

Year	The underground economy level, %	Changes in M0, bln UAH	Changes in M2, bln UAH	Changes in M3, bln UAH	Changes in transfers to local budgets adjusted for inflation, UAH mln	Changes in inflation-adjusted government external debt, UAH bln	Changes in the official hryvnia rate to the US dollar (100 USD), UAH
2008	31.1	43.640	121.254	146.571	3.678,278	16.849,69	265
2009	39	2.270	−27.755	−28.429	−3.060,56	28.630,65	30.12
2010	38	25.961	112.069	110.574	6.625,492	22.368,85	−6.12
2011	34	9.675	84.960	87.643	8.633,463	3.591,824	4.97
2012	34	10.535	89.325	87.685	19.034,83	8.633,54	0.33
2013	35	34.600	135.110	135.900	−5.873,7	8.302,928	0
2014	43	45.100	49.113	47.600	−7.178,06	105.670,7	816.48
2015	40	−230	−184.249	37.360	−4.681,06	46.130,1	899.4
2016	35	31.720	135.200	108.640	−50.0296	16.271,02	196.72
2017	32	18.156	302.559	104.850	14.027,07	−9.500,09	89.71
2018	30	31.083	47.591	70.090	−95.8123	53.451,61	13.39
Average (2008−2018)	35.6	23.338,2	81.792,69	83.351,46	2.823,6	27.309,2	210

Table 3 shows the intermediate data used to calculate the Fechner correlation coefficients.

Table 3. Signs of deviations from the averages of macroeconomic indicators affecting the underground economy level

Source: Calculated by the authors according to the data of the Ministry of Finance of Ukraine (2020) and the State Statistics Service of Ukraine (2020).

Year	The underground economy level, %	Changes in M0, bln UAH	Changes in M2, bln UAH	Changes in M3, bln UAH	Changes in transfers to local budgets adjusted for inflation, UAH mln	Changes in inflation-adjusted government external debt, UAH bln	Changes in the official hryvnia rate to the US dollar (100 USD), UAH
2008	−1	1	1	1	1	−1	1
2009	1	−1	−1	−1	−1	1	−1
2010	1	1	1	1	1	−1	−1
2011	−1	−1	1	1	1	−1	−1
2012	−1	−1	1	1	1	−1	−1
2013	−1	1	1	1	−1	−1	−1
2014	1	1	−1	−1	−1	1	1
2015	1	−1	−1	−1	−1	1	1
2016	−1	1	1	1	−1	−1	−1
2017	−1	−1	1	1	1	−1	−1
2018	−1	1	−1	−1	−1	1	−1

It is worth noting that the budgetary relations' sphere is a generator of significant offenses, which is an important factor in the Ukraine national economy shadowing. A large number of offenses in the budget process occur, inter alia, because of insufficient justification for identifying high-risk areas in the allocation and redistribution of public funds. There is reason to argue that the funds' allocation by the state has an impact on the underground economy of Ukraine.

From this perspective, the relationship between the level of the underground economy and the volume of intergovernmental transfers is interesting. State-level budget expenditures for large and complex programs are much more difficult to control than lower-level expenditures for small and obvious expenditure items that are targeted and can be relatively easily controlled by the local public. In addition, the increase in intergovernmental transfers increases the financial capacity of territorial communities, and therefore the incentives to shade financial and economic activity are diminished. The correlation between the informal economy level and the volumes of intergovernmental transfers during the analyzed period is revealed. The corresponding Fechner correlation coefficient is −0.27, which indicates an inverse relationship between the volumes of intergovernmental transfers and the level of the informal economy (Figure 3).

Another financial factor that shade the economy may be the increase in external state borrowing. A close direct correlation between the level of the underground economy and changes in inflation-adjusted public external debt has been identified. The Fechner correlation coefficient between these indicators is 0.64 (Figure 4).

The direct correlation between the growth of Ukraine's external public debt and its underground economy level indicates a significant increase in the risk of budget allocations misuse when their volume increases as result of external borrowing.

The main regulator of the monetary sphere, the leader of monetary policy is the National Bank of Ukraine, which by using monetary levers can positively influence the transparency of all economic activity types, reduce the scale and risks of the national economy functioning in the undergrounds (Tymoshchuk, 2013). Therefore, it is important to determine what methods and levers the National Bank of Ukraine can reduce the risks of expanding the informal sector and increase the cash flows transparency in the national economy.

The level of the informal economy is influenced significantly by the change in the official hryvnia rate to US dollar (with a Fechner correlation coefficient of 0.45), i.e. there is a direct correlation between the change in the official hryvnia to the US dollar and the underground economy level, which is graphically depicted in Figure 5.
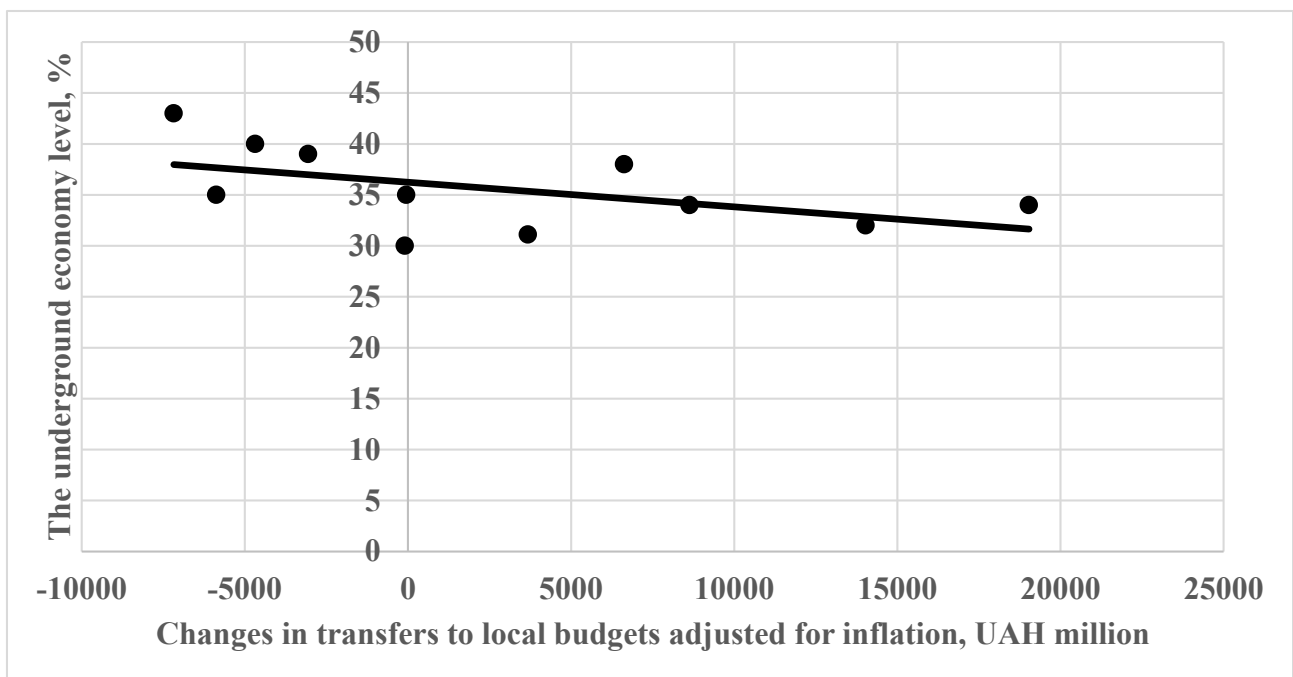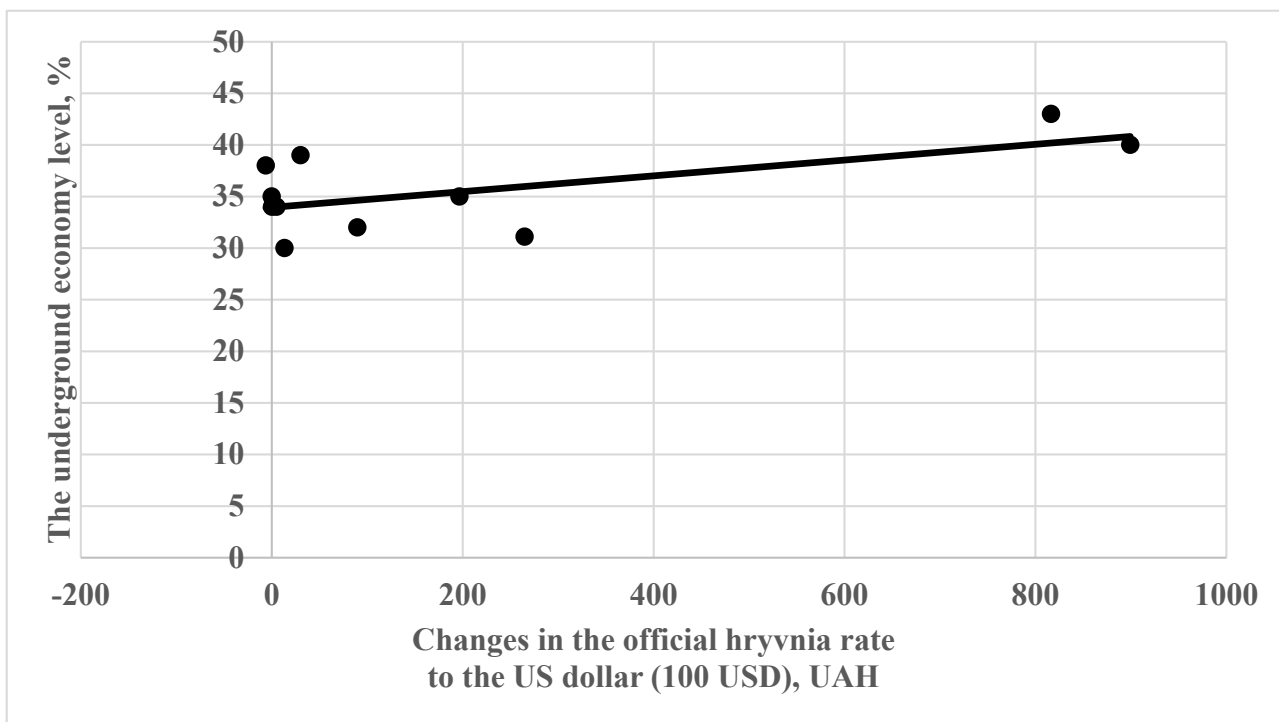

Source: Formed by the authors according to the data of the Ministry of Finance of Ukraine (2020) and the State Statistics Service of Ukraine (2020).

Figure 3. The impact of changes in transfers to local budgets adjusted for inflation on the underground economy level during 2008–2018
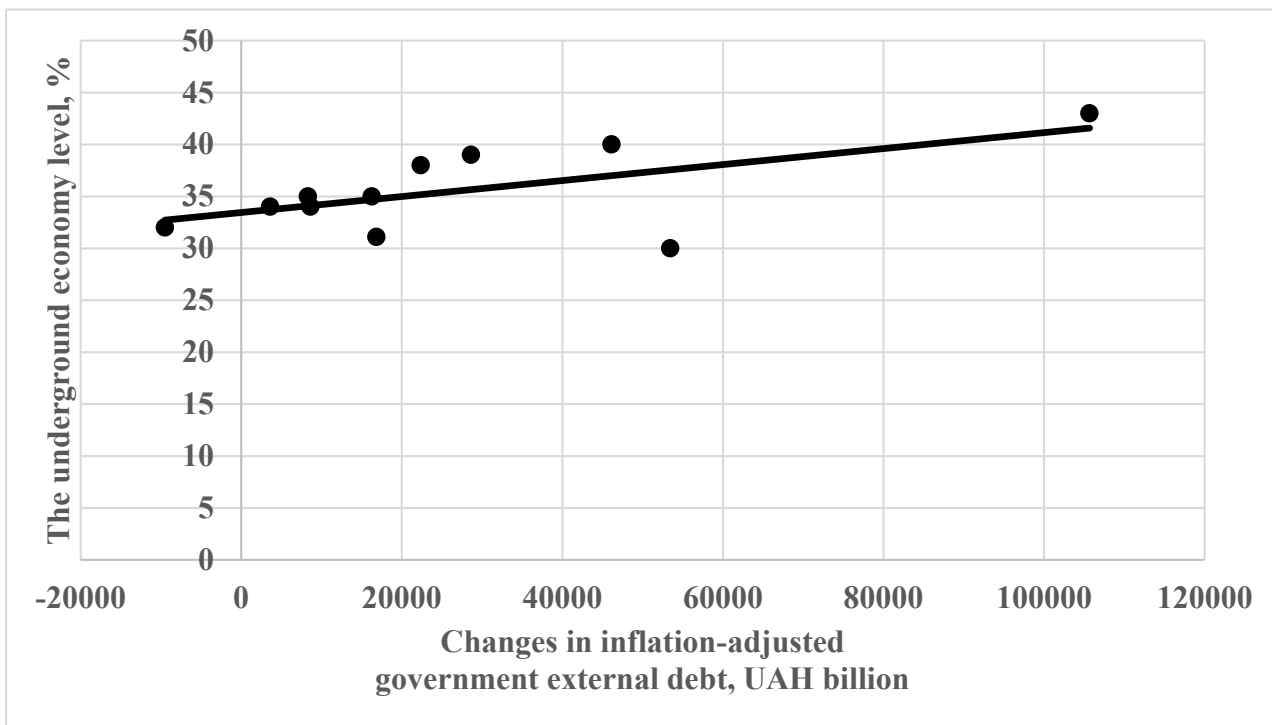
Figure 4. The impact of inflation-adjusted public external debt on the underground economy level during 2008–2018

Figure 5. The impact of changes in the official hryvnia exchange rate to the US dollar on the underground economy level during 2008–2018

The explanation for this may be the directing to the informal sector of NBU's large volumes refinancing, which is provided to Ukraine commercial banks in currency crises times. As the hryvnia exchange rate rises to the US dollar, macroeconomic volatility increases, with the result that business entities use profit-hiding schemes. That is, in the face of devaluation shocks, the level of the underground economy increases, and such an increase has been observed clearly since 2013 in this study.

At the same time, a correlation is found between the level of the black economy and the monetary aggregate M0, which includes cash in circulation outside deposit-taking corporations. The accordant Fechner correlation coefficient is 0.23 (direct correlation between indicators). As the use of cash dominates at the underground economy over non-cash payments, the monetary aggregate M0 growth may proof an increase in the underground transactions' share. By reducing the amount of cash, the National Bank can reduce the risks of the economy shade.

Accordingly, there is an inverse relationship between the monetary aggregate M2 and the level of the underground economy (Figure 6).

The Fechner correlation coefficient is (–0.64), and with a one-year time lag it is (–0.4). Accordingly, the expansion of non-cash payments is a monetary NBU lever to anti-shade the national economy.

In addition, a significant correlation is found between the change in the national currency rate to the US dollar and the M2 aggregate. The Fechner correlation coefficient is (–0.45), which shows a close inverse relationship. That is, as the hryvnia appreciates against the US dollar, the money supply, in particular, the M2 monetary aggregate, shrinks and vice versa. The graphical relationship between these indicators is shown in Figure 7.
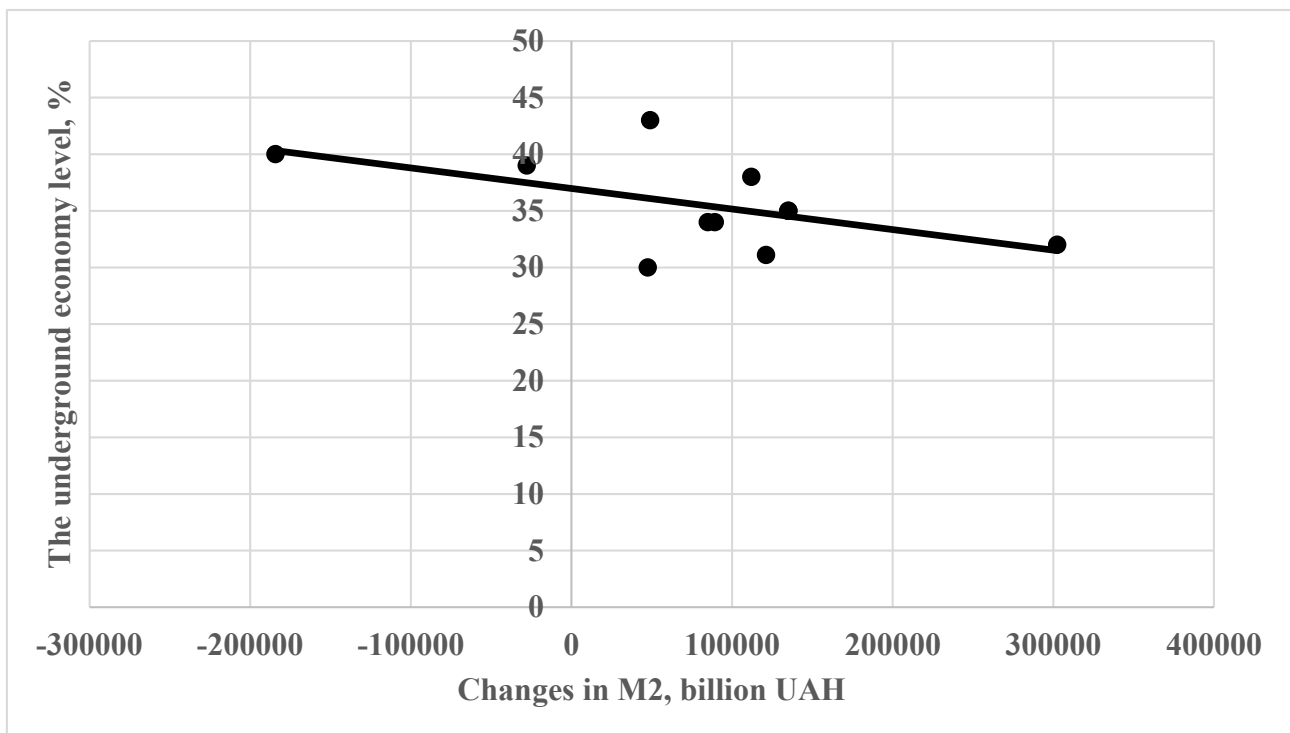
Source: Formed by the authors according to the data of the Ministry of Finance of Ukraine (2020) and the State Statistics Service of Ukraine (2020).

Figure 6. The relationship between the change in the monetary aggregate M2 and the underground economy level during 2008–2018
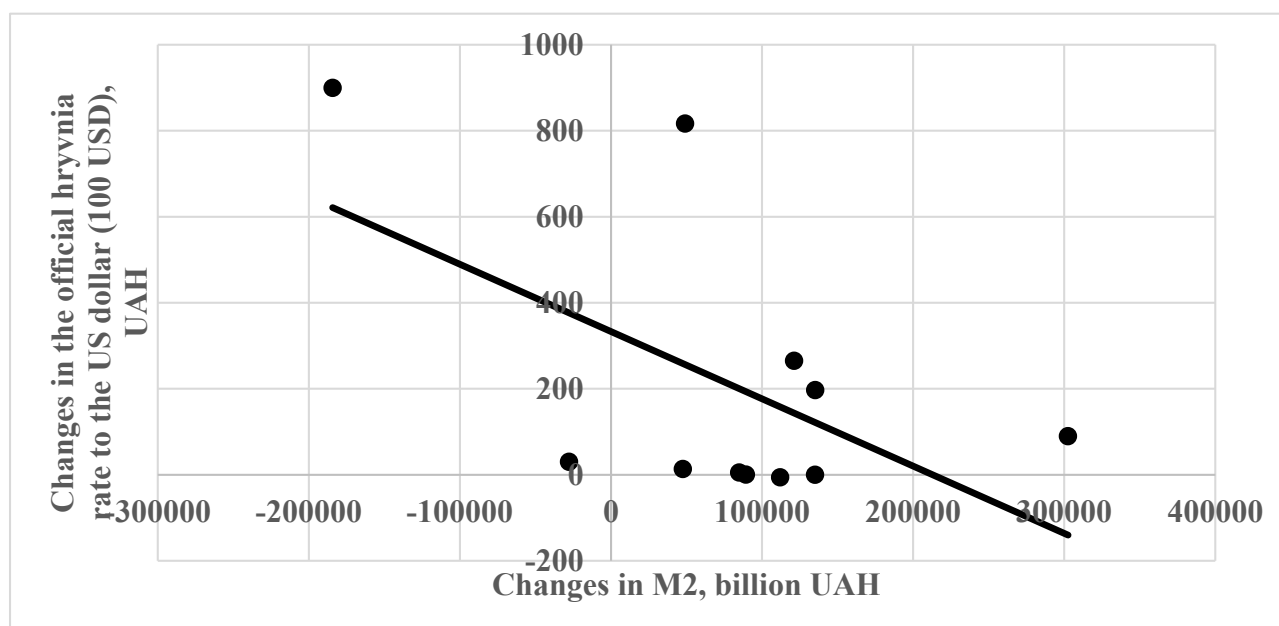
Source: Created by the authors according to the data of the National Bank of Ukraine (2020) and the State Statistics Service of Ukraine (2020).

Figure 7. Relationship between changes in the M2 monetary aggregate and changes in the official hryvnia exchange rate to the US dollar during 2008–2018

The study results revealed also that in Ukraine there is a direct correlation between indicators such as the level of the informal economy and one of the most important indicators characterizing inflationary processes in the country's economy – the consumer price index. The corresponding Fechner correlation coefficient is (0.45).

5. DISCUSSION

It should be noted that the analysis of the monetary regulator measures over the studied period and the obtained economic effects shows that due to the effective measures of the National Bank of Ukraine the corresponding monetary conditions for the growth of the domestic economy were created. However, the level of monetization of the Ukrainian economy is quite significant: from 47.7% to 60.2% during the whole study period. According to NBU data, in 2018, cash in circulation was almost one third of the volume of the monetary aggregate M2; including about 90% outside the banking system (National Bank of Ukraine, 2020). According to the study, such a high level of monetization does not contribute to the anti-shading of the major economic entities' cash flows, since cash is used largely to serve cash transactions in the underground economy. It should be noted that according to the IMF methodology, the dollarization level of the official Ukrainian economy segment is estimated as dangerous, as it exceeds the critical threshold (32.2% > 30%), which causes further economy undergrounding.

The influence of the money supply and M2 dynamics on the exchange rate can be as follows:

1) to affect the level of domestic prices, which, in turn, affect the level of the exchange rate;
2) to influence directly the demand and supply of national currency, which causes its price to change in the domestic foreign exchange market (Dernova, 2010).

In the context of increased inflationary processes, the real incomes of economic entities can significantly decline depending on the inflation rate, which provokes to create the sources of unofficial underground incomes, and vice versa: the decrease in the inflation rate stabilizes the incomes of the main economic entities, which leads to the de-shading of economic processes.

CONCLUSIONS

Thus, the study identified the main financial levers that can be used to manage the risk of shading economic processes. The relationships between the changes in monetary aggregates, the exchange rate, the amounts of intergovernmental transfers, the consumer price index, the public external debt and the underground economy level in Ukrainian are analyzed. The Fechner correlation coefficient reveals a direct correlation between changes in the consumer price index, the amount of public external debt, the exchange rate, the amount of cash in circulation and the level of the economy shading. There is an inverse relationship between changes in the volume of the monetary aggregate M2 and the volume of intergovernmental transfers on the one hand, and the economy underground sector on the other. In order to minimize the risk of national economy shading, governmental regulators should focus on certain financial levers, taking into account the correlation between the studied indicators.

AUTHORS CONTRIBUTIONS

Conceptualization: Oleg Pidkhomnyi.
Data curation: Mariya Rubakha.
Formal Analysis: Oleg Pidkhomnyi.
Investigation: Mariya Rubakha.
Methodology: Oleg Pidkhomnyi.
Project administration: Mariya Rubakha.
Supervision: Oleg Pidkhomnyi.
Validation: Mariya Rubakha.
Visualization: Oleg Pidkhomnyi.
Writing – original draft: Mariya Rubakha.
Writing – review & editing: Mariya Rubakha.

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