ECONOMETRIC ASSESSMENT OF THE IMPACT OF ECONOMIC INDICATORS ON THE NON-OBSERVED ECONOMY OF MOLDOVA

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ABSTRACT

The non-observed economy is an integral part of the modern economic system, representing a threat to economic security in conditions of slow stagnation. The relevance of this study lies in the fact that the identification of factors influencing the non-observed economy makes it possible to develop proposals to combat this phenomenon. At the same time, some problems in econometrically modeling the dependence of the non-observed economy on socio-economic indicators are highlighted. The novelty and purpose of the study is the construction of models with one equation, where the endogenous variable is the level of the non-observed economy in value terms and the share of the non-observed economy in GDP. The main research methods are regression analysis and economic and mathematical modeling. At the first step of the study, the identified main factors of influence that determine the size of the shadow economy in twenty-eight countries of the world were systematized. In the next step, exogenous variables were identified based on the statistical data published by the National Bureau of Statistics of Moldova. The econometric analysis software EViews 9 was used to develop the models of the dependence of the non-observed economy in Moldova on socio-economic indicators. Single-equation models were tested and checked first-order and second-order autocorrelation of the regression errors and heteroscedasticity. The constructed models showed that the growth of the main sectors of the national economy and an increase in the unemployment rate lead to the growth of the non-observed economy in Moldova, while the rise in foreign trade turnover, namely imports, negatively affects the endogenous variable. There is a negative relationship between the freight turnover and the level of the non-observed economy.

Keywords: *non-observed economy; economic indicators; regression analysis; economic and mathematical modeling; single-equation models.*

Economia neobservată este o parte integrantă a sistemului economic modern, reprezentând un pericol pentru securitatea economică a statului în condițiile stagnării latente. Relevanța acestui studiu constă în faptul că identificarea factorilor care influențează economia neobservată face posibilă elaborarea propunerilor de combatere a acestui fenomen. Totodată, se evidențiază unele probleme în elaborarea modelelor econometrice a dependenței economiei neobservate de indicatorii socio-economici. Noutatea și scopul studiului este construirea modelelor care conțin o singură ecuație, în care variabila endogenă este nivelul economiei neobservate în expresie valorică și ponderea economiei neobservate în PIB. Principalele metode de cercetare sunt analiza regresională și modelarea economico-matematică. La prima etapă a studiului, au fost sistematizați principalii factori de influență care determină nivelul economiei tenebre în douăzeci și opt de țări ale lumii. La etapa următoare, în baza seriilor de date statistice publicate de Biroul Național de Statistică al Moldovei, au fost identificate variabilele exogene. La elaborarea modelelor dependenței economiei neobservate în Moldova de indicatorii socio-economici, a fost utilizat programul de analiză econometrică EViews 9. Modelele cu o singură ecuație au fost testate, inclusiv a fost efectuată testarea autocorelării erorilor de ordin întâi și doi, și heteroscedasticității. Modelele construite au arătat că creșterea principalelor sectoare ale economiei naționale și majorarea ratei șomajului duc la sporirea economiei neobservate în Moldova, în timp ce majorarea volumului comerțului exterior, și anume a importurilor, are un impact negativ asupra variabilei endogene. O relație negativă se înregistrează între parcursul mărfurilor și nivelul economiei neobservate.

Cuvinte-cheie: *economie neobservată; indicatori economici; analiza regresională; modelare economico-matematică; modele cu o singură ecuație.*

Ненаблюдаемая экономика является неотъемлемой частью современной экономической системы и представляет угрозу для экономической безопасности государства в условиях вялотекущей стагнации. Релевантность данного исследования состоит в том, что выявление

факторов влияния на ненаблюдаемую экономику позволяет разработать предложения по борьбе с данным явлением. В то же время, при эконометрическом моделировании зависимости ненаблюдаемой экономики от социально-экономических показателей были выявлены некоторые проблемы. Новизна и цель исследования — построение ряда моделей с одним уравнением, где эндогенной переменной выступают уровень ненаблюдаемой экономики в стоимостном выражении и доля ненаблюдаемой экономики в ВВП. Основные методы исследования: регрессионный анализ и экономико-математическое моделирование. На первом этапе исследования были систематизированы выявленные основные факторы влияния, определяющие размер теневой экономики в двадцати восьми странах мира. На следующем этапе, отталкиваясь от статистических данных, опубликованных Национальным Бюро Статистики Молдовы, были определены экзогенные переменные. При построении моделей зависимости ненаблюдаемой экономики в Молдове от социально-экономических показателей, была использована программа эконометрического анализа EViews 9. Модели с одним уравнением были протестированы, в том числе на автокорреляцию случайных отклонений первого и второго порядка, и на наличие гетероскедастичности. Построенные модели показали, что рост основных отраслей национальной экономики, а также повышение уровня безработицы приводит к росту ненаблюдаемой экономики в Молдове, в то время как увеличение внешнеторгового оборота, а именно импорта, отрицательно влияет на эндогенную переменную. Отрицательная зависимость была выявлена между грузооборотом и уровнем ненаблюдаемой экономики.

Ключевые слова: ненаблюдаемая экономика; экономические показатели; регрессионный анализ; экономико-математическое моделирование; модели с одним уравнением.

INTRODUCTION

The non-observed economy is a significant and inevitable part of world economic activity. Globalization has taken the shadow economy to a new higher level. This activity is unregulated, taxes are not being collected, and the state loses part of the income. Informal employment leads to a decrease in wages, in the solvency of the population, and non-compliance with sanitary and safety standards. Not only businesses but also governments are in contact with the shadow economy, which creates not only economic and ethical problems but also political ones. It is especially characteristic of least developed countries with a low level of population well-being.

There is practically no type of economic activity in Moldova that does not contain elements of the non-observed economy. This is a big problem for economic security of the country, especially in the current period. Therefore, it is relevant to study the essence of the non-observed economy, identify the factors of influence to understand how to deal with it, and if not eradicate it at all, then at least reduce the level.

The main objective of this study is to develop econometric models of the non-observed economy that would allow us to determine the main factors of influence and the direction of the correlation. This study is a continuance of the work "Comparative analysis and adaptation of methods for assessing the non-observed economy (case of Moldova)". The novelty of this study is to elaborate models which differ from those developed by the World Bank and from those worked out by the authors in previous works since the goal was not to assess the non-observed economy but to study the factors of influence and the direction of the relationship (positive or negative).

LITERATURE REVIEW

There are comparatively few papers in the world scientific literature that study the factors that influence the non-observed economy, especially using econometric modeling. While a number of methods are used for evaluation. The most commonly used methods are listed in Table 1.

Table 1

Some methods of evaluation of the non-observed economy

METHODS	THE ESSENCE OF THE METHOD	SCIENTIFIC SOURCES
Fiscal audit	This is a direct method which could be used data obtained from direct sources – surveys, State Tax Service, etc.	Williams ([2014](#))
Electricity consumption method	This is an indirect method. The elasticity between electricity consumption and gross domestic product (GDP) is constant and approximately equal to 1. Based on the dynamics of electricity consumption, it is possible to calculate the total GDP and compare it with the official GDP.	Kaufmann and Kaliberda ([1996](#))
Income-expenditure method based on the methodology of SNA	Comparing income with expenditure, the hidden part of productive economic activity is quantified.	Schneider and Kearney ([2013](#))
Currency demand method	This method is based on the assumption that all shadow transactions are made in cash, and the collection of taxes is the main reason for going underground.	Tanzi ([1983](#))
Modeling method (for example: MIMIC multiple-indicators multiple-causes model)	MIMIC method is used to determine the relationship between cause and indicator variables and the level of the non-observed economy, which is a latent variable.	Medina and Schneider ([2018](#))

Source: *Systematization by authors*

ACCA (Association of Chartered Certified Accountants) experts identified three key factors that determine the size of the shadow economy for each of the 28 countries studied. For the world economy, the most significant factors are bureaucratic quality, corruption control, and GDP (Gross Domestic Product) per capita. The importance of each influence factor varies from country to country. For example, GDP growth, GDP per capita, and employment growth are the top three reasons for the increase in the size of the shadow economy in the USA. In the case of Brazil, these are corruption control, bureaucratic quality, and the young population (% of the total population) ([ACCA, 2017: 12](#)).

According to the ACCA survey of 28 countries, 60.71% named GDP growth one of the three main factors that determined the size of the shadow economy, 46.43% – corruption control, and 39.29% – bureaucratic quality (Figure 1). Thus, to reduce the shadow economy, most of the 28 countries need to increase the GDP growth rate, reduce corruption and improve the quality of the bureaucracy.

Based on the results obtained by ACCA, E. Drobot and I. Makarov systematized the factors influencing the shadow economy as:

- *economic factors,*
- *business environment factors,*
- *socio-demographic factors,*
- *socio-environmental factors,*
- *management factors,*
- *scientific and technical factors.*

Figure 1.

The top influence factors that determine the size of the shadow economy by 28 countries
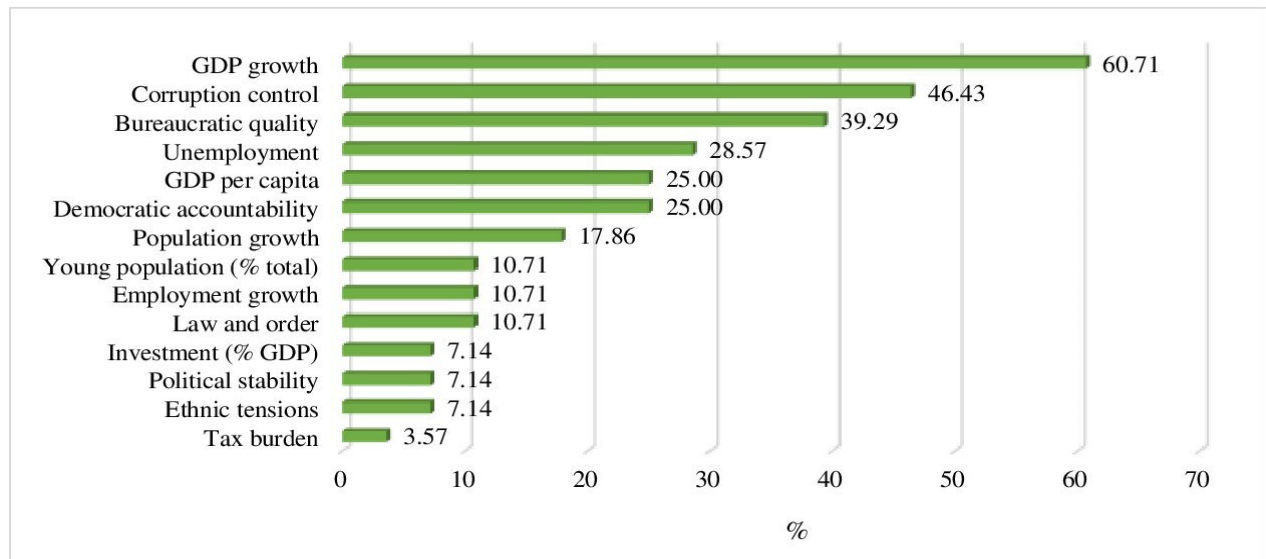
Source: *calculated by authors based on the data from the ACCA (ACCA, 2017: 12)*

Among the economic factors that have a significant impact on the shadow economy, scientists have identified a high tax burden, a recession in the local economy, the complexity of the tax system, a global recession, the ease of participating in the informal sector, and the ease of tax evasion (Дробот & Макаров, 2021).

A. Suslina and R. Leuhin believe that to effectively bring the economy out of the shadow, it is necessary first of all to determine the fundamental causes of this phenomenon. The key factors shaping the shadow economy are "a relatively high tax burden, especially on taxes on labor (including social contributions), administrative barriers to doing business, poor quality of state public institutions, poor quality of labor market regulation, problems of illegal labor, corruption among representatives of the regulatory authorities" (Суслина & Леухин, 2016: 46).

There are relatively more studies on the impact of the non-observed economy on the national economy (Massenot & Straub, 2016; Elgin & Oztunali, 2012; Antunes et al., 2008; Loayza et al., 2004) than surveys of factors influencing it (Реутов & Кифяк, 2021). At the same time, there is a relationship between these two groups of studies. While scientists from the first group argue that the non-observed economy affects economic growth and GDP per capita, scientists from the second group are confident that these two indicators are among the top five influence factors on the level of the non-observed economy. Worth bearing in mind that Ceyhun Elgin & Serdar Birinci found that "the size of the informal economy is mainly associated with growth in Total Factor Productivity, and this relationship very much interacts with GDP per capita" (Elgin & Birinci, 2016: 289).

V. Reutov and A. Kifyak systematized the results of the study by V. Zhukauskas (Zhukauskas, 2015) and identified the following six main groups of factors that form the structure of shadow processes in the economy:

- *social security contributions and tax rates,*
- *tax nihilism,*
- *quality of public institutions,*
- *effectiveness of the social provision,*
- *regulation of the labor market,*
- *the share of communal fees in the cost structure (Реутов & Кифяк, 2021: 95).*

There are a few surveys in this field in Moldova. The object of research is to evaluate the non-observed economy (Costandachi, 2016; Ganciucov et al., 2015), the perception of the population and companies on the informal economy (UNDP, 2021), and not to identify the influence factors. Therefore, it led the authors to explore the factors influencing the unnoticed economy of Moldova.

DATA SOURCES AND USED METHODS

Regression analysis and correlation analysis were applied to assess the impact of macroeconomic indicators on the non-observed economy. Initially, 34 indicators were selected based on a logical analysis. The level of the non-observed economy in value terms and the share of the non-observed economy in the GDP were chosen as endogenous variables. The initial information for the formation of the database was the statistical data of the National Bureau of Statistics (NBS) of Moldova (StatBank, 2022) and the results of the calculation of the non-observed economy using the adapted Currency Demand Approach (CDA). The number of observations is 21 (2000-2020). The most significant socio-economic indicators were considered exogenous variables (34). All value indicators are in current prices.

The authors encountered some problems in econometric modeling of the dependence of the non-observed economy in Moldova on socio-economic indicators. The first difficulty is the small sample of data for some indicators. The second difficulty is the incompatibility of the data to the previous period because BNS modified the methodologies for estimating the following indicators:

- *BNS modified the methodology of the Household Budget Survey in 2019, and the statistical data on "Consumption expenditures of the population" and "Disposable incomes of the population" was interrupted this year*
- *A new indicator, Investments in non-current assets, was calculated starting 2017. It is not comparable with "Investments in long-term tangible assets." The data series of the second indicator was discontinued in 2016;*
- *The data on the "Volume of industrial production" are presented according to the new Classifier of Activities in the Economy of Moldova (CAEM-2) for the period 2011-2020. There are no data for the previous period (2000-2010);*
- *The series of statistical data "Volume of paid services rendered to population" was interrupted in 2011; etc.*

In the second stage, the indicators whose data series was interrupted and whose calculation methodology was modified were removed from the list of exogenous variables. As a result, out of 34 variables only 13 remained (Table 2).

Table 2
System of exogenous variables

| DESIGNATION	EXOGENOUS VARIABLE	UNIT
agr	Gross agricultural production	Million lei
cons	Value of construction works	Million lei
road	Constructed new roads with hard surface	Kilometer
x	Export	Million USD
m	Import	Million USD
tran	Transported goods	Million tonnes
turn	Turnover of goods	Million tonnes-kilometers
eleu	Monthly gross average earnings	Moldovan Leu
eeuro	Monthly gross average earnings	Euro
eusd	Monthly gross average earnings	US Dollar
arate	Activity rate	Percent
erate	Employment rate	Percent
urate	Unemployment rate	Percent

Econometric models of the dependence of the non-observed economy in Moldova on the macroeconomic indicators were built using the program EViews 9.

THE MODELS OF THE DEPENDENCE OF THE NON-OBSERVED ECONOMY IN MOLDOVA ON THE MACROECONOMIC INDICATORS

An analysis of the dynamics of and the share of the non-observed economy in GDP (calculated using the CDA) showed that over 21 years, this indicator decreased by 18.2 percentage points (Figure 2). According to the calculated trend line (logarithmic function), this indicator will decrease.

Figure 2.
Trend functions of the share of the non-observed economy in GDP
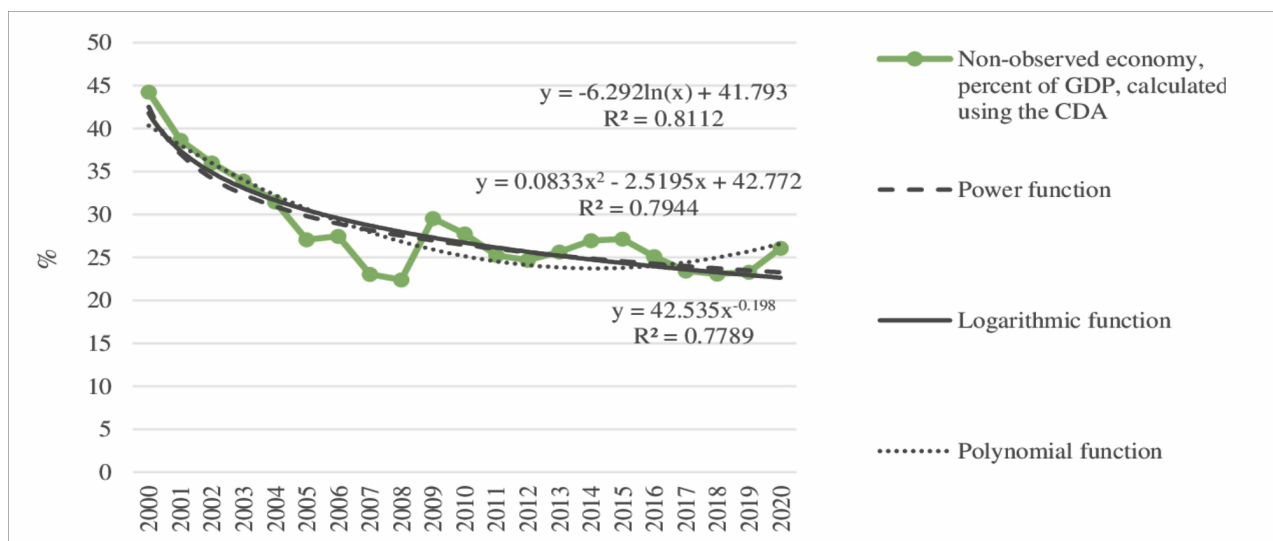
Source: calculated by authors
Note: *y – the share of the non-observed economy in GDP; x – time.*

The presence of multicollinearity is one of the obstacles to the efficient application of regression analysis. It arises in the case of the existence of close statistical relationships between exogenous variables. Using correlation analysis, you can identify and eliminate multicollinearity. For this purpose, a matrix of correlation coefficients between selected indicators was elaborated (Table 3).

Table 3

Matrix of correlation coefficients between exogenous variables

	agr	cons	road	x	m	tran	turn	eleu	eeuro	eusd	arate	erate	urate
agr	1	0.611	0.796	0.741	0.641	0.665	0.652	0.945	0.917	0.884	-0.740	-0.695	-0.693
cons	0.611	1	0.731	0.715	0.676	0.771	0.742	0.975	0.974	0.954	-0.765	-0.715	-0.641
road	0.796	0.731	1	0.726	0.592	0.606	0.465	0.760	0.714	0.659	-0.414	-0.343	-0.769
x	0.741	0.715	0.726	1	0.960	0.614	0.688	0.908	0.927	0.942	-0.644	-0.606	-0.606
m	0.641	0.676	0.592	0.960	1	0.555	0.693	0.830	0.881	0.937	-0.800	-0.665	-0.605
tran	0.665	0.771	0.606	0.614	0.555	1	0.861	0.707	0.661	0.603	-0.400	-0.338	-0.680
turn	0.652	0.742	0.465	0.688	0.693	0.861	1	0.652	0.642	0.644	-0.681	-0.645	-0.660
eleu	0.945	0.975	0.760	0.908	0.830	0.707	0.652	1	0.988	0.949	-0.737	-0.692	-0.797
eeuro	0.917	0.974	0.714	0.927	0.881	0.661	0.642	0.988	1	0.984	-0.782	-0.742	-0.789
eusd	0.884	0.954	0.659	0.942	0.937	0.603	0.644	0.949	0.984	1	-0.850	-0.815	-0.796
arate	-0.740	-0.765	-0.414	-0.644	-0.800	-0.400	-0.681	-0.737	-0.782	-0.850	1	0.994	0.667
erate	-0.695	-0.715	-0.343	-0.606	-0.665	-0.338	-0.645	-0.692	-0.742	-0.815	0.994	1	0.584
urate	-0.693	-0.641	-0.769	-0.606	-0.605	-0.680	-0.660	-0.797	-0.789	-0.796	0.667	0.584	1

Source: *authors' computations using EViews 9*

One indicator of multicollinearity between variables is the value of the pairwise correlation coefficient greater than 0.8. The high dependence is shown by such indicators as "Monthly gross average earnings" (eleu) and "Gross agricultural production" (agr), the correlation coefficient is ($r_{eleu,agr} = 0.945$). In addition, the eleu factor correlates with such indicators as "Value of construction works" ($r_{eleu,cons} = 0.975$), "Export" ($r_{eleu,x} = 0.908$) and "Import" ($r_{eleu,m} = 0.830$). A new set of indicators has been formed following the exclusion of indicators that are multicollinear with each other. Out of thirteen variables, eight remain for assessing the non-observed economy.

The calculation of the pairwise correlation coefficient between the endogenous variable and exogenous variables showed that "Gross agricultural production" has the greatest impact on the volume of the non-observed economy ($r_{lnoe,agr} = 0.970$). "Value of construction works" is in second place in terms of influence ($r_{lnoe,cons} = 0.942$). This is followed by export ($r_{lnoe,x} = 0.912$) and import ($r_{lnoe,m} = 0.806$). The correlation coefficient between imports and exports is high ($r_{x,m} = 0.960$), so only one of them can be used when developing a model.

A fundamental task is to choose the type of function used in the simulation. A multiple linear regression analysis model is often used since this function is easy economically explain. However, the R-squared of the obtained single equation model was less than 0.7. Therefore, the authors applied the logarithmic function. The following three models of the level of the non-observed economy in value terms were obtained.

Model 1.

$\ln(lnoe) = 3.107 + 1.126\ln(agr) + 0.213\ln(cons) - 0.488\ln(m) - 0.499\ln(turn) + 0.422\ln(eusd) - 0.203D08$ (1)

Model 2.

$\ln(lnoe) = 4.258 + 1.194\ln(agr) + 0.480\ln(cons) - 0.365\ln(m) - 0.836\ln(turn)$ (2)

Model 3.

$\ln(lnoe) = 1.839 + 1.302\ln(agr) + 0.238\ln(cons) - 0.114\ln(x) - 0.687\ln(turn)$ (3)

where:

lnoe – the level of the non-observed economy in value terms;

D08 – dummy variable (it takes value 1 in 2008; it takes value 0 in 2000-2007 and 2009-2020).

The authors chose a significance level of 5%. So, the critical level of the probability of rejecting the hypothesis H0, that the regression parameters are equal to zero, is 0.05. If the p-value is less than the established critical level, then the null hypothesis about the insignificance of the model coefficient is rejected, therefore, the coefficient is significant. In the case of model 1, variables ln(agr), ln(m), ln(turn), ln(eusd) and D08 turned out to be significant (Table 4). However, variable ln(cons) is not significant, so the authors reject model 1 and continue testing models 2 and 3.

Table 4

Testing the null hypothesis (the regression parameters are equal to zero) of models 1, 2 and 3

VARIABLES	MODEL 1		MODEL 2		MODEL 3	
	t-value	p-value	t-value	p-value	t-value	p-value
C	2.107	0.054	2.324	0.034	2.705	0.017
ln(agr)	12.358	0.000	10.552	0.000	7.806	0.000
ln(cons)	1.503	0.155	3.555	0.003	2.174	0.045
ln(m)	-3.216	0.006	-2.392	0.029	–	–
ln(x)	–	–	–	–	-2.360	0.033
ln(turn)	-2.756	0.016	-4.734	0.000	-3.605	0.002
ln(eusd)	2.454	0.028	–	–	–	–
D08	-2.432	0.029	–	–	–	–
Marginal level of the test		0.050		0.050		0.050

Source: authors' computations using EViews 9

Table 5 shows the results of testing the quality of the remaining two models. The best among them is model 2, as it has a higher adjusted R-squared and lower information criterion (Akaike, Schwarz, Hannan-Quinn), lower the standard error of the regression, and the residual sum of squares.

Table 5

Testing the quality of model 2 and model 3

	MODEL 2	MODEL 3
R-squared	0.985	0.980
Adjusted R-squared	0.982	0.975
S.E. of regression	0.094	0.109
Sum of squared residuals	0.142	0.190
Log likelihood	22.675	19.626
F-statistic	266.388	198.227
Prob. (F-statistic)	0.000	0.000
Akaike info criterion	-1.683	-1.393
Schwarz criterion	-1.435	-1.144
Hannan-Quinn criterion	-1.629	-1.339

Source: authors' computations using EViews 9

Testing the second model for autocorrelation in the residuals and heteroskedasticity showed that it doesn't have autocorrelation and heteroscedasticity (Tables 8 and 9).

According to Equation (2), an increase in "Gross agricultural production" by 1% will lead to a rising the level of the non-observed economy (NOE) by 1.19%, and a growth of 1% in the "Value of construction works" will lead to an increase in NOE by 0.48%. The following indicators have a negative impact on the level of the non-observed economy: import and turnover of goods. Growth in imports by 1% will carry to a decrease in NOE by 0.37%. Thus, the higher the import, the less profitable it is to engage in shadow business, since the market is saturated, there is no shortage.

Illegal import is much more difficult to implement than illegal export since it is necessary not only to hide the fact of smuggling when crossing the border but also to illegally sell products and hide the income received from the state. Illegal import schemes are much more complex than illegal export schemes.

As a result of econometric modelling of the dependence of the share of the non-observed economy in GDP on the macroeconomic indicators, the following four models were obtained.

Model 4.
$$\ln(snoe) = 6.609 + 0.124\ln(agr) - 0.254\ln(m) - 0.288\ln(turn) - 0.090D17 \qquad (4)$$
Model 5.
$$\ln(snoe) = 6.265 + 0.116\ln(agr) - 0.238\ln(m) - 0.271\ln(turn) + 0.080\ln(urate) + 0.109D14 \qquad (5)$$
Model 6.
$$\ln(snoe) = 6.977 + 0.086\ln(agr) + 0.070\ln(cons) - 0.306\ln(m) - 0.327\ln(turn) + 0.093\ln(urate) + 0.117D14 \qquad (6)$$
Model 7.
$$\ln(snoe) = 4.986 + 0.227\ln(agr) - 0.128\ln(cons) - 0.167\ln(x) - 0.202\ln(turn) + 0.068\ln(urate) + 0.151D20 \qquad (7)$$
where:
snoe – the share of the non-observed economy in GDP;
D14, D17, D20 – dummy variables.

As in the previous case, the significance level was set equal to 5%. Table 6 presents the results of testing the null hypothesis for models 4-7. The probability that the null hypothesis is true for the variables ln(agr), ln(cons), ln(urate) of model 6 and the variables ln(x), ln(turn), and ln(urate) of model 7 are greater than 0.05. Therefore, the authors reject models 6 and 7 and continue testing models 4 and 5.

Table 7 shows the results of testing the quality of model 4 and model 5. The quality of model 4 is higher than model 5 because it has a higher level of R-squared and adjusted R-squared, a lower level of information criteria and a lower level of the standard error of the regression, etc.

Table 6 **Testing the null hypothesis of models 4, 5, 6 and 7**

VARIABLES	MODEL 4		MODEL 5		MODEL 6		MODEL 7	
	t-value	p-value	t-value	p-value	t-value	p-value	t-value	p-value
C	12.790	0.000	9.824	0.000	7.321	0.000	5.258	0.000
ln(agr)	2.418	0.028	2.293	0.037	1.466	0.165	2.623	0.020
ln(cons)	–	–	–	–	1.005	0.332	-2.239	0.042
ln(m)	-6.175	0.000	-6.273	0.000	-3.943	0.002	–	–
ln(x)	–	–	–	–	–	–	-1.416	0.179
ln(turn)	-4.094	0.001	-3.973	0.001	-3.717	0.002	-2.129	0.051
ln(urate)	–	–	2.135	0.050	1.553	0.143	1.026	0.322
D14	–	–	2.167	0.046	2.293	0.038	–	–
D17	-2.392	0.029	–	–	–	–	–	–
D20	–	–	–	–	–	–	2.499	0.026
Marginal level of the test		0.050		0.050		0.050		0.050

Source: *authors' computations using EViews 9*

Table 7
Testing the quality of model 4 and model 5

	MODEL 4	MODEL 5
R-squared	0.951	0.943
Adjusted R-squared	0.935	0.928
S.E. of regression	0.047	0.049
Sum of squared residuals	0.033	0.039
Log likelihood	38.001	36.323
F-statistic	58.357	65.728
Prob. (F-statistic)	0.000	0.000
Akaike info criterion	-3.048	-2.983
Schwarz criterion	-2.749	-2.734
Hannan-Quinn criterion	-2.983	-2.929

Source: *authors' computations using EViews 9*

Testing model 4 for autocorrelation in the residuals and heteroskedasticity showed that it does not have autocorrelation and heteroscedasticity (Tables 8 and 9). The authors include a dummy variable for 2017, because all three factors, especially agriculture, recorded significant increases.

Table 8
Breusch-Godfrey Serial Correlation LM Test of model 2 and model 4

	MODEL 2	MODEL 4
	PROB.	PROB.
lag 1		
C	0.856	0.997
ln(agr)	0.895	0.994
ln(cons)	0.908	–
ln(m)	0.980	0.995
ln(turn)	0.850	0.999
D17	–	0.985
RESID(-1)	0.482	0.966
Prob. F(1, 15)	0.482	0.966
lag 2		
C	0.928	0.774
ln(agr)	0.953	0.827
ln(cons)	0.936	–
ln(m)	0.956	0.754
ln(turn)	0.935	0.808
D17	–	0.911
RESID(-1)	0.462	0.965
RESID(-2)	0.601	0.272
Prob. F(2, 14)	0.684	0.535

Source: *authors' computations using EViews 9*

Table 9

Heteroskedasticity Breusch-Pagan-Godfrey Test of model 2 and model 4

	MODEL 2	MODEL 4
	PROB.	PROB.
C	0.884	0.138
ln(agr)	0.439	0.525
ln(cons)	0.723	–
ln(m)	0.459	0.634
ln(turn)	0.648	0.266
D17	–	0.168
Prob. F(4, 16)	0.777	0.357

Source: *authors' computations using EViews 9*

According to model 4, the "Gross agricultural production" has a positive influence on the share of the non-observed economy in GDP, and the following indicators have a negative impact on the endogenous variable: import and turnover of goods.

CONCLUSIONS

This study revealed that the increase in the level of the non-observed economy is affected by the growth of "Gross agricultural production", "Value of construction works" and the decrease in import and turnover of goods. The authors did not include in the single equation models such indicators as the value of manufactured industrial production and turnover in retail trade of commodities due to the lack of data for 21 years, but the turnover of goods directly depends on these two variables.

It is difficult for the tax authorities to verify retailers' income, as they come directly from individual consumers. The high level of the non-observed economy has a negative impact not only on the level of tax collections but is also a factor directly limiting economic growth. Firms do not pay taxes on shadow activities and achieve significant cost reductions. Tax-hidden funds are used to cover losses from low labor productivity and allow firms to receive additional income to be more competitive than firms that do not practice shadow activities. As a result, low-performing informal players do not go out of business and do not allow more productive formal enterprises and organizations to increase their market share. Thus, in the short term, informal enterprises win in a competition and provide informal employment. In the long term, they negatively affect economic growth and the population's well-being, which loses part of the pension. To reduce the level of the non-observed economy, it is necessary to eliminate the causes and conditions that give rise to it, which are in the economic, political, social, labor, and other spheres of public life.

Given that the turnover of goods and imports are factors influencing the non-observed economy, it is necessary for the government to reduce the volume of the shadow economy in both areas. It is necessary to combat the practice of false declarations, smuggling and corruption.

Combating the non-observed economy should be based on the principle of balancing stimulus and tightening measures (the stick and carrot principle). One way to reduce the shadow sector is to expand non-cash turnover. The most elusive shadow segment for the tax authorities (small retail sales and the provision of personal services) has to voluntary transition to non-cash payments.

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