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The Impact of the Shadow Economy in Romania

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In the article, predictions on the underground economy in Romania are described between 1997 and 2018 using the MIMIC method. To describe the complexity of assessing the size of Romania's underground economy, the MIMIC methodology is used, a scientific method, often implemented in recent years.

Keywords: Shadow economy, Multiple Indicators Multiple Causes (MIMIC), predictive mean matching (PMM).

JEL Code: C40, E25, E60

1. Introduction

The problem of quantifying the underground economy is particularly complex, because agents who carry out illegal activities or legal activities but for whom payment of taxes is omitted, try to hide their facts and remain undiscovered. It is obvious that the analysis and issuance of the necessary economic policies in time and space, adopted to balance the variation of the main macroeconomic indicators, economic development, production of goods and services, are infusely by the underground economy, in the case of unofficial hidden production of goods and services. The main tool for predicting and reducing tax evasion and the control measures adopted are dependent on estimating the size of this illicit economy.

Due to its polymorphic nature, the underground economy is also defined in the literature as a black economy, grey economy or informal economy and derives from the illicit nature of the activity of producing "hidden" goods and services. The standard definition of the underground economy covers all economic activities hidden from the competent authority for monetary, regulatory and institutional reasons [1]. Thus, non-payment of taxes and social contributions (monetary motivations), non-compliance with the necessary regulations and authorizations (regulatory or informal reasons), respectively, the legislative framework and control of the state on combating corruption, the ability of political institutions to regulate the economic environment (institutional motivations), are the main activities of the underground economy.

As the size of the informal economy is unknown, an approach based on latent variables is applied. In this context, a special type of models with latent variables is the MIMIC model (Multiple Causes, Multiple Indicators), which is built on the statistical theory of unnoticed variables.

The idea of applying the Mimic model is to examine the relationships between the latent variable (informal economy) and the observable variables in terms of the relationships of a set of observable variables using information from their covariance matrix. The main advantage is that it takes into account multiple determinants (causes) and multiple effects (indicators). A factorial approach is used to measure the size of the informal economy as a latent variable over time. Unknown coefficients are estimated in a set of structural equations[3].

2. Data analysis

In applying the structural equation model, we take into account the annual data for 5 economic indices: THE GDP growth rate, the share of indirect taxation, the unemployment rate, the labour participation rate, GDP per capita and policy indicators: the tax freedom index, the effectiveness of the government, the rule of law, from 1997 to 2018. We are limited to annual data because few of the variables are available at higher frequencies. Also, some of the variables have only been studied once every two years. All data is publicly available and provided by international organisations, such as the World Bank or taken from published research.

Table 1. Empirical data

YEAR	SOM	PIBL	INDIR	GPIB	FF	LF	RL	GE
1997	8.9	1131.0	4.6	-4.6	44	66.02	-0.1	-0.6
1998	10.4	1644.6	6.2	-1.8	44	65.05	-0.11	-0.57
1999	11.8	2454.6	6.1	-0.2	45	64.94	-0.17	-0.52
2000	10.5	3604.7	6.5	2.6	58	64.26	-0.2	-0.37
2001	8.8	5238.7	6.3	6.7	58	62.87	-0.23	-0.23
2002	8.4	7025.0	7.1	7.7	64	57.25	-0.26	-0.2
2003	7.4	8895.6	7.4	3.1	69	55.5	-0.21	-0.26
2004	6.3	11406.4	6.7	11.1	70	55.08	-0.17	-0.21
2005	5.9	13455.3	8.1	5.3	70	53.48	-0.14	-31
2006	5.2	16172.8	8.0	8.7	88	54.5	-0.12	-0.21
2007	4.0	20384.6	7.9	8.8	86	54.24	-0.09	-0.32
2008	4.4	26284.9	7.5	11.1	86	53.94	-0.01	-0.32
2009	7.8	26065.8	6.3	-4.7	87	53.76	0.05	-0.36
2010	7.0	26090.4	7.6	-3.3	86	54.97	0.05	-0.27
2011	5.2	27757.3	8.6	2.5	87	54.13	0.06	-0.33
2012	5.4	29598.1	8.3	2.5	87	54.58	0.04	-0.31
2013	5.7	31790.9	8.1	3.9	88	54.41	0.13	-0.07
2014	5.4	33569.7	7.6	3.8	87	54.68	0.17	-0.03
2015	5.0	35948.9	8.1	4.4	87	54.32	0.16	-0.06
2016	4.8	38826.7	6.4	5.4	88	53.58	0.36	-0.17
2017	4.0	43788.8	6.2	7.6	87	54.85	0.39	-0.17
2018	3.3	48491.0	6.4	4.7	87	54.48	0.39	-0.2

3. Research methodology

The identification procedure starts from the most general specification (MIMIC) and eliminates variables that do not have statistically significant parameters. Different specifications of the model were considered. Estimates were obtained using the RStudio statistical software.

The MIMIC model is a theory-based approach to confirm the influence of a set of exogenous causal variables on the latent variable (shadow economy), and also the effect of the shadow economy on macroeconomic indicator variables. At first, it is important to establish a theoretical model explaining the relationship between the exogenous variables and the latent variable[4]. Therefore, the MIMIC model is considered to be a confirmatory rather than an explanatory method.

This discussion suggests the following structural equation:

$$SE = SE\left[\overset{-}{p}\left(\overset{+}{A},\overset{-}{F}\right);\overset{-}{f};\overset{+}{B}\left(\overset{+}{T},\overset{+}{W}\right)\right]$$

In the following, we briefly explain the MIMIC estimation procedure (compare also Figure 1):

(1) Modeling the shadow economy as an unobservable (latent) variable;

(2) Description of the relationships between the latent variable and its causes in a structural model: ; and

(3) The link between the latent variable and its indicators is represented in the measurement model:

Where:

η: latent variable (shadow economy);
X: (q×1) vector of causes in the structural model;
Y: (p×1) vector of indicators in the measurement model;
Γ: (1×q) coefficient matrix of the causes in the structural equation;
Λy: (p×1) coefficient matrix in the measurement model;
ζ: error term in the structural model and ε is a (p×1) vector of measurement error in y.

The specification of the structural equation is:

[shadow economy] = [γ1, γ2, γ3, γ4] x [Growth rate of GDP]
[Share of indirect taxation]
[Unemployment rate]
[Fiscal Freedom index]+ [ε]

[corruption] = [γ1, γ2, γ3, γ4] x [Government Effectiveness]
[Rule of Law]
[Labor force participation rate]
[GDP per capita]+ [ε]

4. Results

Observable variables used by implementing the structural model of equations, allow to evaluate the size of corruption and the underground economy. The variables used are the growth rate of Romania's GDP and the coefficient of labour force participation. The model implemented considers the following four hypotheses to be true:

- The size of the underground economy is directly proportional to the growth rate of GDP. Real GDP per inhabitant and a factor for measuring the degree of corruption, inversely proportional to the integrity of the judiciary, is used;
- The size of corruption is inversely proportional to real GDP per inhabitant. This derives from the fact that the dimension of corruption is inversely proportional to economic development and, therefore, to the well-being of the citizen;
- The size of the underground economy is directly proportional to the unemployment rate, in particular, in the male population. Information on the unemployment rate of the male population and labour market assessment factors are analysed;
- A greater degree of trust for the rule of law and competent institutions leads to a reduction in the size of corruption.

Using the algorithm to reverse the initial scores and transform the indices presented above, experimental results comparable to the 4 hypotheses presented are obtained. Thus, both economic, social and political components (efficiency of the rule of law and the government in combating corruption and adopting necessary economic and legislative measures) of corruption are analyzed.

Figure 1 shows the path diagram of the structural equation model for the reference specification by which the small squares attached to the arrows indicate the expected sign in the empirical analysis. The model was estimated in RStudio and the results confirmed the validity at the indicator level.

This chapter should present the theoretical arguments that support the thesis of the paper, including arguments already existing in the scientific literature.

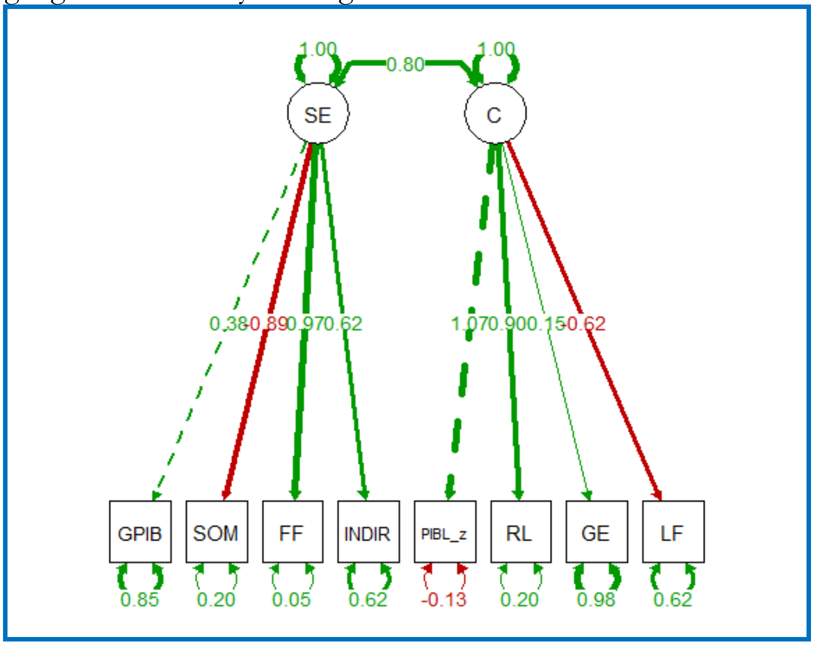

Figure 1. Path Structural Equation Model (SEM)

Table number 3 shows us the result of the estimate, the values corresponding to the correlation between the latent variables, the indicators and the causes considered. The data presented in Table No. 2, allow the simplified view of the correlation/match for each specification. Also analyzed are the indicators and causes that influence the size of the underground economy and the size of corruption. The structural equation estimation model uses a normalization algorithm for one of the indicators of each latent variable at a priori value. The value -1 is established for the coefficient of the real GDP growth rate, i.e. the real GDP per inhabitant, because it is the indicator that loads the construction represented by the latent variable the most.

From a statistical point of view, it is noted that almost entirely, the estimated coefficients for the causes corresponding to the size of the underground economy, show significant values and the theoretical sign expected. Thus, on the basis of the coefficients obtained, we can say that the most important determinants of the underground economy are the growth rate of real GDP and the indicators of the state of the labour market. The specification [2], according to which the unemployment rate is replaced by a size directly proportional to labour market regulations, confirms this observation.

The variable corresponding to the size of governance effectiveness (GE) is less significant for the specification. Regarding the indicators of the economy, a relationship of direct proportionality between the underground economy and the tax freedom index and the rule of law index is identified. There are inverse proportionality relationships between the underground economy and the real GDP growth rate and between the underground economy and the labour force participation rate. The results confirm the findings of other theoretical and experimental works.

Table 2. The goodness-of-fit statistics

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lavaan 0.6-5 ended normally after 51 iterations

Estimator                              ML
Optimization method                    NLMINB
Number of free parameters              25

Number of observations                 22

Model Test User Model:
Standard      Robust
Test Statistic               77.494      77.494
Degrees of freedom               19          19
P-value (Chi-square)          0.000       0.000
Scaling correction factor                     NA
for the

Model Test Baseline Model:

Test statistic                  231.304     231.304
Degrees of freedom                   28          28
P-value                           0.000       0.000
Scaling correction factor                        NA

User Model versus Baseline Model:

Comparative Fit Index (CFI)     0.984       0.991
Tucker-Lewis Index (TLI)        0.971       0.981

Robust Comparative Fit Index (CFI)               NA
Robust Tucker-Lewis Index (TLI)                  NA

Loglikelihood and Information Criteria:

Loglikelihood user model (H0)          -531.633    -531.633
Loglikelihood unrestricted model (H1)-492.886    -492.886

Akaike (AIC)                                  1113.266    1113.266
Bayesian (BIC)                            1140.542    1140.542
Sample-size adjusted Bayesian (BIC)           1063.266    1063.266
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Root Mean Square Error of Approximation:

RMSEA	**0.001**	**0.041**
90 Percent confidence interval - lower	0.290	0.000
90 Percent confidence interval - upper	0.463	0.000
P-value RMSEA <= 0.05	0.000	0.000

Robust RMSEA	**0.041**
90 Percent confidence interval - lower	0.000
90 Percent confidence interval - upper	0.000

Standardized Root Mean Square Residual:

SRMR	**0.009**	**0.039**

Parameter Estimates:

Information	Expected
Information saturated (h1) model	Structured
Standard errors	Robust.sem

Model adequacy indices have very good values (Table 2), above the recommended minimum values (Hair et al, 2006): ϱ2 =22.226, DF=16, ϱ2 /df=1.389, EFI=0.984, RMSEA=0.041, SRMR=0.039.

Table 3. Estimation Results (Standardized Coefficients)

Latent Variables:

	Estimate	Std.Err	z-value	P(>|z|)	Std.lv	Std.all
ES =~						
GPIB	1.718	0.465	3.698	0.000	1.718	0.382
SOM	-2.051	0.154	-13.286	0.000	-2.051	-0.895
FF	15.378	1.770	8.689	0.000	15.378	0.974
INDIR	0.599	0.062	9.626	0.000	0.599	0.620
C =~						
PIBLe_z	1.041	0.100	10.397	0.000	1.041	1.065
RL	0.175	0.019	9.264	0.000	0.175	0.895
GE	0.955	0.606	1.576	0.115	0.955	0.149
LF	-2.664	0.594	-4.486	0.000	-2.664	-0.618

Covariances:

	Estimate	Std.Err	z-value	P(>|z|)	Std.lv	Std.all
ES ~~						
C	0.802	0.045	17.867	0.000	0.802	0.802

Intercepts:

	Estimate	Std.Err	z-value	P(>|z|)	Std.lv	Std.all
.GPIB	3.873	0.960	4.034	0.000	3.873	0.860
.SOM	6.618	0.489	13.546	0.000	6.618	2.888

.FF	75.136	3.366	22.320	0.000	75.136	4.759
.INDIR	7.091	0.206	34.423	0.000	7.091	7.339
.PIBLe_z	0.000	0.208	0.000	1.000	0.000	0.000
.RL	-0.000	0.042	-0.011	0.991	-0.000	-0.002
.GE	-1.672	1.365	-1.225	0.221	-1.672	-0.261
.LF	56.857	0.919	61.896	0.000	56.857	13.196
ES	0.000			0.000	0.000	
C	0.000			0.000	0.000	

Variances:

	Estimate	Std.Err	z-value	P(>|z|)	Std.lv	Std.all
.GPIB	17.326	1.676	10.339	0.000	17.326	0.854
.PIBLe_z	-0.129	0.019	-6.774	0.000	-0.129	-0.135
.INDIR	0.574	0.103	5.556	0.000	0.574	0.615
.SOM	1.045	0.264	3.959	0.000	1.045	0.199
.FF	12.827	8.641	1.484	0.138	12.827	0.051
.LF	11.468	0.840	13.654	0.000	11.468	0.618
.RL	0.008	0.001	8.014	0.000	0.008	0.199
.GE	40.068	14.055	2.851	0.004	40.068	0.978
ES	1.000				1.000	1.000
C	1.000				1.000	1.000

R-Square:

	Estimate
GPIB	0.146
PIBL	**0.753**
INDIR	0.385
SOM	**0.801**
FF	**0.949**
LF	0.382
RL	**0.801**
GE	0.022

In Table 3 we note that the β coefficients are significant (at a significance threshold $p<0.001$) and have high values of 0.98 (GE) and 0.85 (GGDP). The version explained by the model is R2=0.94 for the FF formative index and R2=0.80 for SOM and RL.

From a statistical point of view, a strongly significant coefficient is obtained for the index of fiscal freedom and the index of the rule of law representing the fact that a lower economic freedom increases the size of corruption. The coefficient for the effectiveness of government is not statistically significant and has the theoretical sign expected although the coefficient for the rule of law is significant. This indicates that the size of corruption is higher for states that put greater political pressure on public institutions. Also, reducing tax freedom is a cause of increased corruption.

In all specifications of the model, the indicator variables of the corruption dimension are generally consistent and have the expected signs. Lower levels of real GDP per capita, i.e. lower levels of economic development, are associated with higher levels of corruption.

Interpretation of the estimated coefficients of the mutual relationship between the dimensions of corruption and the underground economy is taken into account, because the results obtained for both latent variables confirm the findings of the experimental research considered. The coefficients for quantifying the influence of the underground economy on corruption and the influence of corruption on the underground economy are statistically significant and positive. The mutual relationship of proportionality between corruption and the underground economy is robust and stable in all estimated specifications.

Even though the coefficients corresponding to the size of corruption and the underground economy are both positive, they differ significantly in amplitude. Therefore, the causal effect of the underground economy on corruption is stronger than the effect of corruption on the underground economy. One possible explanation for this is that corruption functions as an additional tax in the official economy and involves increasing the size of the underground economy. The underground economy also induces greater corruption as bureaucracy exploits leadership functions and so firms or individuals pay bribes for concealing underground activities. The underground economy can be seen as an indication of the general deterioration of social and cultural norms, leading to much greater corruption.

Confirmatory factorial analysis (CFA) has made it possible to establish the importance of each of the components of the underground economy in the hierarchical structure used to measure these general, multidimensional concepts.

5. Conclusions

This scientific paper allows the analysis of the correlation between the dimension of corruption and the underground economy, using a structural equation model. The relationship between the underground economy and corruption is experimentally analyzed, without first assuming that the two are complementary, positively or negatively correlated. The results obtained indicate that an underground economy with a larger size is correlated with high values of the size of corruption. Unfortunately, in Romania, the size of the underground economy is very high with values of approx. 26% of the country's GDP. Agents carrying out activities belonging to the underground economy resort to bribing representatives of state institutions, in order to avoid the discovery of illicit activity, punishment and taxation. This is why there is a decrease in tax revenues leading to a reduction in the quality of public services and infrastructure. This, in turn, reduces incentives to stay in the official economy. Politically compromised legal systems and unstable conditions for economic activity increase corruption.

The main conclusion was to highlight the experimental correlation between corruption and the underground economy, which confirms the findings of Johnson, Kaufmann and Shleifer (1997), Johnson, Kaufmann and Zoido-Lobatón (1998b), Hindriks, Muthoo and Keen (1999) and Friedman et al. (2000).

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