Quantitative Methods for Evaluating the Informal Economy. Case Study at the Level of Romania

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Abstract. *The evaluation of the hidden economy involves major difficulties related to the use of an adequate methodology and to ensuring the necessary database for estimating some econometric models and some economic variables. The studies conducted showed that the size and forms of the informal economy differ from one country to another. The transition from the economies of the former socialist countries led to an increase in the size of the hidden economy. The highest levels are recorded in some former Soviet republics and in some South American countries. The evaluations made at the level of Romania estimated that the hidden economy accounts for approximately 30% of the Gross Domestic Product. This paper evaluates the size of the hidden economy on the basis of an econometric approach which assesses the cash outside the banking system according to various factors and to its use in official and hidden economy transactions.*

Keywords: informal economy; econometric model; cash outside the banking system; monetary method; regression models.

1. Introduction

The disintegration of the state planned economies and the emergence of the first elements of the market economy led to a new attitude on the part of some people or economic operators, who transferred some activities from the official to the unofficial economy. Thus, by eluding the legal framework and accepting certain risks, the economic operators are "exempted" from the payment of some taxes or duties to the state or avoid a series of bureaucratic barriers. Under these circumstances, the analysis of the informal economy in Romania has become an important topic for economic theory and practice. In recent years, a series of studies measuring the informal economy and its effects on the economic and social environment were published. Among the most important ones are Albu (2002, 2001), Anghelache (2008), French (1999), Andrei (2009) etc.

The studies conducted by national institutions or international organisations showed that taking measures for reducing the financial crimes and implicitly the informal economy is fundamental for the improvement of the economic environment of a country undergoing transition. After a while, these measures will stimulate the arrival of high-potential foreign investors that will boost Romania's economic development in the medium and long run. In the EU accession process, the Justice and Internal Affairs chapter was the most difficult to close. Special challenges in the accession process were posed by the implementation of efficient and quantifiable measures for "combating tax evasion" and ensuring the "reform of the tax system and of tax policy". The high level of taxes led to ineffective tax collection and implicitly to an increase in the size of the informal economy.

In economic theory there is a large variety of methods that can be used to estimate the size and dynamics of the informal economy. Among the most important ones we mention: the monetary approach to the informal economy, the implicit labour supply method which is applied in our country on the basis of the data obtained through AMIGO, the energy consumption method etc.

The results obtained by applying the various methods are often different, particularly when evaluating the size of the informal economy at the level of transition countries. For instance, in Romania's case, the size of the informal economy, measured as a share of GDP, is 20% if evaluated through the energy consumption method (Enste, Schneider, 2000) and over 45% if the evaluation is made using the monetary approach (French, Balaita, Ticsa, 1999). The National Institute of Statistics evaluates the informal economy through the national accounts methodology, and its value usually accounts for 25-28% of the official economy calculated on the basis of the GDP.

In this paper, the size of the informal economy is estimated based on the monetary approach using the methodology presented in Cagan (1958) and Ahumada (2008). Part II contains a presentation of the data series employed to estimate the econometric models used for estimating the size of the informal economy. Part III describes the methodology applied and the results obtained based on the quarterly data series for the 2000-2009 period. The last part presents the conclusions and the possible developments of the model dealt with in this article.

2. Data series used

In order to analyse aspects related to the estimation of the hidden economy at the level of Romania during the 2000-2009 period, we used quarterly data for a series of economic indicators. The table below contains information on the series of data employed for this purpose. For all the data series expressed in monetary units the values were given using the 2005 prices.

Table 1

Description of the variables used

No.	Variable	Data series	Data source
1	NASBR	Cash outside the banking system	NBR
2	CGTR	Total government expenses	NIS
3	PIBR	Gross Domestic Product	NIS
4	DR	Short-term interest rate	Bucharest Interbank
5	RI2	Inflation rate, calculated based on the rate of increase of the consumer price index as compared to the previous year	NIS
6	TAXR	Taxes on products	NIS

For the data series presented above, a series of statistical indicators at the level of the periods of government were calculated: for the year 2000; for the period in which Romania was led by a left government; for the 2005-2008 period, when the government was led by a representative of the right; for the year 2009 different statistics were calculated considering that this was the year when the effects of the crisis were deeply felt. The results obtained are presented in Table 2 and in the graph in Figure 1.
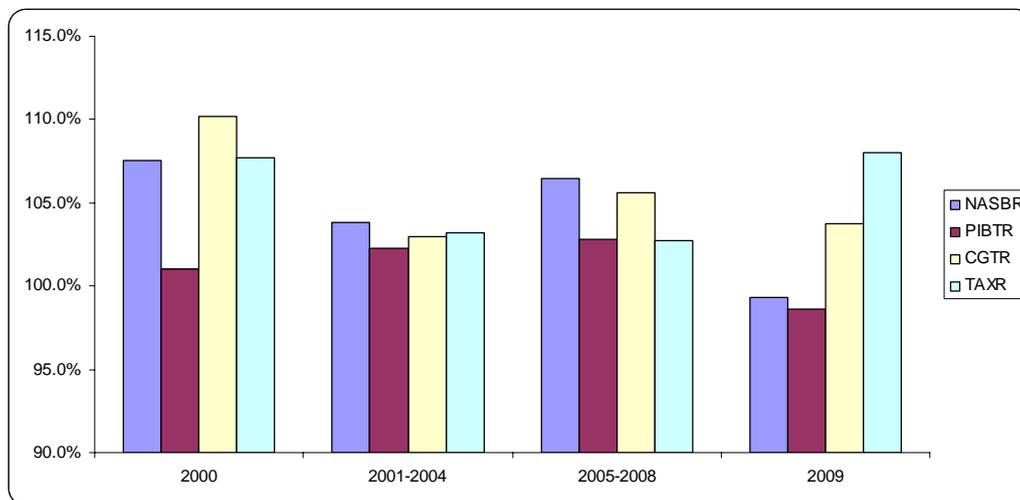
Figure 1. *Quarterly average indices for 2000, 2001-2004, 2005-2008 and 2009*

Table 2

Quarterly average indices for 2000, 2001-2004, 2005-2008 and 2009 (%)

|	2000	2001-2004	2005-2008	2009
NASBR	107.5	103.8	106.5	99.3
PIBTR	101.0	102.3	102.8	98.6
CGTR	110.2	103.0	105.6	103.7
TAXR	107.7	103.2	102.7	108.0

Based on the above results we make the following observations:

- During all the periods, the cash outside the banking system increased more rapidly than the GDP. The evolution corresponding to 2000 and to the 2005-2008 period can be mentioned here;
- In 2000, 2005-2008 and 2009 we saw a much more rapid increase in government expenses in relation to the GDP;
- The taxes on products increased much more than the GDP in 2000 and 2009.

The graph in Figure 2 shows the evolution of the share of government expenses in the Gross Domestic Product for the 2000-2009 period. Some of the most important characteristics of this data series are the following:

- In the 2000 q1-2006 q3 period, excepting the fourth quarter of the first year, the share of government expenses in the GDP ranged between 30% and 40%;
- The share of government expenses in the GDP in the fourth quarter of 2006 exceeded 50%; in 2006 and 2007 this share was around 50%;

- In 2009 we saw an increase in the value of this indicator, with the values for the last three quarters exceeding 40%.
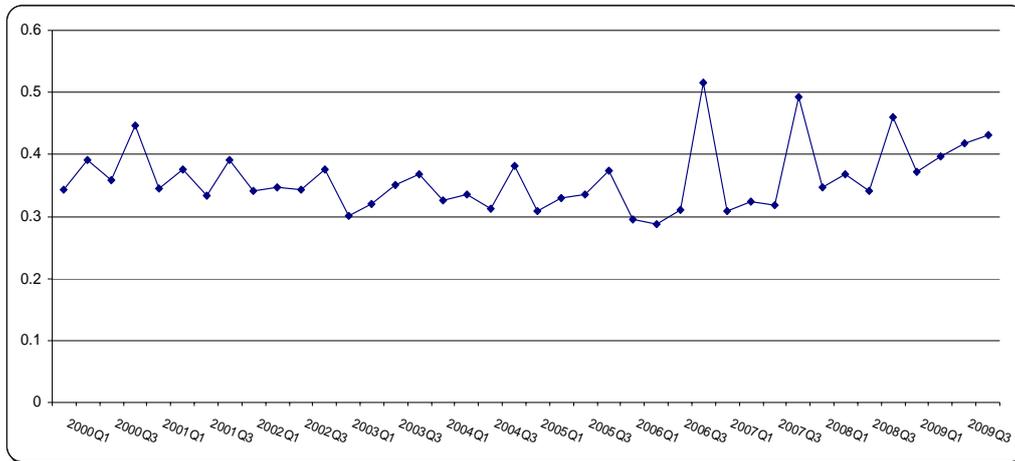
Figure 2. *Share of government expenses in the GDP in the 2000-2009 period*

The statistical analysis of the data series shows a significant influence of the seasonal factors on their evolution during the time period considered. For instance, government expenses had much higher values in the fourth quarter. The very high shares of government expenses in the GDP (around 50%) recorded in the fourth quarter of 2006, 2007 and 2008 can be mentioned here.

3. Estimation of the size of the hidden economy

In order to estimate the hidden economy, a model presented by Cagan (1958) and adopted by Ahumada (2008) was used. The undertaking is based on assessing the cash outside the banking system that was used in the economy recorded through the GDP and in the hidden economy. Our purpose is to determine the share of the cash outside the baking system used in the hidden economy in the total cash outside the banking system. To this end, three important variables are estimated:

- NASBR – Cash outside the banking system, on the basis of an econo-metric model. This variable is estimated based on regression equation 1;
- NASBR_R – Cash outside the banking system used in the transactions performed in the economy recorded through the GDP, i.e. the official economy;
- NEA – Cash outside the banking system used to support the hidden economy transactions.

Equation 1. The parameters of the equation used to describe the cash outside the banking system are estimated.

The "cash outside the banking system" variable is used as a dependent variable. The behaviour of this variable is explained in relation to the behaviour of three categories of factors:

- the size of the economic activity measured through the Gross Domestic Product (GDP);
- the pressure exercised by the government on economic operators and individuals through the taxes that must be paid by them. For the evaluation of this factor, one of the following variables can be used: the share of government expenses in the GDP or the share of taxes on products in the GDP;
- the opportunity cost of possessing cash. For the evaluation of this factor, the inflation rate or the real interest within the banking system can be used.

The equation analysing the cash outside the banking system is:

$$\log(NASBR_t) = a_0 + a_1 \times \log(1 + PCG\_PIB_t) + a_2 \times \log(PIB_t) + a_3 \times DR_t + u_t \quad (1)$$

where $NASBR_t$ is cash outside the banking system, PIB_t − Gross Domestic Product, PCG_PIB_t − share of government expenses in the GDP, DR_t − real interest rate expressed as a coefficient. The variable u_t is normally distributed, with a zero mean and variance σ_u^2. The parameters a_1 and a_2 are positive, and a_0 and a_3 are negative.

In order to estimate the parameters, quarterly data series for the 2000-2009 period and the two-stage least squares method were used. The results obtained from the estimation of the parameters are presented in Table 3.

Table 3

Characteristics of equation (1)

Dependent variable	LOG(NASBR)	
Independent variables		
	Parameter value	Standard deviation
C	-11.334*	0.5157
LOG(1+CGTRC/PIBTR)	1.896*	0.5943
LOG(PIBTR)	1.795*	0.0438
(DCNB-RI2)/100	-111.249*	45.3002
R²	0.98	
DW	1.33	

* significance threshold $\alpha = 0.00$

Equation 2. Estimation of official economy transactions. For this estimation, the equation proposed by Ahumada (2008) starting from the formula suggested by Cagan (1958) is used. In order to make this estimate, it is considered that the size of the hidden economy is zero if in equation (1) it is considered that $LOG(1+PCG\_PIB_t) = 0$. Under these circumstances, by using the value of the parameters estimated in the previous stage, we obtain a size of official economy cash transactions calculated on the basis of the following equation:

$$NASBR\_R_t = \exp(\hat{a}_0 + \hat{a}_2 \times \log(PIB_t) + \hat{a}_3 \times DR_t) \tag{2}$$

Equation 3. In order to estimate the underground economy transactions, we start from the premise that the total cash transactions performed in the economy ($NASBR_t$) are made up of official economy transactions ($NASBR\_R_t$) and hidden economy transactions (NEA_t):

$$NASBR_t = NASBR\_R_t + NEA_t \tag{3}$$

Based on equations (2) and (3), the size of the hidden economy is determined as follows:

$$NEA_t = NASBR - \exp(\hat{a}_0 + \hat{a}_2 \times \log(PIB_t) + \hat{a}_3 \times DR_t) \tag{4}$$

The graph in Figure 3 shows the evolution of the values of the variables $NASBR_t$ and NEA_t for the 2000-2009 period (quarterly data).
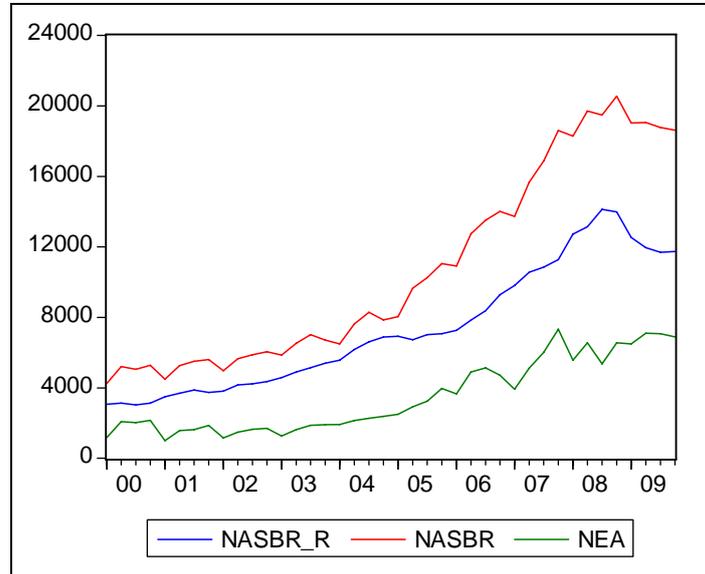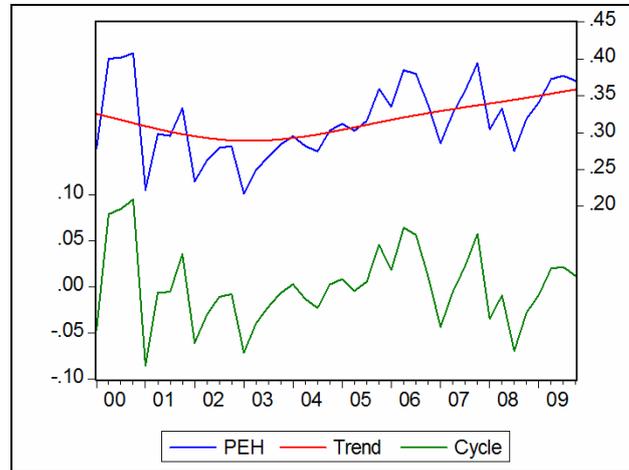
Figure 3. *Evolution of the cash outside the banking system overall,*
in the official economy and in the hidden economy

The share of the hidden economy cash transactions in the total cash transactions performed in the economy is calculated based on the formula:

$$PEH_t = \frac{NEA_t}{NASBR_t} \times 100 \tag{5}$$

Figure 4 shows the evolution of the value of this indicator during the 2000-2009 period. For the filtration of the long-term component, a Hodrick-Prescott filter was used.

Figure 4. *Evolution of the share of hidden economy cash transactions in the total cash transactions performed in the economy*

4. Conclusions

The results obtained above show that a high proportion of the cash outside the banking system is used in the unrecorded economy. With few exceptions, the share of the cash used in unrecorded transactions in the total cash circulating in the economy is high, ranging between 25% and 35%. During the 2000-2004 period we see a decreasing trend in this share (down to 30%), while in the 2005-2009 period the trend was upward. The saturation threshold for the last period was 35%.

References

Albu, L.-L., Kim, B.-Y., Duchene, G. (2002): „Households' Activities in Informal Economy: Size and Behavioural Aspects", *Romanian Journal of Economic Forecasting*, Vol. 3-4 (11-12), 2002

Albu, L.-L., „Tax Evasion and the Size of Underground Economy: a Theoretical and Empirical Investigation", *Romanian Journal of Economic Forecasting*, Vol. 1-2 (5-6), 2001

Ahumada, H., Alvaredo, F., „The monetary method to measure the shadow economy: The forgotten problem of the initial conditions", *Economics Letters, Economics Letters*, Volume 101 (2), 2008, pp. 97-99

Andrei, T., Oancea, B., Stancu, S., Iacob, A.I., „Econometric Models Used in the Analysis of the Informal Economy at the Regional Level", *Informatica Economica Journal*, Vol. 13 (3), 2009, pp. 179-188

Anghelache, C-tin et al., (2007). *Sistemul conturilor naţionale*, ediţia a II-a, Editura Economică, Bucureşti

Cagan, P., „The Demand for Currency Relative to the Total Money Supply", *Journal of Political Economy*, 66 (3), 1958, pp. 302-328

French, R., Balaita, M., Ticsa M., „Estimating The Size And Policy Implications Of The Underground Economy In Romania, US Department of the Treasury", Office of Technical Assistance, Bucharest, August 1999