

UNDERGROUND ECONOMY'S MEASUREMENT METHODS

Dan Tudor LAZĂR
Bogdan Andrei MOLDOVAN
Alexandru PAVEL

Dan Tudor LAZĂR

Associate Professor, Department of Public Administration,
Babes-Bolyai University, Cluj-Napoca, Romania

Tel/fax: 0040-264-431361

Email: danlazar@apubb.ro

Bogdan Andrei MOLDOVAN

Researcher, Regional Center for Training for Public Officials
Cluj-Napoca, Romania

Tel/fax: 0040-264-431361

Email: moldovan@apubb.ro

Alexandru PAVEL

Researcher, Center for Research in Public Administration
Cluj-Napoca, Romania

Tel/fax: 0040-264-431361

Email: alexpavel@apubb.ro

Abstract

It is argued that the underground economy is as old as government itself. Many people know how the underground economy functions, but a few are those who know its level.

This article analyzes the most important measurement methods of the underground economy, as well as the way these methods could be applied. The methods are grouped into three categories: direct methods (that are using micro-economy data, gathered through sociological investigations, fiscal audits and other direct investigation methods), indirect methods (that use macroeconomic indicators in order to highlight the evolution and the level of the informal economy) and causative methods. The paper also describes five indirect indicators which are used for the underground economy estimation, and presents the advantages as well as the limits of the methods.



*Transylvanian Review
of Administrative Sciences,
23E/2008 pp. 43-58*

Numerous authors claim that they know how the underground economy functions, but only a few know its real level. This is why the attempt to estimate the level of the underground economy is interesting and hard to accomplish. This study will try to show the main methods used internationally in order to assess the underground economy in great detail. The great number of measurement methods of the underground economy, as well as the manner in which they are applied, may be grouped in three main categories: direct methods, indirect methods, causative methods.

1.1 Direct methods of the underground economy estimation

These methods concern the measurement of the informal economy using micro-economy data, which are gathered through sociological investigations, fiscal audits and other direct investigation methods. The use of the surveys as the main direct investigation method concerning underground economy is widespread, especially in the Northern European countries. The major disadvantage of this method is that the questionnaires are applied to some persons who hesitate admitting their fraudulent behavior. That is why the results of this kind of findings are considered to be far from reality regarding the assessment of the level of the underground economy. Nevertheless, the surveys may give precious information about the underground economy's structure and its way of manifestation. Actually, what it is important is the questionnaire's structure and its way of application.

Another direct measurement method of the informal economy uses the fiscal audits. The disadvantage of this method is that the subjects of the fiscal audits often know the date and the object of the audit in advance, which leads to poor results. On the other hand, the audits are not representative for the entire population because they are not sampled and many of the illicit activity categories are usually not even found by the fiscal agents.

Therefore, a major role in the underground economy's estimation through direct methods lies in the sampler method and the results depend on how it was made up (Morgensen, 1994). Unfortunately, these kinds of methods cannot estimate the development rhythm of the underground economy during a certain period of time or the causes of this evolution.

1.2 Indirect methods of the underground economy estimation

The indirect measurement of the underground economy represents the privilege of the macro-economy. Particularly, these methods are using some macroeconomic indicators in order to highlight the evolution and the level of the informal economy. In this section we will describe five indirect indicators which are used for the estimation of the underground economy (Schneider and Ernste 2002).

1.2.1 The difference between the national incomes and expenses

The premise of this indicator is that there must be a balance between the national incomes and expenses. Specifically, GNP or GDP is considered as reference points. Usually, in the less developed countries GDP is higher than GNP, because the capital

and the nonresidents' work are used more often, which causes it to be more attractive than GNP from the governmental statistics point of view. GDP may be calculated using one of the three methods: revenues method, expenditures method or production method:

$$\mathbf{GDP=C+GOS+OTP-OSP,} \quad (1)$$

where, C - compensation of employees;
GOS - the gross operating surplus;
OTP - other taxes on production and imports;
OSP - other subsidies on production;

$$\mathbf{GDP=FC+GFCF+CS+(E-I),} \quad (2)$$

where, FC - final effective consumption;
GFCF - gross fixed capital formation;
CS - change in inventories;
E-I - the net export of goods and services (exports - imports);

$$\mathbf{GDP=GVA+TP+D-SP,} \quad (3)$$

where, GVA - the gross value added (basic prices);
TP - taxes on products (VAT inclusive);
D - import duties;
SP - subsidies on products

A major discrepancy between the calculated GDP as the sum of the national expenditures and GDP as a total of the national revenues or using the production method shows the existence of a quite developed underground economy (Thomas and Macafee in Tanzi, 2002). The method seems quite easy at first, but, unfortunately, GDP is extremely difficult to be calculated as the sum of revenues or expenditures, as well as the total of production. If we consider GDP as the total of national revenues, we have to find out the value for each previously described indicator. So, the compensation of employees can be calculated rather easy using the Ministry of Finance data about the payment of wage tax. Unfortunately, these statistics of the Ministry of Finance show only the legal incomes, without taking into consideration the illegal work. Often the survey is used in order to estimate these incomes, but its results are approximate because the subjects are not interested in, or they simply don't want to answer the questions for most of the times. On the other hand, finding GDP's value as the sum of the national expenditures encounters difficulties on the goods and services' consumption determination. Many countries as: SUA, Great Britain, Germany, etc. use investigations regarding family and companies expenditures for its estimation as well as of the incomes (Pissarides and Weber in Schneider, 2002). In our country, the National Institute for Statistics (NIS) uses "Family Budgets Investigations (FBI)" and "the Integrated Households Surveys (IHS)". The other indicators are not extremely difficult to estimate, as they are undertaken from the national statistics. Nevertheless, it is interesting that the annual reports of the NSI emphasizes a perfect balance between the GDP that was calculated

by the previously described three methods and these causes doubts regarding the truthfulness of NSI data.

1.2.2 The difference between the official labor and actual labor

The labor may be considered a relevant indicator for the underground economy measurement (Del Boca in Tanzi, 1982 and Contini, 1981). The premise of this method is that the illegal work stays at the base of the underground economy. The employers from the informal economy sector are tempted to use illegal labor in order to hide their illicit activities (Schneider, 2002). Most of the studies (Del Boca, 1982, Thomas, 1992 in Tanzi, 2002) in their social investigations are focused on the labor dynamics (emigration and immigration of the labor). It was necessary to estimate the total volume of the native and foreign labor from Italy and USA, because the foreign labor (illegal immigrants) wasn't present in the official statistics; or the native labor force, which had another job, different from the official one. A lot of national sociological investigations were made in order to identify the illegal work, as premise in the estimation of the informal economy (CENSIS investigation - "L'occupazione occulta" 1976 from Italy, first national investigation for evaluating the unofficial labour, showed that in Italy the illegal work and the second job represent 5.6% from the official activities - approximately 3 billion working places).

Usually, the greatest discrepancies between the official and real labor force are noticed at the rural level, where, according to some researches (Mincer and Polacheck, 1974) it was emphasized that more than 50% of the total labor force volume is undeclared, which means that they work illegally in agriculture or they have a second unofficial job in industry. The percentage of the rural illegal labor force's working hours is rather high representing 29.6% of the total number of working hours. The same investigation CENSIS (1976), as well as others (Del Boca and Forte, 1980) describes the illegal labor force profile as being women of all ages or very young or old men; experimented and the best prepared labor force, specifically, 25-35 years old men, are requested for the second job (Gallino, 1980).

At the urban level, CENSIS and other investigations (Colombino, Negri and Del Boca) observed that the characteristic factors for the illegal labor force profile setting or the second job are not the sex, the age and the experience, but education, working hours and the distance to the job. Usually, the illegal jobs are far from the urban zone and they are preferred by the immigrants and the unemployed and the second job is usually short and preferred by the young people (to pay the studies) and the home women (they take care of the children, too). In the USA the same structure of the illegal labor market is noticed (O'Neill in Tanzi, 2002), the illegal urban jobs are not outside the towns, but inside of them, and the labor force is more flexible (there can often be noticed a mobility of the labour force from the rural to the urban areas and especially for jobs from the industrial zones and of services).

Although, this indicator doesn't give information about the underground economy dimension, nevertheless, it may show its existence. Actually, a decline in the labor force taking part at the legal economy may be interpreted as an increase of the illicit activities at the informal economy level (Schneider and Ernste, 2002).

The weaknesses of this method (Del Boca, 1982 and Thomas, 1992, in Tanzi, 2002) come from the impossibility of making some precise studies regarding the rate of the labour force participation. For most of the times, the subjects of the social investigations either declare only the official jobs, or overlook to declare seasonal or temporary jobs or the second unofficial job. Schneider and Ernste (2002) showed that the situation called „moonlighting” can appear, which means that the employees should have only one illegal place of work unregistered in any official papers (Pyle, 1989).

Unfortunately, due to their uncertainty, these indicators are not preferred by the specialists, even if they may offer detailed information regarding the type of the illicit activities and the underground economy’s structure as well (Contini in Tanzi, 2002).

1.2.3 The currency methods

Different measurement methods of the informal economy have been developed over time, but the most popular and used methods were the ones based on the currency methods. These statements are proved by the events that take place in the real economy, precisely, on the currency market. It is well known that most of the underground economy’s transactions take place in cash, in order to leave as little traces or detection chances for the state’s authorities as possible (Pyle, 1989). This is why the premise of this method (Cagan, 1958, Gutmann, 1977, Feige, 1979, Tanzi, 1980) was that an increase in cash quantity in the economy over the normal level highlights the level of informal transactions (according to the consuming investigations from Great Britain and USA from 1985 the medium budget for consuming/person is 60£ in GB and 100\$ in USA per week, from which more than 50% are transactions in cash. On the other hand, the cash on the market is about 225£ and 500\$/person. We agree with the fact that 25£/100\$ is the cash quantity owned by the investors, lost or destroyed but where does the difference of cash come from?).

At least three indirect, distinct, based on currency statistics underground economy measurement methods have been developed so far. All the three methods and their derivations refer directly to the existent cash quantity in economy.

1.2.3.1 The currency demand approach

The approach based on the currency demand ratio to the money supply was first used by Cagan, in 1958. He calculated the correlation between the currency demand and the tax burden (actually, the author tried to show a connection between the currency demand increase and the tax evasion expansion) from the USA, in the period 1875-1955, as an estimation of the following regression equation:

$$\log \left(\frac{C}{M_2} \right)_t = \beta_0 + \beta_1 \log T_t + \beta_2 \log Y_t + \beta_3 \log R_t + u_t, \quad (4)$$

with β_0 - constant, $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 < 0$,

where, C/M_2 is the proportion between the currency demand and the money supply,

R represents the interest rate, Y is the expected real income per capita, T is the annual percentage from the personal income, which is collected as income tax, u is the estimation error, and t refers to the specific (certain) year.

The idea of using the currency demand approach as the underground economy indicator was then undertaken by Gutmann in 1977, which succeeded in conducting a study regarding the USA underground economy dimensions between 1937 and 1976, without using statistics. Although ordinary at the first sight, the method was and it is applied for the informal economy level estimation in different countries.

The Gutmann model was developed starting from a series of essential hypotheses: first of all he considered that the period before the Second World War (1937-1941) was the precursory period of income tax increasing and, implicitly, there wasn't underground economy. In the second place, he argued that the majority of illicit transactions were achieved through currency. The Gutmann algorithm is the following:

$$k = \frac{C_0}{D_0}, \quad (5)$$

where, k-currency ratio, C_0 -the currency in use, D_0 -bank deposits.

During this period 1937-1941, the author calculated the currency demand ratio reported to the bank deposit economies (it is also known as currency ratio), getting an index $k=0.217$ (Pyle, 1989).

This means that \$2.17 in currency were in use in the economy, at the \$10 under the deposits form (the information is available if we start from the initial hypothesis of Gutmann that during 1937-1941 there was no underground economy. Then he used the following formulas:

$$C_t = kD_t \quad (6)$$

$$M_t = C_t + C_u + D_t \quad (7)$$

For the determination of the cash demand for 1976, Gutmann started from the dates obtained during 1937-1941. He assumed to be necessary \$ 49.1 billion C_t – cash, as long as according to the statistic data there were \$ 226.2 billion in banking deposits D_t , to create an official GNP of \$1693 billion. Practically, it means that every dollar invested created 6.15 \$ from GNP. In reality, in the economy there were approximately \$77.8 billion in cash. It resulted \$28.7 billion C_u used in the underground economy. Then, assuming that income velocity is the same in both economies legal and illegal, he estimated a value of \$ 176.5 billion or 10.42% from the GNP.

The Gutmann's algorithm, simple enough, was put under questioning by many authors (Smith, 1986, Feige, 1979, Laurent, 1979 and Garcia and Pak, 1979). Stephen Smith (1986) does not agree with Gutmann hypothesis that "the transactions from the underground economy are made exclusively in cash". They think that in order not to be discovered, companies prefer barter transactions (the payments in products and services), the cash, being dangerous because "you can never know who is your business partner".

A second critique was the one regarding the hypothesis of Gutmann that between 1937-1941 there was not any underground economy. This statement can be easily

contradicted if we think that it was the period after the prohibition, which determined the prosperity of the underground economy (see the prohibition period 1919-1923 which stimulated the mafia type activities in the USA).

The third hypothesis of Gutmann – the income velocity was the same in both legal and illegal economies was drastically criticized by some authors (O'Higgins and Michael 1989, Feige, 1979). O'Higgins thought that the legal income velocity is higher than the illegal one because the last one is constantly under the risk of being discovered. On the other hand Feige, and even Gutmann himself, said that the income velocity in the underground economy is higher, because the cash is strictly used to finance the illegal activities, while the legal economy can have other destinations (for example - saving).

In the end, another critique was aimed at the hypothesis that the growth of the currency ratio is based only on the growth of the cash quantity. Laurent (1979), Garcia and Pak (1979) argued that the growth of this parameter (currency ratio) is determined by the decrease of the bank deposits and not by the growth of the cash in the economy.

Relying on the studies of Cagan (1958) and Gutmann (1979), Tanzi (1980), based on a statistic calculation, developed a study regarding the estimation of the informal economy using currency ratio, under the form of a logarithmic regression equation:

$$\ln\left(\frac{C}{M_2}\right)_t = \beta_0 + \beta_1 \ln(1+TW)_t + \beta_2 \ln\left(\frac{WS}{Y}\right)_t + \beta_3 \ln R_t + \beta_4 \ln\left(\frac{Y}{N}\right)_t + u_t \quad (8)$$

with expected values β_0 - constant, $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 < 0$, $\beta_4 > 0$

Where $\frac{C}{M_2}$ is the currency ratio, R is the interest rate; Y/N is the real income per capita, TW fiscal rate (arithmetic average of the tax rates – in order to estimate the dynamics of underground economy), WS/Y wages ratio in the national income (to approximate the level of wage payments and cash economies), u is the estimate's error and t refers to the specific year.

Trying to estimate the underground economy in USA 1929-1980 Tanzi (1980) has created the following scenarios:

1. The size of the value \hat{C} when we consider the real tax ratio between 1929-1980
2. The size of value C' when we consider the lower tax ratio in history
3. The size of value \hat{C} when we consider a zero tax ratio.

We will present just the 1976 estimation, because it was the year with the highest fiscal ratio, and to compare it with Gutmann's estimations presented earlier (Pyle, 1989). After the calculation, we obtained the following currency ratio values (1976):

- $C = 77,8$;
- $\hat{C} = 78,3$;
- $C' = 63,8$;
- $\hat{C} = 46,8$

Where C represents the real cash quantity from the USA economy in 1976, \hat{C} represents the estimated cash quantity considering the real tax ratio (obtained using

(8)), C' – the estimated cash quantity with the lower tax ratio between 1929-1980 and \hat{C} – the estimated cash quantity if we consider zero tax ratio.

Tanzi presented the difference between C , \hat{C} , C' , \hat{C} as being obtained as the differences between the tax ratios taken into consideration, because the higher the tax ratio gets, the more tempting the underground economy activities will be. He also states that the difference between \hat{C} and C' is $C_{u1} = 14.5$ billion \$, the cash quantity used by the informal economy, owed to the tax ratio growth compared to the lowest level between 1929-1980, and the difference between \hat{C} and \hat{C} is $C_{u2} = 31.5$ billion \$, the cash quantity used by the informal economy when the tax ratio equals zero.

Then the income velocity was calculated, as ratio between GNP measured and the cash quantity used in the legal transactions ($M - C_{u1}$ or $M - C_{u2}$). We multiplied C_{u1} or C_{u2} with the income velocity (Tanzi as well as Gutmann considered the income velocity as identical for legal and illegal activities) and was obtained an underground economy level of \$86.1 billion (5.1% from GNP) and \$198.8 billion (11.7% from GNP).

As we can see from the results presented, even if Tanzi used a more complicated method, the results obtained were quite similar with Gutmann's results, \$199 billions (11.7% from GNP) compared to ≈ 177 billion \$ (10.4% from GNP).

On the other hand, Tanzi's study gets the same critiques as Gutmann:

- Not all the illegal transactions are made in cash
- The presumption that the income velocity is the same in the legal and illegal economy.

The studies by Tanzi were criticized because the currency ratio estimation was made by considering only the 4 independent variables: per capita income, taxation ratio, the ratio of wages in the national income and interest rate. Some authors (Pyle, 1989 and Susic, 2002) think that in the calculation of the cash quantity other independent variables should be listed, such as: penalties for being caught, the probability of being caught, and government regulations and dollarization of economy (American Dollar and Euro are often used in the illegal transactions, but as well as in saving usually in CEE).

Finally, even Tanzi (1983) made some corrections in the calculation of the underground economy in the optimist case (zero taxes). Its new level would be approximately \$100 billion (approximately 4% from GNP). The author blamed the instability of the independent values due to the values of β for this error.

Even if the attempts for estimating the underground economy of Gutmann and Tanzi were the subject of many critics, nevertheless the two methods have been and they still are applied in different countries with results, along with the Kauffman – Kaliberda method of electricity consumption or the MIMIC method (multiple indicators and multiple causes) presented below.

1.2.3.2 Transaction method

This model was developed by Feige in order to estimate the level of underground economy, based on a monetary approach. The author started from the idea that between the transaction volume and the official GNP there is a constant relation over time. At the base of his study he had the quantitative Fisher's equation of money.

$$\mathbf{M \times V = P \times T}, \quad (9)$$

where, M is money supply, V – velocity of money, P – average price level of transactions and T – transactions volume. Feige considers that money supply is obtained by adding currency in circulation to bank sight deposits. This is not a comprehensive approach and it is open to criticism. We think that time deposits should be introduced as well.

Similarly to Gutmann, in order to estimate the level of informal economy, Feige started from the following assumptions:

- The total value of transaction (P*T) can be replaced in Fisher's equation with k * nominal GNP (official GNP + unofficial GNP);
- The velocity of money is the same for the legal and underground economy;
- 1939 was considered as reference year for this study.

To calculate the total value of transactions, the velocity of money (V) remains unknown. He had the ingenious idea of calculating only V in the case of cash because he already knew the value V regarding the bank sight deposits, using the following algorithm: the studies of Laurent (1979) regarding the number of transactions before a monetary unit is withdrawn from circulation (125) and then divide this number with the average use of a monetary unit (which Feige found in the cash withdrawal annual statistics made by the Federal Banks of Reserve).

He calculated the total transaction value in 1939 using the formula:

$$(C_0 * V_1) + (D_0 * V_2) = P_0 * T_1, \quad (10)$$

where, C_0 is the cash quantity on the market in that year, V_1 the cash circulation velocity, D_0 the cash quantity in sight deposits and V_2 money circulation velocity at the level of sight deposits, P_0 the level of medium price of transactions and T_0 the total volume of transaction in that year.

Taking as reference the year 1939 (Feige considered the year 1939 as being a year without underground economy) he calculated the value of transactions using the equation (10) and he obtained \$934.9 billion. He divided it by the official GNP (nominal if we assume that 1939 is a year without informal economy – 90.8 billion \$) and he obtained a 10.3 transaction ratio. He estimated the value of transactions with (10) in 1976 of \$19899.4 billion and he divided it by the transaction ratio. Feige obtained a nominal GNP of 1932 billion \$. According to the statistics in the same year the official GNP was 1706.5 billion \$ which means a difference of \$ 225.5 billion (13% from GNP). This value was considered by Feige to be the level of underground economy in USA in 1979. Afterwards, the author developed several more “optimistic” scenarios, stating that the value of informal economy is \$369 billion (22% from GNP). According to Pyle, Feige corrected the initial estimations because in some studies published in 1976 showed that from 1957 the duration of a monetary unit increased from 125 to 150 because of the quality of the material from which the money were made.

The critiques of Feige's estimations could be classified as follows (Frey and Pommerehne, 1984, Schneider and Ernste, 2000, Thomas, 1986, 1992, 1999, Gordon, 1981 and Gilles, 1999):

- Feige’s assumption that in 1939 there was no informal economy;
- The existence of the same velocity of money in both formal and informal economies;
- The exclusion of barter transactions;
- The growth of the underground economy during the years 1976 – 1978 with 140 % is not credible, in the conditions that the measured GNP increased with only 23%;
- During 1939-1968 according to the transaction method it would have had a negative value in comparison with other studies (Tanzi 1983, Gutmann 1979, Frey and Pommerehne, 1984) that showed a growing evolution.

Feige’s method has a lot of errors but maybe the most prevalent critic is about the money circulation velocity estimation and the number of transactions that a monetary unit participates in.

Besides these critiques, the transaction method as Schneider (2000) said, is attractive “theoretically speaking” and it could be used together with the other estimation methods of the informal economy for comparisons.

1.2.4. Electricity consumption based methods

These methods are based on electricity as the main indicator of the entire economic activity. According to the studies made in former soviet countries conducted by Dobozi and Pohl (1995), the dynamics of real GDP is directly influenced by the evolution of electricity consumption. Until now 2 methods to estimate the underground economy starting from the electricity consumption were developed: the Kaufmann – Kaliberda method and the Lacko method.

Kaufmann – Kaliberda method

The model is named after the two economists, who conducted a study regarding the estimation of informal economy in Ukraine and CSI countries (former USSR); it is developed based on global electricity consumption reported the GDP. The two authors argue that:

$$\mathcal{E}_t = e_0/gdp_0 = e_1/gdp_1 = \dots e_t/gdp_t \dots = e_n/gdp_n \approx 1 \quad (11),$$

where \mathcal{E} represents the electricity consumption’s elasticity in terms of GDP and e the increase (decrease) of the global level of energy consumption related to the previous year, gdp represents the increase (decrease) of the GDP level related to the previous year, t and n the specific years.

Then Kaufmann and Kaliberda (1996) calculated the nominal as $GDP = \text{official GDP} + \text{unofficial GDP}$. Having the time series of e and gdp , the authors estimated the nominal GDP. The difference between nominal GDP and official GDP represents, in the author’s opinion, the level of the underground economy.

The critiques of this method (Schneider and Ernste, 2000) includes the following comments:

- There are some economic branches that do not need electricity (like agriculture and certain services) or use different types of energy (oil, methane gas, coal);

- The technological progress can significantly reduce the electricity consumption, which can lead to a misinterpretation of results;
- The evolution of elasticity in terms of GDP can suffer important modifications due to the structural changes of the economy (for example a decrease of the industry's weight in GDP).

An improved model of the Kaufmann – Kaliberda method is the one of Kyle and Warner (2001), which made a study regarding the estimation of informal economy in Bulgaria between 1989 and 1998. The promoters of the model substitute the role of electricity consumption's elasticity in terms of GDP in the estimation of underground economy as follows:

$$TA_n = E_n * \frac{TA_{base}}{E_{base}}$$

where subscripts “n” and “base” stand for the base year and the year in question, and E denotes Energy (or Electricity) consumption. They stated that

$$SE = \frac{TA - Y}{Y} = \frac{TA}{Y} - 1 \quad (12)$$

where Y is the country's GDP, and let $base\ SE = x$ be the fraction of underground economy of GDP in the base year. Then

$$TA_{base} = Y_{base} (1 + x) \quad (13)$$

$$TA_n = E_n * \frac{Y_{base} (1 + x)}{E_{base}} = (1 + x) * \frac{Y_{base} * E_n}{E_{base}} \quad (14)$$

So for the underground economy in year n:

$$SE_n = \frac{TA_n}{Y_n} - 1 \quad (15)$$

$$SE_n = (1 + x) * \left(\frac{Y_{base}}{E_{base}} / \frac{Y_n}{E_n} \right) - 1 \quad (16)$$

The advantage of this method is its simplicity and the fact that takes into account all forms of energy, not just electricity. Moreover, besides the dynamics of GDP and of global energy consumption, the model considers also the level of underground economy. Once we know the level of the informal economy for a certain year, it is easy to estimate its level in another year.

The limit of this model is that it does not solve the problems of the previous method but simplifies the calculations. Schneider and Ernste (2000), Lacko (1996, 1997), Kyle and Warner (2001), even Kaufmann (1997) believe that a part of the problems would be solved if a sector approach would be made, that means assuming as benchmarks: sector energy consumption and GDP on activity sectors and not their global value.

Lacko method

This method tries to solve a part of the problems the other estimation methods have, taking into account household activities and other undeclared economic activities. The author says that in an economy in which the household electricity consumption is considerable, the underground economy that it is associated with it is considerable as well (Lacko, 1996). The Lacko model is concentrated on the informal economy generated by household activities („do-it-yourself activities”) and can be described though the following equations:

Equation (17) describes the impact of the factors that determine household electricity consumption:

$$\ln ER_{ij} = {}_1\ln C_{ij} + {}_2AG_{ij} + {}_3G_{ij} + {}_4Q_{ij} + {}_5PR_{ij} + {}_6H_{ij} + {}_7$$

$${}_1 \geq 0, {}_2 \leq 0, {}_3 \leq 0, {}_4 \leq 0, {}_5 \leq 0, {}_6 \geq 0, \quad (17)$$

where

i : the number assigned to the country

E_i : *per capita* household electricity consumption (million tons)

C_i : *per capita* real consumption of households without the consumption of electricity in country i in US dollars (purchasing parity)

PR_i : the real price of consumption of 1kwh of residential electricity in US dollars (at purchasing parity)

G_i : the relative frequency of months with the need of heating in houses in country i

Q_i : the ratio of energy sources other than electric energy to all energy sources in household energy consumption

H_i : the per capita output of the hidden economy

T_i : the ratio of the sum of paid personal income, corporate profit and taxes on goods and services to GDP

S_i : the ratio of public social welfare expenditures to GDP

D_i : the sum of number of dependents over 14 years and of inactive earners, both per 100 active earners

Equation (18) of the model describes the effect of the factors that determine the hidden economy:

$$H_{ij} = {}_1TL_{ij} + {}_2TC_{ij} + {}_3D_{ij} + {}_4I_{ij} + {}_5EX_{ij}$$

$${}_1 \geq 0, {}_2 \geq 0, {}_3 \geq 0, {}_4 \geq 0, {}_5 \geq 0 \quad (18)$$

where

TL_{ij} : tax rates on labor income in country i in year j

TC_{ij} : tax rates on capital income in country i in year j

D_{ij} : output decline since 1989: $D_{ij} = 1 - (GDP_{ij} / GDP_{i1989})$

I_{ij} : annual inflation rate of consumer prices

EX_{ij} : general government expenditure, per cent of GDP

Lacko (1996) applies (17) to a country, replacing H_i with (18) and then making a hierarchy of the countries according to household electricity used in unofficial activities. In order to determine the level of the underground economy, it is necessary to first determine how much of the GDP can be created by using a unit of electricity in the underground economy of each country. Because the level of hidden economy of all countries is unknown, the existent estimates are applied to the others (Schneider and Ernste, 2002).

Lacko applied this method in order to estimate the level of hidden economy of several Western countries and from Central and Eastern Europe, taking as a reference point the level of the US hidden economy - 10,5% of GDP (Morris, 1993 in Schneider and Ernste, 2002).

Like Kaliberda – Kaufmann, Lacko method has several weaknesses (Schneider, 2002):

- Only the hidden economy at household activity level is taken into account;
- Not all hidden economic activities require the use of electricity;
- The use of the level of underground economy of one country in order to estimate the level of the underground economy in others is questionable, especially in the case of Eastern European countries.

The soft modeling approach

This method based on the statistical theory of the unobserved variables was developed by Frey and Weck - Hannemann (1984) to estimate the hidden economy of 24 OECD states. Their approach is totally different from the ones of Tanzi (1980, 1984), Feige (1979), Gutmann (1958), Del Boca (1982) and others because in the estimation of underground economy they use more than one cause-effect relation. They think that the underground economy occurred due to many causes (not just tax burden), and their effects are felt simultaneous, in production, money market, and workforce market. The scheme of soft modeling can be presented as in Figure 1, where A, B, C,..., are the causes (tax burden, taxpayer's morality, per capita income, etc.), which determine the evolution of underground economy, and X, Y, Z are the indicators - effects (real GDP increase/decrease ratio, workforce participation ratio, number of work hours, etc.) that are present in the real economy due to those causes, implicitly due to underground economy's development. In order to apply the method in an empirical manner, Frey and Weck-Hannemann (1984) identified four distinct causes that determine the underground economy:

- Tax burden (direct taxes, the indirect taxes are not considered important) on individuals
- Law roughness
- Taxpayer's morality
- Degree of economic development.

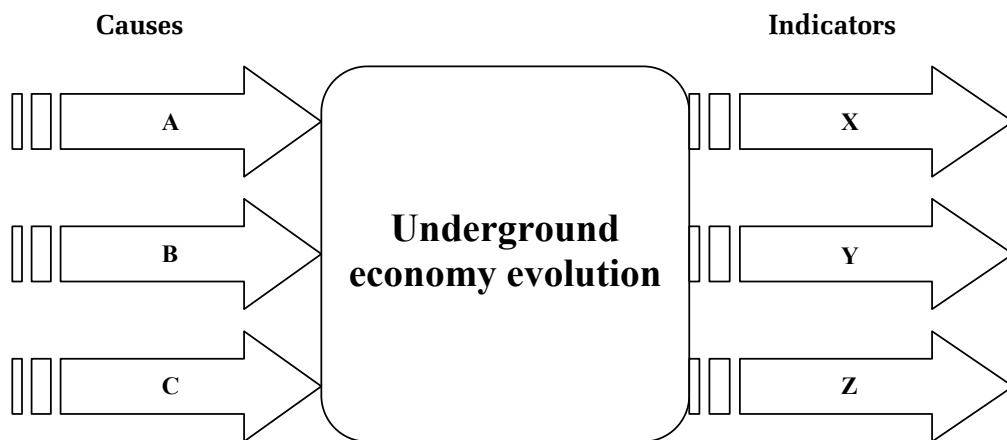


Figure 1 – Soft modeling scheme

For the underground economy's estimation a set of three indicators was used:

- Real GDP growth ratio
- Masculine workforce participation ratio
- Number of working hours.

In Frey and Weck's opinion a decrease of the three indicators' value is the effect of the increase in hidden activities. In order to estimate the level of underground economy they found the following equation:

$$UE = \alpha T + \beta P + \chi M \quad (19),$$

where UE – underground economy, T – tax burden of direct taxes, P – workplaces in the public sector reported to the total of workplaces, M – taxpayer's morality index.

The major problem in estimating underground economy based on soft modeling approach is to determine the coefficients α , β , χ , because it is very hard to find in real numbers or percentage the level of taxpayer's morality. The authors tried to make a classification of 24 OECD countries, considering the Swiss citizen as the "most ethical", and the Italian citizen as the "less ethical" (Frey and Weck-Hannemann, 1984). This approach can be easily questioned because it is based strictly on suppositions and not on serious analysis of the indicator. For example, one of the questions asked in this kind of study is: which is the ratio between the number and the quality of services offered by the public administration and the taxpayer's morality. Practically, the lower the services levels are, the lower taxpayer's morality will be. On the other side, factors like probability of being caught, the performance of institutions in fighting tax evasion, coherence of tax legislation, culture, mentality and country's specificity, should represent an important part in measuring the level of morality. If we take into account only the last factor, we may agree with the hierarchy made by Frey and Weck-Hannemann. The economic reality and the study of human behavior (Becker, 1991) showed us that the human nature has to adapt to the surrounding environment and act considering its dynamics (Becker, Gary, 1998).

Giles and Tedds (2002), Dell'Anno and Schneider (2003), Bajada and Schneider (2005) tried to develop the research made by Frey and Weck-Hannemann, using the MIMIC method (multiple indicators and multiple causes) and using the LISREL® software technique. The results of the studies, although they start from the same hypotheses, are different; some authors have criticized the method, especially for the way of calculating the “sensitive” indicators (taxpayer’ morality), but also because of the way of correlating latent variables (Breusch, 2005).

Applying the soft modeling method is controversial, because it needs exact statistical calculations, which are extremely complicated and hard to deal with modern technique. If we think of the last 20 years statistical innovations in econometrics, but also of the IT evolution, it can be presumed that in the following years, estimation methods of underground economy will be more precise and applied worldwide, and, will represent a larger base of debate.

Conclusions

The measurement of underground economy is a very complex and intensely debated issue. The researches on this topic and the developed methods prove once again the high interest in this subject, interest which has increased in the last years due to the terrorist attacks. It is known that the terrorist groups take their resources from this kind of economy. In some countries, the transition from the planned economy to the free marked economy facilitated the development and the boom of the underground economy. The system of underground economy that includes as the main forms, illegal work, tax evasion, and the criminal activities it is a very complex system and the methodologies for evaluation and quantification have to consider the specificity of the each country economy, the level of democracy, the forms of government, the culture etc. We can not argue that there are perfect methods for measuring this kind of economy or that the use of a method will ensure the measurement of the real level of the underground economy. Anyway, considering the specific aspects for each method and the characteristics of the country we intend to evaluate with these methods, a combination between the presented methods that can be chosen, combination that can help us to estimate the best the real level of the underground economy.

References:

1. Becker, G. S., *Human behavior*, 2nd edition, All Beck Publishing, Bucharest, 1998, pp. 77-90.
2. Breusch, T., “Estimating underground economy using MIMIC models”, Centre for Social Research Studies, Canberra, 2005, pp 27-28 available at <http://ideas.repec.org>.
3. Cagan, Ph., „The demand for currency relative to the total money supply”, 1958, *Journal of Political Economy*, vol.66, pp. 303-328
4. Contini B., „Labor market segmentation and the development of the parallel economy. The Italian experience” 1981, *Oxford Economic Papers* 33, no 4, pp. 401-412
5. Dobozi, I., Pohl, G., “Real Output Decline in Transition Economies - Forget GDP, Try Power Consumption Data”, 1995, *Transition: The Newsletter About Reforming Economies*, 6, pp. 1-2, summarized in EBRD, Transition Report, pp. 181-183.

6. Feige, E., *The underground economies. Tax evasion and information distortion*, Cambridge University Press, Great Britain, 1989
7. Feige, E., "How big is irregular economy", 1979, *Challenge Journal*, vol 22, No 1, pp. 5- 13
8. Frey, B., Weck – Hannemann, H., „The hidden economy as an „unobserved” variable”, 1984, *European Economic Review*, vol 30, No 1, pp. 1-23
9. Garcia, G.,, Pak, S., "The ratio of Currency to the demand deposits in the United States", 1979, *The Journal of Finance*, vol. 34, pp. 703-715
10. Gutmann, P., „Subterranean economy”, 1977, *Financial Analysis Journal*, No 34, pp. 24-27
11. Kaufmann, D., Kaliberda, A., „Integrating the unofficial economy into dynamics of post socialist economies: A framework analyses and evidence”, 1996, *Policy Research Paper*, World Bank, Washington DC, USA, pp. 10
12. Kyle, S., Warner, A., and others, „Measuring the Shadow economy in Bulgaria”, 2001, *Cornell University Working Paper*, New York, USA, pp. 9-10
13. Lacko, M., „Hidden economy in East-European countries in international comparison”, 1996, *International Institute for Applied System Analysis Working Paper*, Luxemburg, Austria
14. Laurent, R., "Currency and the subterranean economy", 1979, *Federal Reserve Bank of Chicago Economic Perspectives*, vol. 3, pp. 3-6
15. Morgensen, G. V. & all, *The shadow economy in Denmark. Measurement and results*, Rockwool Foundation Edit, Copenhagen, Denmark, 1994, pp. 21-27
16. Pyle, D., *Tax evasion and black economy*, St.Martin Press, New York, USA, 1989, pp. 12
17. Schneider, F., Ernste, D., *The Shadow Economy. An International Survey*, Cambridge University Press, Cambridge, UK, 2002, pp. 16-24
18. Smith, S., *Britain's Shadow Economy*, Oxford University Press, Great Britain, 1986, pp. 88
19. Tanzi, V., *The underground economy in United States and abroad*, Lexington Books, 1982, pp. 147-163
20. Tanzi, V., (ed), *Managing fiscal decentralization*, London, Routledge, 2002