Quantitative Techniques used for the Informal Economy Analysis at National and Regional Level

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The main issues in the informal economy domain are related to its definition, quantification, its position at the level of national economy and the application of econometric models to quantify its effects on economic and social development, at national and regional level. In order to evaluate the informal economy is presented the Ahumada's model (2007). Using data series from the official statistics we made estimations of the informal economy for Romania for 2000-2009 time period. The obtained results for the ratio between cash transactions from the informal economy and the ones from the formal economy indicate that this one is situated between 24 and almost 41%. The parameter estimation for the applied regression models was realized using EViews software.
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1 Some comments on informal economy

The main issues in the informal economy domain are related to its definition, quantification, its position at the level of national economy and the application of econometric models to quantify its effects on economic and social development, at national and regional level.

The informal economy concept is defined in [18] and [19]. The size of the informal economy is expressed as a percentage of the official GDP. Its estimation, using different methods, is difficult to be realized for the same country because is leading to slightly different values. In the case of the European System of National Accounts is considered that the informal economy includes only black labor and tax evasion.

A series of papers present analyses and monographs of a country or of a geographical region [6], [13], [23], [34]. Basically, certain institutions, such as the United Nations Development Organization, the World Bank, the International Labor Organization with its headquarters in Geneva, the International Monetary Fund, the European Commission, but also a series of well-known universities and research institutes are periodically drawing up monographs in order to assess the underground economy size and dynamics, preponderantly at the level of development countries. In this sense, we can mention: Joaquin Herranz (Massachusetts Institute of Technology), Marta Chen (Harvard University), and Jacques Charmes (University of Versailles), which analyzed the situation from countries underdeveloped. In these countries, the weight of illicit labor force which is not working in agriculture is situated between 50% and 75%: 48% in North Africa, 51% in Latin America, 65% in Asia and 75% in Africa (near Sahara desert). In India, the percentage is higher - 83% and if we consider the agricultural activities - 93% from total labor force, a huge number.

If we also include in the category of "informal economy activities" people working on their own, or developing part-time activities, their percentage, for 15 European countries, is representing 30% of total labor force and 25% for the USA. In the USA, less than 20% of all workers which are

working part-time benefit of health insurance or pensions from the employers. Those ones working on their own represent almost one third of total global labor force which are not working in the agriculture domain. For developed countries it represents only 12%, while for sub-Saharian Africa it reached 53%. Money earned from non-standard activities are significant for developed countries. In 2004, part-time workers were representing 14% of the OECD countries' employees.

The transition period of the Romanian national economy determined the growth of the informal economy size, which has influenced in a considerable extent the development of certain sectors of economic development regions. Under these conditions, the evaluation of the informal economy dimension, its causes and consequences in Romania have become important issues for the economic theory and practice at national level.During the EU accession process, one of the most important dossiers that have been negotiated by Romania was "combating tax evasion" and "tax and fiscal policy reform", as important tools to reduce the Romania's size of the informal economy and for its economic and social development. In the national economic approach, an explanation of the informal economy size was the high level of taxes and fees. Due to unsuitable system adaption at the economic reality, the informal economy has increased, considerably reducing the tax base. Fiscal policy during the electoral cycle which began at the end of 2004 was based on lower taxes on revenues, on the decrease of the informal economy size and on tax base growth.

In the economic theory there are several methods used for the estimation of the informal economy size such as: monetary approach, the implicit labor force method, a range of methods based on energy consumption etc. The first two methods are based on statistical information provided by National Accounts. Most of the times, the results obtained from the application of these methods are significantly different. For example, in Romania's case [16], the size of the informal economy represents between 20% and 45% of GDP. The lowest size of the informal economy is obtained by energy consumption method [24], and the highest, above 45%, is estimated by the monetary method [16].

The figures reported by the National Institute of Statistics, based on National Accounts methodology, have increased from about 5% in 1992 at 20-21% in 2001. It should be mentioned that, mainly, this growth is caused by the change of the calculus methodology of this economic indicator. For a more exactly estimation of the informal economy size is advised to take account of rural households own consumption. In these circumstances, in Romania, the informal economy level is about 25-28% of the total volume of national economy activity.

Worldwide, both in the scientific research and in the economic practice case, there are major concerns in the field of the informal economy analysis. Informal economy can be defined, studied and measured with difficulty, taking account of: the temporal nature of this activity, changes occurring at the legislative level, due to the diversity of the activities, of the lack of unitary methodology used for its evaluation etc. In order to describe the essential aspects related to the informal economy we present in Table 1 an adaptation of Hussmanns informal economy matrix.

. **Table 1.** Hussmanns Informal Economy Matrix Adaption

	Independent Workers		Employers		Unpaid household workers	Employees		Productive associations workers	
	Informal	Formal	Informal	Formal	Informal	Informal	Formal	Informal	Formal
Formal sector firms					1	2			
Informal sector firms	3		4		5	6	7	8	
Households	9					10			

Obs. The areas that are not numbered don't show direct interest for this research. Informal sector firms are defined as private firms which are not incorporated in companies that don't have a certain number of employees and are/or are not legally registered. The components of the informal economy in the above matrix are: 1, 5 - unpaid household workers which don't have a legal employment contract and legal protection; 2, 6, 10 - employees developing an informal activity or an activity in a formal (2) or informal (6) sector firm, or at households level as paid domestic work, but is not registered in official documents; 3, 4 – independent workers (3) and employers (4), possessing their own independent informal firm. The informal character directly results from the firm's characteristics which it owns or works; 7 - employees working in informal firms but which are developing a formal activity (this is the case of the firm which is informally defined in relation with the number of the employees); 8 - members of the informal production association; 9 – the production of households goods or at the level of final users (this is, for example, the final ones case).

The paper is structured as follows. In the first part are presented some statistics on the informal economy of some countries. In the second part are presented some aspects of the definition of variables used in the estimation of the informal economy. There are three examples of estimating the informal economy in the hotel industry, construction and education. In the third part, using a monetary method we estimate the ratio between informal economy and formal economy for Romania.

The major objectives of this work are: the identification of the macroeconomic variables used to define the model for the evaluation of the informal economy size and its impact on the economic and social processes from a country; the estimation of some aspects of the Romanian informal economy for the period 2000-2009, the identification of possible developments of the proposed methodology for estimating the informal economy and of its effects on developing regions.

2 The definition of the variables used for the measurement of the informal economy

In order to define the analysis model and the variables used in this sense, we consider some aspects concerning the definition of informal economy and the identification of the necessary data sources. From the most important, we are mentioning the following ones:

1) An important aspect in the evaluation of the informal economy is the way of defining it. The informal economy includes "all economic activities that are" screened " to the statistical observations" [5];
2) In the definition and the evaluation of the informal economy we must take account of the causes that are generating it at the level of an economic space covered by legislation. Among the most important we are mentioning the following ones: the characteristics of the Tax and Social Contributions System; the characteristics of the regulations for the sectors of activity from the economy, the characteristics of the national statistical system, etc.
3) The informal economy is not solely the result of illegal activities developed by economic agents or individuals, but also the activity done by various registered agents, but who do not declare all goods and services resulting from its employees activity [25];
4) In the application of certain analysis and evaluation methods of the informal economy, we must do the difference between illegal production, hidden production and informal sector production:
   a. *Illegal production* comprises two categories of products: products that are prohibited by law, such as production, distribution and marketing (drugs, pornography etc.); most of the times, production is legal, but it is done by unauthorized economic agents (unlicensed gambling, movies and

software multiplication etc.).

b. *Underground or hidden production* is the result of the activity developed by licensed economic agents, but that is not evidenced in legal documents to avoid the payment of taxes;

c. *Informal sector production* includes, "as been defined by the International Labor Organization, the production units with a lower level of organization, smaller capital or with no distinction between capital and labor, or with relationships based mostly on family relationships rather than on firm contracts." Generally, the production of this sector is obtained in the population households. If the output produced by these agents is intentionally excluded from the financial records, then it goes into the hidden economy category [5];

5) The informal sector includes:
   a. All of the family associations and own-account workers whose activity is regulated by law. To estimate the size of the informal economy generated by this category of operators are used data provided by the Ministry of Public Finances and by AMIGO (Household Labor Force Survey). In this category can be identified the part of the informal economy due to the non-reporting or sub evaluation of their own work for various reasons;
   b. Economic agents which are not registered at the Tax Register, Commercial or Statistical Register, as tailors, auto mechanics, teachers who give private lessons, etc.;
   c. Economic agents who, from various reasons, are sub evaluating their legally realized production;
6) To estimate the production of the informal sector can be used several ways:
   a. Statistical Methods, which are trying to complete statistical information, which, for various reasons, are not available in official statistical system;
   b. Methods of the informal economy estimation that are based on macroeconomic models. This category includes: monetary method, a method based on labor force, the estimation based on supply and demand from a particular industry etc.;
7) The estimation of the informal economy size is not such a certainty and the obtained results are estimated with certain probabilities;
8) The estimations made for Romania by the National Institute of Statistics are based, mainly, on AMIGO provided information to estimate the population households' labor force supply and ASSB - Annual Structural Survey In Enterprises, for the estimation of the labor force demand.

In this sequel are presented some statistical variables that are used directly or indirectly to evaluate the informal economy:

(1) Gross Domestic Product (GDP) is a statistical indicator that characterizes the entire volume of activity taking place during a period of time at the level of an economic space. This indicator is calculated quarterly or annually, at Romania's level and at the eight economic development region level;

(2) Labor Supply (OFM) consists of all persons who have developed a paid activity during a certain period of time. In this category are not included the persons which are taking part of family associations and the ones which are self-employed. The estimation of the labor supply is done by activities branches, according to NACE classification. The necessary information to estimate these variables are obtained from AMIGO. This survey is held quarterly by the National Institute of Statistics, since 1996, on the households labor force. Thus, are obtained cyclical data concerning the size and the structure of labor supply. There are also estimated some seasonal characteristics of labor supply. The obtained data are available quarterly and annually, at national and regional level, on the eight economic and social development regions. Based on this survey is calculated the number of the persons which are developing a fully, partially or that have a

second job. Thus, this statistical tool allows the calculus of certain statistical indicators that are used to characterize the employed labor force and the unemployment from economy:

a. Employment (OP);
b. Number of unemployed by ILO methodology (NSB);
c. Employment rate (RO);
d. Unemployment rate by ILO methodology (RSB);

(3) The labor force demand (CFM) is representing the labor force necessary of the economic agents to develop their activities. In order to evaluate the labor force demand is applied the Annual Structural Survey (ASS). This one is providing information to evaluate the average number of employees, the number of persons working part-time and occasionally;

(4) The size of the informal economy is measured by:

- the number of persons which are developing an undeclared work (NMN);
- the ratio between the labor force demand and supply (RMN;
- the weight of unobserved economy in GDP (PNP).

By comparing the supply and the demand for labor is estimated the size of the informal economy. According to the survey conducted in September 2008 by the Romanian Centre for Economic Modeling (CERMA), the size of the informal economy, measured by the number of employees working in this sector, was higher than 756.000 persons. From these, 705.000 persons were working without contracts as main activity and other, 51. 000 persons developed a secondary activity where they didn't have a labor contract. In these circumstances, it is estimated that the informal economy represents 11.2% of total activity from the economy. The economic crisis from the last year has generated an increase of the informal economy size in the total of the economic activities.

The estimation of the informal economy size at the level of units not included in the formal economy is based on the available data series and from a series of agreements concerning the behavior of the population which is consuming products obtained by these units. In this sense, we are presenting a number of examples as follows [5]:

Example 1. In the hotel sector is considered that the size of the unregistered economy represents one third of the size of this business sector, reported by official statistics data.

Example 2. For the constructions sector is considered that almost three quarters of the workers which are developing a work on their own in the constructions domain are not declaring it. For a monetary evaluation of the informal economy from this sector we are applying the following calculus relationship:

$$VABN = 0.75 \cdot \sum_{i=1}^{12} N_i \cdot SLB_i ,$$

where N_i – the number of workers on their own from constructions during a month, while SLB_i – the gross average wage from constructions during a month.

Example 3. To estimate the hidden economy from education is considered that half of the students are taking private lessons during the school year. Under these conditions, the size of hidden economy from education (EAE) is calculated using the following relationship:

$$EAE = 0.5 \cdot \sum_{i=1}^{12} N_i \cdot PL_i \cdot FL_i \cdot NS_i$$

where N_i – the number of students, PL_i – the average price of private lessons, FL_i – the average number of weekly private lessons taken by a student and NS_i – the average number of weeks of each month, during which a student is taking private lessons.

Obviously, to implement the above relationship must be evaluated the values for the last three variable. They are estimated by applying a statistical survey on the pupils from certain education cycles.

Similar evaluations can be realized also to

determine the hidden economy from other sectors of activity, as, for example, the tip at the level of restaurants, hidden income from health domain etc.

3 The estimation of the informal economy-case of Romania

Among the methods usually applied to measure the informal economy we mention the monetary method. Although were formulated some critics, generally, this method is currently used in the literature [7] [8] [27] [28]. This method was first used in [14] [16] and the first econometric estimations were made in [23]. In [16] are formulated the following four axioms:

- The higher level of taxes and also the higher state intervention in the economy represent causes of the informal economy development;
- In the informal economy case are usually used cash transactions;
- There was a time in the past when the informal economy was not present in the economy;
- The exchange rate is efficient in deposits creation.

In the following we present a methodology to estimate the ratio between the size of informal economy and the formal economy based on statistical data. Parameter estimation for these models is made based on data from the Romanian economy. The main features of these data series are:

- Data series used are quarterly, from Q1 2000 to Q4 2009;
- Parameter estimation was performed after eliminating the seasonal component of the data series. In this way X-12 procedure was used, procedure that is implemented in EViews software;
- Data series used for the estimations are reported by the National Institute of Statistics and National Bank of Romania.

Equation 1 describes the estimation method of the monetary demand. In this case, the econometric model used to estimate economic transactions in cash is defined on the basis of the following relationship:

$$\log(C_{ot}) = a_0 + a_1 \log(1+\Theta_t) + a_2 \log(Y_t) + a_3 i_t + u_t$$

where

- C_{0t} is the size of cash transactions at the economy level;
- Θ_t is a variable that quantifies the state pressure on the economic agent, which determines the economic agent to develop his business in the informal economy area (for example, we can use in this sense taxes or government expenditures share in GDP);
- i_t is the inflation rate or interest rate;
- A, α, β and γ are positive parameters which are estimated using empirical data sets;
- We noted with $u_t, t = 1,2,...$ random variable with zero average, uncorrelated and constant variables.

To estimate the parameters of this equation we take into account the variable Θ_t that measures the pressure of government on economic entities and individuals through taxes and duties on them may be defined by the GDP share of government expenditures or product tax share in GDP. In our model the first working version was used. Parameter estimation was done by the two stages least squares method, and results are presented in Table 2:

Table 2. The characteristics of the econometric model used for equation 1

Dependant 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
R^2	0.98	
DW	1.33	

* the level of significance $\alpha = 0.00$

The results from the above table validate the estimated model. Durbin-Watson statistics highlight an autocorrelation of errors, but it is low.

Equation 2 and **Equation 3** define the volume of transactions in the economy, and the workload of the economy. Thus, the volume of economic transactions in a given period is calculated as the sum of transactions in the real economy (official) and the informal economy (hidden). Thus, the folowing equality is defined below:

$$C_{0t} = C_{Rt} + C_{Ht}$$

where C_{Rt} is quantifying the size of the transactions from the formal sector (recorded transactions) and C_{Ht} is measuring the size of transactions from the informal economy.

Similarly, the total volume of economic activity can be defined as the sum of activities of the formal economy (measured in official statistics by the Gross Domestic Product) and those in the informal economy (informal). This equality is defined below:

$$Y_{0t} = Y_{Rt} + Y_{Ht}$$

where Y_{Rt} is GDP, and Y_{Ht} measures the dimension of the informal economy.

Equation 4 estimates the size of the formal economy transactions made in cash. For this estimation the equation proposed by Ahumada (2008), based on the formula suggested by Cagan (1958), was used. To achieve this forecast we considered that the hidden economy size is zero if in equation (1) $\Theta_t = 0$. Under these conditions, using parameters estimations from the previous stage we obtain the size of the formal economy transactions in cash using the following relationship:

$$\log(\hat{C}_{Rt}) = \hat{a}_0 + \hat{a}_2 \log(Y_t) + \hat{a}_3 i_t$$

To write this econometric model we estimate the parameters based on the equation (1) and the term $\log(1+\Theta_t)$ is zero. This corresponds to the situation where the government does not make pressure on economic agents by the size of taxes and fees that they have to pay to transfer economic activities of the formal economy (demand) to the informal economy (hidden).

Equation 5 estimates the size of liquidities from the informal economy. Keep in the mind that C_{Rt} is estimated by Equation 5 and C_{0t} is evaluated based on national statistics.

$$\hat{C}_{Ht} = C_{ot} - \exp(\hat{a}_0 + \hat{a}_2 \log(Y_t) + \hat{a}_3 i_t) \quad \hat{C}_{Ht} = C_{0t} - \hat{C}_{Rt}$$

Equation 6 describes the ratio between cash transactions from the informal economy and the ones from the formal economy. Thus, we define the following ratio:

$$PEH = \frac{\hat{C}_{Ht}}{C_{0t}}.100$$

In Table 3 is shown the above ratio for the period 2000-2009. The results are shown in Figure 1.

Table 3. The values of the ratio between cash transactions from the informal economy and the ones from the formal economy

	Quarter			
Year	Q1	Q2	Q3	Q4
2000	35.9	39.9	40.1	40.7
2001	32.5	35.3	33.7	38.2
2002	29.3	26.3	31.2	35.3
2003	26.5	24.3	27.6	29.9
2004	29.5	28.2	27.5	30.2
2005	31.1	30.2	31.5	35.9
2006	33.5	38.5	37.8	28.5
2007	28.5	32.6	35.7	39.4
2008	30.4	33.3	27.5	31.9
2009	34.1	37.3	37.9	37.0

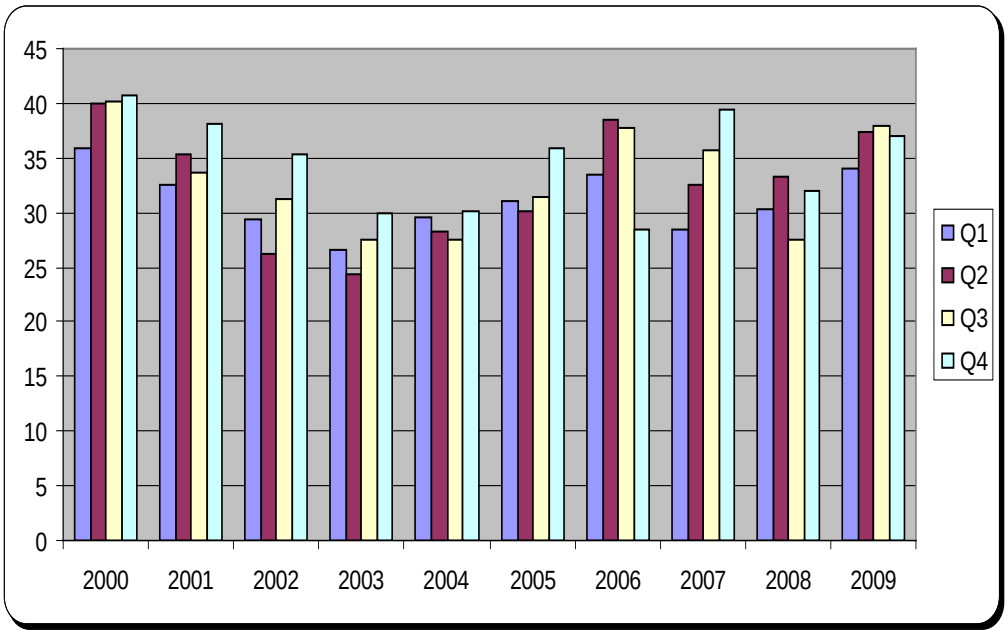

Fig. 1. The evolution of PEH variable during the period 2000:Q1-2009:Q4

The obtained results allow us to formulate the following comments on the evolution of PEH variable during the analyzed period:

- Values for this variable were situated within the range of values [24.3, 40.7];
- The values were lowest for the period 2002-2004. During this period most values are below 30%;
- For the period 2005-2009 most values are above 30%, showing a large size of the hidden economy in Romania;
- For 2009 the value of this ratio is situated between 34 and 40%;
- Estimates suggest that the introduction of the unique quota in 2005 did not lead to a reduction of the hidden economy;
- Note the high volatility of the variable values from one quarter to another.

4 Conclusions

Informal economy registered during the transition period was one of the major problems encountered in all Eastern countries. Moreover, for Romania, for the EU accession

process, "combating tax evasion" and "tax and fiscal policy reform" was one of the most difficult negotiation chapters. The reduction of the informal economy size represents an important component of Romania's economic policies.

Calculations made based on the methodology of this article estimates the ratio of cash transactions made in the hidden economy and the official economy during 2000-2009 to values between 0.24 and 0.40. Highest values are obtained for 2000, 2008 and 2009 and the lowest for 2003 and 2004. The obtained values are much larger than those estimated in [24] for OECD countries. The estimated values for these countries are below 0.25.

Possible developments of the methodology proposed in this paper refers to these two issues: estimating the size of hidden economy for the development regions, estimating the hidden economy effects on economic and social development at national and regional level. The major difficulty for applying this methodology to estimate informal economy at regional level is related to ensuring data series for some variables that appear in the econometric models. VAR or ECM can be used to estimate the effects of the informal economy on economic and social development of such models.

The estimation of the informal economy at regional level raises a series of problems concerning the data series available at the development regions level. Panel data models can be efficient for the estimation of the informal economy size and its effects on regional profile only to the extent that can be identified the data sources necessary for their construction. Thus, we believe that model [2] can be estimated at the development regions level.

Often, for various variables, cannot be identified the data series at the level of certain public institutions. To remove this obstacle is recommended to identify latent variables for which we can build data series at the development regions level.

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