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UNDERGROUND ECONOMY ESTIMATION IN IRAN BY MIMIC METHOD

Underground economy, is all countries economy reality and forms a percent of each country`s economy and is the cause of many social and economic disorders that presents its existence in community with an unseen hand and is the cause of monetary and financial problems emergence and obscures economic data and makes inappropriate performance of economic policy therefore, due to the sensitivity of this phenomenon, this research measure the volume of smuggled goods during the years of (1974-2011) based on Lisrel software. In this study, for determining the size of the underground economy, firstly, its index has been determined by using MIMIC[4] method in a ranked series of numbers and then for the sake of comparing different years, calibration and the previous studies were used to estimate the volume of relative and absolute underground economy. Based on mimic method, the average size of the underground economy during (1974-2011), was about 21% of official GDP. The results of this study show that the openness of the economy, inflation, education and the size of the government are considered main causes of the underground economy in Iran. The average size of the underground economy in past studies, was about 19% of GDP but in this study, it`s two percent higher than the average of the whole period.
JEL: C22; E26; C51; H26

1. Introduction

The phenomenon known as shadow economy, smuggling, black economy, underground economy and … attracted the attention of economists from the second half of 1970, however, this phenomenon also existed before this decade (Schneider, 2006) and is the economic reality of all countries of the world.

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[4] Multiple-Indicators Multiple Causes.

Underground economy growth has negative effects on the financial sector and the macroeconomic performance. Difficulty in observation and measurement of smuggled goods lead to unreal evaluation of social and economic conditions of persons and families in out of the country and due to its obscure nature, it can`t be recorded on formal statistics and its existence hides part of economic performance of countries and this would challenge the efficiency of distribution and allocation policies of government.

On the other hand, smuggling lowers the public revenues, changes the internal structure of a society through the creation of strong illegal domestic institutions and changes consumption patterns of society (Dominguez, 1975).

Poverty is commonly referred to etiology of underground economic phenomena (Tanzi, 1999). Poverty can be examined with unbalanced development view. It is based on this view that the causes of injuries and abnormalities in the society root in the structure of society. These structures are founded on relations and benefits governing the society. Within the existing relations and under unequal social development perspective, the society is divided in to the center and periphery. The focal center has access to exclusive technology, financial management, investments, natural monopolies, Medias, relations and resources and put them in its services and benefits from them but the periphery center is bereft from many available resources in the community. This major periphery bereft more by poverty increases, income unequal growing and unfair division of labor, investment, and low income, and these pave the ground for many of the social problems and deviations. People of peripheral and deprived center turn to illegal activities such as smuggling, so that through its revenue they would satisfy their social and economic needs. Their poverty can be both a cause and effect of smuggling. The secondary effects immediately occur after the defeat of production, decrease of employment and income. On the other hand, since smuggling is a major obstacle in the production and job creation, the underground economy increases the speed of impoverishing the lower classes of society.

Having information of the hidden economy size, including the size of the underground economy is important because of aspects of the tax gap, the effectiveness of monetary and fiscal policies, economic growth and income distribution, but the data of the size of the underground economy is not statistically reliable. Considering the difficulty of observing and measuring the size of the underground economy, it may lead to mistakes in evaluating the economic and social conditions of individuals and families abroad, and the economic landscape may become vague. Due to the underground economy hidden nature it is not recorded in official statistics and on this basis it hides a part of the country's economic performance. Without the estimation of time series of the underground economy, the quantitative investigation of its reasons and also the effects of it on the social and economic variables are not possible.

2. Literature

Different definitions of the underground economy have been presented and some of them are mentioned below:

Schmolder (1980) defined the hidden economic activity as, "concealing the incomes of depreciated equipment and machinery purchases, having secondary income and keep it secret by having a special account maintained abroad."

Tanzi (1982) described it as the activity of the underground economy which is legal in terms of income, but not reported to the tax authorities.

Smith (1982) didn't consider the criminal activity and criminal fraud and theft at workplace as hide economy, but from his point of view the hidden economy is the economic activity in the unregulated sector. These activities are done both in the regular sector and irregular sectors of the economy, for example, installing wallpaper or painting can be done by both companies and individuals who work formally and legally and also by those who do not have the permission and are not willing to pay taxes, etc., but the main problem of this definition is putting boundary between regular and irregular.

Frey and weck (1983) believed that the in addition to the financial transfer, activities are also part of the informal economy which create economic values for the country. The values that are part of GDP and logically should be placed in the national accounts, but are not in national account are also part of the informal economy.

Stiler (1985) divided the economy into two parts (overt , and covert) and stated: the activity which is illegal in terms of income source and reported is called overt economy, and if the activity is legal in term of the income source, but is not reported is considered covert. If an activity is illegal in terms of income is also covert, and if the activity is both illegal and not reported, it is also part of the covert economy.

Thomas (1992) believed that informal economy in empirical research in a broad sense, refers to all activities that are not part of the national account for any reasons. In further studies, according to Its broad sense, terms such as illegal (Lacko, 1992), black (pyle, 1989), unreported (Feige, 1989), latent (Giles, 1998), shadow (Cassell, 1984), Second (Contini, 1982), infisible (Feige, 1981) and underground (Tanzi, 1983) are used to define the parts of these series. Thomas introduction and definition of the informal economy is perhaps one of the best presented definitions and classification. He used two criteria in his classification "legality" and "market exchange". According to his classification, the informal economy can be divided into the following four categories:

1. Household sector: This sector is produced goods and services that are consumed in it. The household sector characteristics is this that its products are seldom sent to the market and lack of prices for manufactured goods, make it difficult to assess the values of goods and thus it is ignored in the national accounts. In all countries unpaid activities that are done at home, such as housewives services is ignored in national accounts. Household productions in rural communities are also included in this part.

2. Informal sector: This sector includes component producer and their employees as well as tradesmen and craftsmen without commercial service workers, transportation and other services which are informal. Although the activities of itinerant merchants are one of the most prevalent types of activity, but small workshop often at home and without workers (home workshop), are more important in terms of the numbers. The difference between this section and the household sector is this that the home products in the

informal sector are sold to the consumers as final goods and this means that the market exchange takes place, but the household sector doesn't have any market exchange.

3. Irregular section: All classified activities in this sector have illegal nature such as escape of regulation and social security fraud. The main feature of this section is that, despite of the legality of production activity of goods and services, there is illegality in the manner of production or distribution.

4. Illegal sector: The production of irregular sector are legal and valid but illegal sector productions, includes activities and productions of illegal goods and services such as robbed properties, extortion, manufacturing and purchasing of narcotics, prostitution and so on. Considering the fact that the criminals and lawbreakers don`t report their illegal actions, they obviously escape from paying taxes. Informal activities separation from Thomas point of view is presented in table (1).

Table 1

The informal economy from Thomas view

Section	Market transactions	Nature of production	Nature of production and distribution
Family	No	Legal	Legal
Informal	Yes	Legal	Legal
irregular	Yes	Legal	Illegal
Illegal	Yes	Illegal	Illegal

Source: Thomas, 1992.

It can be concluded from Thomas classification that the informal economy is a kind of economic activity that violate at least one criterion of market transactions, mean the nature of production or distribution.

Giles (1999) believes the underground economy includes activities and transactions that may be either legal or illegal, but due to the lack of reporting, have not been measured. Refusing to report is performed for the sake of taxes payment (tax evasion), such as unreported cash payments, extortion, corruption, prostitution and the drug trade.

Given the various definitions that have been proposed by various researchers, the definition of the underground economy concerned in this study is largely in accordance with Thomas definition (1992) named illegal activity.

3. Underground economy background

The phenomenon of the underground economy has enough history in the economic writings. Eastern areas of London in the mid-nineteenth century are obvious examples of hidden organizations that compete with each other's in filthy areas. Since the 1970s, the term underground economy is used for the activities of public company or private firms which are out of established framework. Firstly this term was introduced, in response to the rise of self-employment in Third World countries` cities, but was later extended to

developed countries, including Britain. This term was also associated with other non-industrial properties and with interpretations such as hidden economy, smuggling, the underground economy and etc….

After a period of happiness of success of being able to estimate the hidden economic activity, nowadays from the point of views of many scholars, the hidden economy has turned back to a mysterious and inaccessible measure. The economic crisis of the 1970s, more than anything, has led to the mysterious concept of hidden economy. Sociologists, anthropologists, geographers and historians had gained the opportunity to confuse economists by discussing about this issue (Hart, 1987).

Most economists especially those engaged in economic related organizations such as the World Bank or international organizations of workforce have found that the underground economy have effects on the future life of the poor cities in third world countries.

Henry Moyhew (1850) research named forming London labor and the Poor London in the local "morning" newspaper in the 1850s can be considered as the original classics sources in this field. Whyte study (1943) about the social congregating in street and poverty of culture indicate a small part of these problems impacts on developed economies. The dual models of economic development prevailed in the 1960, lost their headship role of world. Louis (1954) considered the notion of unlimited supply of labor and designed the innovative and capital of international business essentially shows the combination of the lives and livelihood of farmers (informal workers). Hart (1973) suggested that the relationship between the sectors and two sources of employment (formal and informal) may be an intangible factor that is the source of growth, and its dynamicity lead economic changes in some cases.

In other words, in traditional models, the covert section was essentially considered job market phenomenon and the result of surplus labor force, which mostly comprised of rural migrants that were not able to find jobs in the modern urban part, therefore created a hidden way to work and earn money. With this view, the informal sector, was considered a sector which is far from general direction of development and logically should has been entirely eliminated or reduced by increasing employment in modern urban area, but in recent years, with most countries facing with financial crisis, this view has been adjusted, so that the informal sector considered a sector comprised of surplus labor force previously, is now considered an important source of income and product that deal actively with modern urban area. With this view, the informal sector is employment making part and is free from short-term external factors effects and deserves to have access to credit, training and technology and be supported in different markets to increase productivity and earnings. Economy dualism (formal and informal) and the informal economy sector importance might be directly and fully accepted by people. Its acceptance in major organizations such as the ILO and the report of its effect on income and employment in Kenya in 1972 that considered the informal sector a main source of national development, was enough to make large groups of researchers focus on this issue from the 1970. Most of these studies, investigate the relationship underground economy and poverty.

Parallel to the development of empirical studies about the underground economy, the phenomenon of smuggling and illegal trade were regarded by economists and international

trade theorists since 1970s and thereafter. The first opinions about the underground economy were introduced by Bhagwati and Hansen (1973). Based on this research the non-synchronous mode, of smuggling and legal trade, smuggling will lead to a reduction in welfare. However, under certain circumstances, it may also increase welfare. But when the synchronous mode of smuggling and illegal trade is ruling, smuggling necessarily reduces social welfare. Bhagvaty and Srinivasan (1974), in a study entitled illicit trade in international trade and in the form of a mathematical model, confirmed the results of Behaguaty and Hansen. Based on this research, when dealing with restrictions on the legal trade and smuggling under competitive conditions, smuggling may increase or decrease welfare.

Sheikh (1974), while criticizing the Behaguaty and Hansen, has analyzed the welfare impacts of smuggling. According to this research in the synchronous mode of the legal trade and smuggling, and assuming that the smuggling not only has the risk of discovery and confiscation of contraband but also use from inputs used in the legal production activities, may increase or decrease the overall welfare.

Loayza (1996), indicated that an oversize of unofficial economy has a negative effect on economic growth. This happens in two ways:

1. An increase in the volume of unofficial economy will cause a decrease in public services available for individuals.

2. Also, an increase in the volume of unofficial economy can make activities which are low in productivity decrease.

Palada and Elgar (2001), believe that while limiting a healthy economy, Underground Economy inflict costs which disturb economic growth which disables governments to supply the needed general commodities for the public. These costs will inevitably when institutions evade tax payment.

4. The reasons for manifestation of Underground Economy in different countries:

- Mirus et al (1999) claim that high tax rates, unfair tax construction, inefficient governments and unnecessarily large numbers of unsuitable regulations are some of reasons for Underground Economy in Canada.

- Cebula(1997) surveyed the influence of tax rates from revenues from punitive policies adopted by the auditing office on the relative size of the us Underground Economy. Cebula came up with the conclusion that limiting as well as reducing tax rates will not pave the ground to minimize the volume of Underground Economy while the increase in punishments and punitive policies will end in a downsize of Underground Economy.

- Enste (2003), who did a study of Eastern European countries, concluded that factors such as distrust in official institutions, high tax burden inflicted on entrepreneurs, high taxes compared with insufficient public services have been the main causes of Underground Economy in eastern European Countries.

- Giles et al (2002), found high tax burdens and the increasing rate of inflation to have been the reasons for Underground Economy as well as tax evasion in Canada.

- Dell Anno and Solomon (2006), who did a survey on the US economy, concluded that unemployment was the major cause of manifestation of Underground Economy in the United States.

5. Empirical studies

- One of the most important early empirical studies on the underground economy is Cagan study (1958) for the United States. Cagan used from currency ratio to estimate the volume of unreported people income in America during World War II. In this method, at first the ratio of currency and bill to deposits of total economy is calculated and then assuming that the only means of exchange in the underground economy is cash, and the speed of money circulation is the same in the formal and underground economy, the size of the underground economy has been estimated using the quantity theory of money. after applying algebraic operations and assumptions the final equation can be written as follows:

$$Y_u = Y_f \cdot \left[\left[\frac{CC - R_f \cdot DD}{[(R_f + 1) \cdot DD]} \right] \right] \tag{1}$$

Where:

CC: Volume of currency and bill

DD: The volume of demand deposits

R_f: Cash ration in the formal economy

Y_f: Official income at current prices

Y_u: Income from the underground economy at current prices

(1) Relation is with the paradox that the more the volume of informal economy, the more the underground economy will be. In other words, there is always a positive relationship between underground economy and official economy.

- Cagan conducted a study (1958) to investigate the long-term behavior of cash ratio (volume of currency and bill people have to money supply (M2)) of America in 1875-1955 period. In this study the ratio of cash is assumed affected by factors such as interest rates of bank deposits, real expected income per capita , volume of retail trade, volume of travel per capita, degree of urbanization and the rate of tax on deals. It is expected that by increasing in interest rates of bank deposits and real income per capita, cash ratio decreases. Since in retail trading, mostly cash is used, it is expected that by increasing in retail trading, the cash ratio also increases. This positive relationship is expected for the volume of travel per capita too, because people use of cash for transactions in travel. Due to the advanced resources in cities it is expected that increase

in the degree of urbanization, decreases the cash ratio. Trade tax rate, is like a circle that link the cash ratio with tax escape. Cagan argues that some people escape from paying the tax by transactions with cash and not reporting to tax rate. Tax escape occurs when the tax rate is high. Therefore it is assumed that there is a direct and positive relationship between tax rates and the ratio of cash. This study confirm above assumptions through using of equation in which the dependent variable is cash velum and the independent variables are interest rate of bank deposits, real expected income per capita, and the annual tax rate on income the assumptions.

- Gutmann (1977) estimated the size of the underground economy for the United States of America using the cash ratio method. In this study, assuming the lack of underground economy in the 1937-1941 period (in these years income tax rate has been normal) increase in cash in other years in ratio to this period was considered the increase of underground economy volume. Based on these results, the size of the underground economy in the period under review was approximately 176 billion dollars.

- Given the objections to the cash ratio and money exchange method, Tanzi (1980) estimated the size of the underground economy by using adjusted cash ratio method. Considering Cagan`s study in estimating the volume of USA underground economy, Tanzi believes that the cash ratio is affected by tax rate, the proportion of remuneration and salary in personal income, real income per capita, the interest rate of long-term annual deposit. In this study, real income per capita, is considered as a general alternate of all developing indicators such as credit cards, degree of urbanization, volume of travel per capita, improvement in banking services and because mostly salaries are paid in cash, the proportion of salary and remuneration in personal income is considered as an exploratory variable.

For the calculation of the tax rate three different options are considered:

A: proportion of transaction to pure personal incomes

B: The top rate of legal tax

(C): The average weight of tax rate on income

Then equation is estimated considering the third option for estimating the size of the underground economy in America over the 1929-1976 period using ordinary least squares. The results of this estimation represent the extreme sensitivity of estimating equations regarding to changes in assumptions associated with different tax rates. Thus, if the tax rate, assumed to be zero, the size of the underground economy is estimated equivalent to 11.7% of GDP but if the tax rate is considered equal to the least value, rather than zero- and within the studied time period, the volume of the underground economy is estimated equivalent to 5.1% of GDP.

- Kirchgassner (1983), considered the cash ratio as a function of real income per capita, interest rate of long-term deposit, inflation rate, final tax rate on average received salary, and dependent variable with a halt, in order to estimate underground economy volume in West Germany. Given that the tax rate in 1957 in West Germany has been minimal, Kirchgassner assumes the underground economy in 1957 is zero. His results showed

that the size of the underground economy until 1975 was fixed proportion – about 3 to 4 percent of GDP – but this volume increased and reached 10.3% of GDP in 1980.

Given the criticisms over the monetary methodology and limiting assumptions of these methods, new approaches were introduced for estimating the underground economy gradually. One of the most important approach and method is multiple indicators - multiple causes approach (MIMIC).

- Frey and Weck-Hannemann (1983, 1984), are pioneers in using MIMIC method for assessing the underground economy in these world and studied the relative size of underground economy for 17 members of Organization for Economic Cooperation and Development (OECD). They used in their pattern the direct tax burden, social insurance contributions, visible tax burden, regulation load, adherence to tax payment and the level of economic development as the leading causes of the underground economy and used GDP growth rate variable, the rate of male labor force participation in the labor market, changes in hours (over a specified period), as indicators of the underground economy and by using cross-sectional data for 1960, 1965, 1970, 1975, 1978 years, the relative size of the underground economy were estimated by them. This study results showed that the direct tax burden, tax burden and the burden of regulation and adherence to tax payment are the most important factors in the development of underground workings; other factors had no significant effects on the underground economy.

- Schneider and Enste (2000), in a study entitled "shadow economies: size, causes and consequences" estimated the underground economy for 76 different countries. The important point in this study is the fact that there is a significant difference between the estimation of relative underground economy in developed countries and developing countries. The results showed that the average size of the underground economy in both relative and absolute form is much more in developing countries than in developed countries.

- Ashrafzade and Mehreghan (2000) estimated in a study the size of the underground economy during 1962-1995. In this study bill demand and coins in circulation method, which is a modified form of the demand for money has been used. The average size of the underground economy during the period under review was approximately 12% of real GDP.

- Arabmazar Yazdi (2001) estimated the size of the black economy using MIMIC method in 1968-98 periods. He used from tax burden variables, trade restrictions, increased in commodity prices, unemployment and per capita income, as the reason of the black economy growth and emerge, and used from the fluctuations of household expenditures variables, official and unofficial exchange rate, money demand and energy consumption, as indicators reflecting the impacts of the black economy. His study results showed that relative size of underground economy in Iran in the period under study was full of ups and downs and in the last period under study had rising flow, means that from 8% official GDP in 1995 increased to more than 22% of official GDP in 1998.

- Wang and others (2006) estimated in a study the underground economy of Taiwan by using MIMIC method during 1996-2003. In this study, tax burden variables, the real government consumption logarithm, unemployment rate, inflation and crime rates considered as causal variables and the real GDP logarithm variable and the ratio of financial net were used as the underground economy indicators. The results of the study showed a positive correlation between the size of the underground economy and the government real consumption and inflation but crime rates and unemployment rates don`t significantly associated with the underground economy. The results also indicate that the underground economy size fluctuates between 11.3 and 13.1% of real GDP before 1988 in Taiwan and also fluctuate between 10.6 to 11.8% of real GDP since 1989.

- Schneider (2006) estimated the volume of Underground Economy using the Mimic Method and Money Demand approach in 145 different countries. Based on this survey, the volume of Underground Economy was on the rise for all the corresponding countries except for OECD States; moreover, with a 1% rise in the volume of Underground Economy, economic growth will decline in developing countries, developed countries, and countries in transition as much as 0.06 , 0.08 and 0.01% respectively.

- Zaranezhad and Ebrahimi (2012) in a study named (commodity smuggling in Iran and its relationship with formal economy, Granger causality test) estimated the volume of commodity smuggling in Iran through hidden variable approach and investigated its relationship with formal economy in 1974-2007 period. According to study results, unemployment, government size, income per capita, inflation and openness of the economy, are the most important factors that influence smuggling in Iran. Based on other results, there is a causal one-way relationship, from informal economy toward smuggling, but, no evidence has been found for the reverse relationship. The average volume of smuggling during the studied period, despite large fluctuations in some years, was about 19% of real GDP.

6. Model estimation

6.1. MIMIC approach

Now, the underground economy estimation will be described by using MIMIC method. Graphical for estimation of the size of the underground economy in Iran by MIMIC approach is shown on figure 1.

The used time series in this study is 1974-2011. All used data in this study, except the final consumption of energy, is taken from the website of the Central Bank of Iran and Heritage Institute. Final energy consumption data is taken from ministry of power and electricity site.

Figure 1
Model to estimate the size of the underground economy in Iran
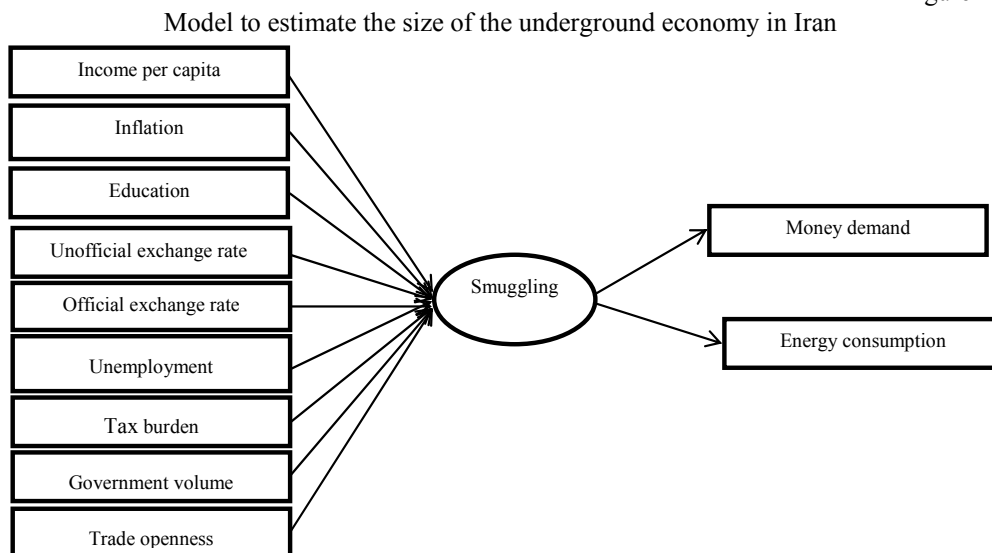
6.2. Model estimation and results analysis

All time series durability was tested by Augmented Dickey–Fuller (ADF) test. Assumption of time-series durability of real tariff indicators variables, economic openness rate, illiteracy rate, corruption index, money growth rate and energy demand growth has been confirmed and variables are I (0). Inflation variables, the size of government, the unemployment rate, exchange rate and per capita income are not durable (I (1)), but the first order difference of them is durable (I (0)). Hence, the level of durable variables and first order difference of the durable variables I (1), was used in the modeling.

The underground economy estimation was done by using Liserel software package and the method of Maximum Likelihood Estimation (MLE). Since the goal in modeling the structural equitation was reaching the best model in criteria of fitness and accordance of variables signs with theoretical principles, in research methodology section more than 100 models were tested and among them a model was chosen as the top one that is consistent with theoretical principles and is verified through criteria of fit and test of significance of the coefficients. Two points are important here:

Firstly, for solving the problem of parameters identification of the model, we were forced to stabilize one of the parameters affecting the underground economy to a predetermined amount. This makes possible in estimation of the model not consider absolute values of the variables and only their relative values will be regarded. To do this, in the two individual conditions, the final consumption of energy and the demand for money, stabilized to a predetermined amount of 1. When the demand for money was fixed to a constant value of

1, index performance was approximately better. So the money demand in all models was given a constant factor of 1.

Secondly, money demand variable applied in the model in two separate form of money demand and money demand growth. Models of money demand growth in comparison to the money demand is better. For this reason, in the other models, the growth of money demand was used. Similarly, instead of final consumption of energy variable, final energy consumption growth variables was used for modeling the effects of the underground economy. Index of economic openness in two ways: I) ratio of exports to GDP and II) ratio of exports and imports to GDP are defined. These two separate indicators were used in the modeling and it was used to estimate the underground economy, regarding the desired results of the first index.

The best fit models results are discussed separately below:

1. In all estimated models, the per capita income variable, economic openness and government size, are statistically significant. the illiterate rate variables, inflation rate in most models and the unemployment rate variable in some of them, are statistically significant but the official and unofficial exchange rate are not statistically significant in any of the models. The openness of economy index variable is positive in some models and negative in some others and in some models it`s 90% significant.

2. In all estimated models, symptom variables are consistent with the theoretical principles and the values of the parameters are relatively stable. Among the indicators reflecting the underground economy, money demand variable in all models are statistically significant and positive, meaning that the increase in size of the underground economy associated with increases in money demand for activities related to the underground economy. Growth in consumption of petroleum variable in all models is statistically significant, i.e., increasing in the size of the underground economy also increases the consumption of oil products.

3. Among causal variables of estimated models, the index of economic openness, inflation rate, the unemployment rate, economic openness and government size are subsequently higher in weight and therefore have more importance in influencing the underground economy.

4. The variable index of economic openness is statistically significant with a confidence level of 90%[5]. The sign of this variable is positive in some models, and negative in some others. The negative effect of this indicator means that by reducing restrictions on trade, the size of the underground economy also reduces. But the positive effect of it means that rapid liberalization of trade, without any transparency and effective enforcement of the rules, may increase the size of the underground economy.

5. Unemployment rate variable in all models has the positive sign which is consistent with previous studies.

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[5] Other variable considence is 95%.

6. Official and unofficial exchanges rates variables that are not statistically significant, have low weight and little importance in all models and therefore are not considered in the selection of the final model.

7. Per capita income variables are statistically significant in all models and has a positive sign, i.e., with increases in per capita income, the size of the underground economy also increases.

According to the above results, for selecting the best model among the proposed ones, and to estimate the size of the underground economy in Iran, two methods are used. First, the method of Frey and Weck-Hannemann (1984) based on this model the priority of choosing the best model is with symptoms variables consistence with theoretical foundations and significant coefficients that are statistically significant. Second- the method of Giles (1999), in which the priority is with the general model fit indices. The final model selection approach is two-fold approach in this study. Based on this approach, firstly the models that are consistent with theoretical framework and are statistically significant are selected and then among them, the one that is in better condition regarding the Liserl general fit criteria will be selected as the best model. Chi-square index (Chi-square) and Akanke's Information Criterion (AIC) are from general Liserl fitting criteria and small amounts of them indicate a better fitting model. These criteria are based on the assumption that the smaller the difference size between the covariance matrix of sample data and the variance-covariance matrix of model, the fitness of model with experimental data will be more. These criteria are influenced by sample size and if sample size change, their value will change too. In addition to these criteria, the criteria of Goodness of Fit Index (GFI), Goodness of Adjusted Fit Index (AGFI) and Non-normal Fit Index (NFI) are also indicators of fit goodness of model. The values of these models are between one and zero and the closer the values to one, the better they will indicate the best fitting model. This index is not affected by sample size and emphasizes the relative superiority of general fitting model. Among other super criteria is Root Mean Square Error of Approximation (RMESA). The values of these indicators for the very good models are less than or equal to 8%. Values greater than 8%, indicate a poor fit. All models in terms of the general Liserl fit measures are in good condition. After comparing the models in terms of Liserl fit criteria, the following model was chosen as the top model. The regression form of model is as follows:

$$smug = 0.492 Inf + 0.511 unlat + 5.202 Open + 0.56 gav \quad ; \quad R^2 = 0.81$$

$$(2.35) \qquad\qquad (1.70) \qquad\qquad (1.56) \qquad\qquad (2.46)$$

$$Rmd = 1.00 smug$$

$$energy = 0.06 smug \quad ; \quad R2 = 0.39$$

$$energy = 0.050 smug \quad Rmd = 1.00 smug \quad ; \quad R^2 = 0.19$$

Standardized form of the above model is as follows:

$$smug = 0.001\ inf + 0.45 unlat + 0.40 Corr + 0.82 gav$$

$$Rmd = 0.44 smug$$

$$Energy = 0.62smug$$

The above regression results are shown in the below table for further exploration:

Table 2

The results of model estimation

Variable	Coefficient	Statistics t
Inf	0.490	2.35
Unlat	0.511	1.70
Open	5.202	1.56
Gov	0.560	2.46
$R^2 = 0.81$		

Source: research Results.

As it was observed in the regression equation and also table (2), inflation rates, illiterate rate, economic openness and government size variables are present. According to the above equations, the total effects of these variables on the underground economy are positive. This result is consistent with previous theoretical studies.

Indicators of fit for these models are as follows which shows that this index satisfies the acceptable criteria.

Table 3

The fitting Lisrel index

Index	Quantity
Chi-square/DF	1.386
RMSEA	0.106
NFI	0.840
NNFI	0.850
CFI	0.890
GFI	0.960

Source: research Results.

Khajavi et al (2011) showed that the most effective factor for the expansion of Underground Economy in Iran have been the rise in tax rates as well as unemployment rate. They also concentrated on a study of a relationship between tax-gap and Underground Economy according to which (1971-2007), the volume of Underground Economy was 17.21% of Iran's GNP.

The present study however has put its concentration on the volume Underground Economy taking into account variable such as inflation rate, illiteracy rate, the openness of economy and the volume of the government. It is worth mentioning that this survey has taken into consideration the variable "illiteracy rate" yet such factor was not ever considered in Khajavi's work. That is to say, the higher illiteracy rate is in Iran, the bigger the volume of Underground Economy is.

6.3. Estimation of the underground economy and its relative and absolute size

For estimating the underground economy index, the explanatory models variables are replaced with numbers in equation to estimate the underground economy index in Iran for each year. The following diagram shows the underground economy index in the 38 year (1974-2011).

Figure 2

The flow of changes of underground economy index in Iran

Source: research Calculations.
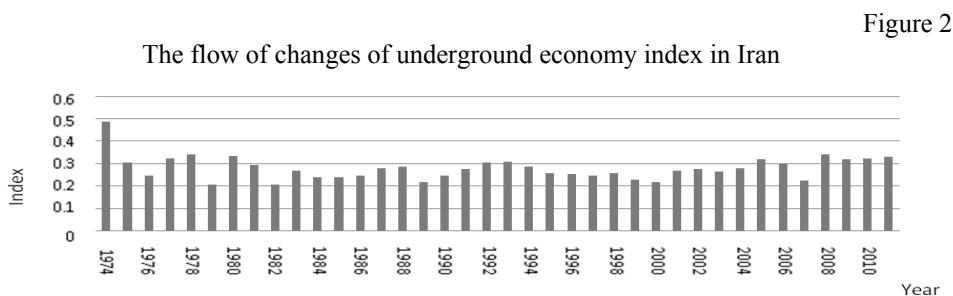
As can be seen, the underground economy has the highest amount in Iran in 1974 and it is mainly due to increase of government current spending in this year. Then in a full of ups and downs period, it reached the lowest amount in 1982. The main reason of this reduction in the number of underground economy in 1982 is depression in government current spending in this year in comparison with previous years**.**

Then the numerical underground economy index declined from 1982 and reached its lowest amount in 1985. The main reason of significant decline in underground economy flow in 1985 was significant 8% reduction in inflation in this year in comparison with previous year. After significant decline in inflation in 1985, immediately due to 12% increase in inflation, a significant leap in the underground economy index occurred and the underground economy index increased from 0.34% to 0.58%. The underground economy index flow in Iran, after little fluctuation in decline period, continued its increasing flow and reached the highest amount in 1995 in periods under studies. The acute increase in underground economy index of this year is due to acute increase in inflation rate of this year (the inflation rate was about 49%). Regarding the declination in inflation and unemployment rate in 1996, the underground economy flow decreases again in this year and from then on, the underground economy flow fluctuate around the average amount of it in whole period and spent a rising flow with ups and downs till 2008 and then again decreased in 2009 because of reduction in inflation rate. The underground economy flow increased slightly in 2010 and 2011 due to inflation rate and unemployment, in comparison with 2009.

Other additional side information is required to change the above indicator to relative size (as a percentage of GDP), in this study six previous studies in which the size of the underground economy in Iran has been estimated been used. Since all of these studies have covered 1991, this year was selected as the base year for calibration data. To do this, the previously estimated values of underground economy for 1991 were averaged and the mean

was used to convert a numerical index of underground economy to relative index. Table (4) shows a summary of these studies.

Table 4

The relative size of the underground economy (percent of Official GDP) in 1991 in different Studies

Researcher	Estimation method	Quantity estimation
Khalatbary (1990)	Cash ratio	7.0
Deputy of strategic review (1997)	Money demand estimation	30.0
Taherfar (1997)	Cash ratio	26.0
Bagheri Garmaroudi (1998)	Money demand estimation	17.0
Arabmazar Yazdi (2001)	Hidden variable	13.0
Sameti et al (2009)	Hidden variable	18.6
Average		18.6

Source: cited Studies.

So if you choose 1991 as the base year and the rest being normalized based on it, the above parameters can be indicated as a percentage of GDP. Relative index of underground economy (as a percentage of official GDP to constant prices in 1997) is shown in figure 3.
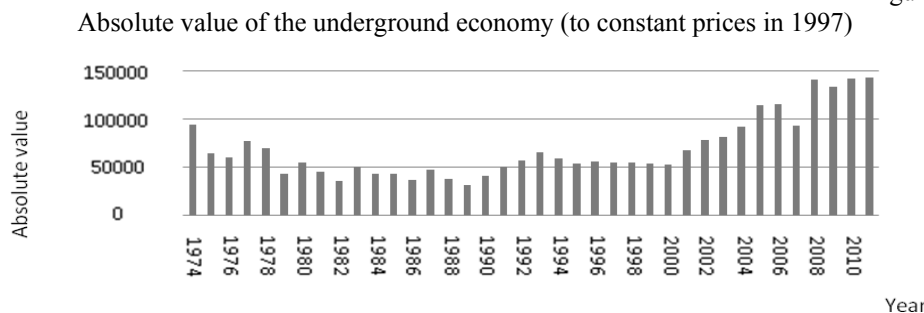
Figure 3

Relative index of underground economy (as a percent of Official GDP)
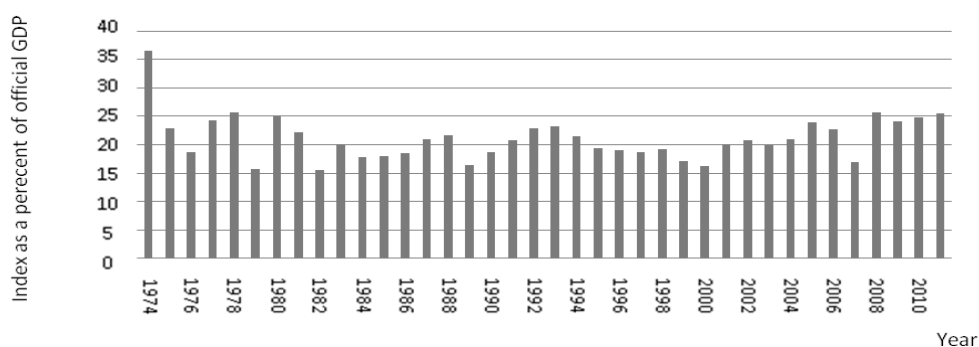
Source: research Calculations.

If the above relative index is multiplied by per year GDP, the absolute value of the underground economy for each year to fixed price of 1997 is obtained. Figure 4 shows the absolute value of the underground economy for each year of the periods under review.

Figure 4

Absolute value of the underground economy (to constant prices in 1997)

Source: research Calculations.

As it is obvious in Figure 4, the size of the underground economy over the course of 38 years has increased from 36 % of official GDP in 1974, after a period full of ups and downs, reached its lowest amount in 1982 means the 15.59% official GDP. Absolute value of the underground economy during the period under study had increasing flow and from 93976 billion Rials in 1974 and after 70% declination reached the lowest amount of 31098 billion Rials in 1989. Absolute value of the underground economy in 2008 reached 140096.91 billion Rials. Then by 6% decrease has been 132884.66 billion Rials in the 2009 year. This flow reached its highest amount in the last two years under study and in 2010 reached the highest amount means the 147832 billion Rials.

The results of this study are largely in agreement with the previous studies of underground economy. Average size of the underground economy in past studies, was about 19% of GDP it was two percent higher than the average of the whole period in this study, indicated that in recent years the size of the underground economy increased in Iran and it requires more analysis.

7. Conclusions

Planning for economic development of the economy and deciding for implement of established policies require the general understanding of economic performance (official and underground). Such understanding requires economic and efficient information system. One of the main problems of economic policy formulation in developing countries and particularly Iran, is lack of reliable, accurate and timely, social and economic statistics, especially when intentionally, part of the general economic performance of countries is ignored by the agents and units of information gathering. This makes the policy decisions that must be made based on statistics and macroeconomic indicators, inaccurate and efficient ones and implementation of this policy will lead to incorrect results. On the other hand, no obviousness of these statistics make the income sources of government from the received taxes, which is the main source of government`s activity and their services for people, be estimated inaccurately, and the government be deprived from receiving taxes and giving services to people. In addition, in the completion between formal economy and

underground economy, the formal economy practitioners who act in a legal ways, lose their power of competing with underground economy because of extra expenditure of working legally and may be put away. Having knowledge of the size and dimensions of the underground economy is important in tax escape, the effectiveness of fiscal and monetary policy, economic growth and income distribution. Taking these factors in to accounts together with the estimated size of the underground economy justify the goals of this study. In order to achieve this goal the underground economy estimation and evaluation in Iran during the (1974-2011) period based on Lisrel and MIMIC methods was discussed. It bear mentioning that considering the different definitions of hidden economy and its size, the one being considered in this study is mostly the same as Thomas`s definition named illegal activity. Study results show that underground economy size in 38 years under study with mimic method had rising flow and from 36% formal GDP in 1974, in a period of full of ups and down reached its smallest amount in 1982 that is 15.59% formal GDP. Absolute value of underground economy has increased over the studied period and from 93976.71 billion Rials in 1974 after a decline of about 67%, reduced to its smallest amount of 31098.01billion in 1989. Absolute value of the underground economy reached its maximum value in 2008, i.e., 140096.91 billion Rials. Then decreased by 6%, amounting to 132884.66 billion Rials in 2009 and in 2010 and 2011 reached to the maximum value during the periods under review. Study results also indicated that among causing variables, the openness of economy variable, inflation rate, economy openness indicators variables and government volume had high Wight in estimated models, are subsequently the most important causes of underground economy in Iran. The average size of the underground economy in the study, despite large fluctuations in some years, is averagely equivalent to 21% of formal, official GDP (regarding the constant prices in 1997).

References

Ashrafzadeh, H. & Mehregan, N. (2000). Estimating the volume of underground economy activities at Iran using the application for bill and coins in circulation. Proceedings articles for the third national conference of goods smuggling survey and ways of preventing it. 1999, Tehran: University of instructors training. Institute of Economics, p. 25-44.

Arabmazar Yazdi, A. (2001). Black economy in Iran, its size, causes and consequences in last three decades. – Journal of Planning and Budgeting 6 (63 and 62), p. 3-60.

Bhagwati, J. & Hansen, B. (1973). A theoretical analysis of smuggling. – Quarterly Journal of Economic 87(3), p. 71-198.

Bhagwati, J. & Srinivasan, T. N. (1974). Illegal transaction in international trade. Oxford.

Bagheri Garmaroudi, A. (1998). Underground economy, estimation and its impacts on budget deficits and private sector investment during 1971-1995. MA thesis, School of Economics and Politics, Martyr Beheshti University in Tehran.

Cagan, P. H. (1958). The demand for currency relative to total money supply. – Journal of political economy 66(1), p. 303-328.

Cassel, D. & Cichy, E. U. (1984). Explaining the growing underground economy in east and west: a comparative systems approach. – Compar. Econ. Stud., 28:1, p. 200-241.

Cebula, R.g. (1997). An Empirical Analysis of the Impact of Government Tax and Auditing policies on the size of the Underground Economy: The case of the United States, 1993-1994. – American journal of Economics and sociology, 56, p. 173-185.

Contini, B. (1982). The second economy in Italy. – In: Tanzi, V. (ed.). The underground economy in the United States and Abroad. Lexington, MA: Lexington Books.

Dell Anno, R. and Solomon, H. O. (2006). Shadow Economy and unemployment rate in U.S.A., Is There a structural Relationship?. An Empirical Analysis for the Annual meeting of European public choice society, Finland, April 20-23.

Dominguez, J. I. (1975). Smuggling. – Foreign Policy, N 20, p. 87-96; 161-164.

Enste, D. (2003). The shadow Economy and Institutional change in Transition Countries. Institut der deutschen.Wirtschaft, Koln.

Feige, E. L. (1979). How big is the irregular economy?. – Challenge, Vol. 22, p. 5-13.

Feige, E. L. (1989). The underground economies, Tax evasion and information distortion. Cambridge, New York, Melbourne, Cambridge University Press.

Feige, E. L. (1989). The underground economies, Tax evasion and information. Distortion. Cambridge: Cambridge University Press. Finanzrecht 6, p. 151-161.

Palada, F. & Elgar, E. (2001). Tax Evasion and Firm survival in Competitive Markets.

Frey, B. S. & Weck-Hannemann, H. (1983). Estimating the underground economy: A 'naive' approach. Oxford Economic Papers, Vol. 35, p. 23-44.

Frey, B. S. & Weck-Hannemann, H. (1984). The hidden economy as an unobserved variable. – European Economic Review, 26(1), p. 33-53.

Giles, D. E. A. (1998). The underground economy: Minimizing the size of government. – In: Grubel, H. (Ed), How to spend the fiscal dividend: Minimizing the size of government, Fraser Institute, Vancouver, p. 93-110.

Giles, D. E. A. (1999). Modeling the hidden economy in the tax-gap in New Zealand. – Working paper, Department of Economics, University of Victoria, Canada.

Giles, D. E. A. and Tedds, L. M. (2002). Taxes and the Canadian Underground Economy. – Canadian Tax, paper, 106, Canadian Tax Foundation, Toronto, Canada.

Gutmann, P. M. (1977). The underground economy. – Financial Analysts Journal, Vol. 34/1, p. 24-27.

Gutmann, P. M. & Fig, N. (1984). The Underground Economy. – Financial Analysts Journal, Vol. 34/1, p. 24-27.

Hart, K. (1987). Informal economy. The new pallgrave a dictionary of economics. London: Mac Millan Press.

Kirchgaessner, G. (1983). Size and development of the West German underground economy, 1955-1980. – Zeitschrift für die gesamte Staatswissenschaft, 139/2, p. 197-214.

Khalatbarry, F. (1990). Underground economy. – Boom Journal 1 (1), p. 5-11.

Khajavi Maliheh, Rezaei Ebrahim, Khodavasi Hassan. (2011). An estimating of Underground Economy and Tax-gap in Iran's economy: mimic approach. – Economic Research review, fall 2011, Vol. 11, N 3 (42), p. 65-90.

Lacko, M. (1992). Hidden economy an unknown quantity? Comparative analyses of hidden economies in transition countries in 1989-95. – Working paper 9905, Department of Economics, University of Linz, Austria.

Leuis, W. A. (1954). Economic development with unlimited supplies of labor. Manchester School, 22: 139-91.London: Harvester Wheat sheaf.

Loayza, N. V. (1996). The Economics of the Informal sector: A simple model and some Empirical Evidence from Latin America. – Carnegie-Rochester Conf.series public policy, 45, p. 62-129.

Mirus, R., Smith, Rs. and Karoleff, V. (1999). Canada's Underground Economy. Revisited: updata and critique. – Canadian public policy, 20, p. 235-251.

Pyle, D. J. (1989). The informal economy. Utrecht.

Presidential Assistance of Strategic Reviews. (1998). The underground economy in Iran. – Economic Bulletin, 5 (3).

Schmolders, G. (1980). Shadow economic activity. LSE, Handbooks in Economics.

Schneider, F. & Enste D. (2000). Shadow economies: Size, Causes, and Consequences. – The Journal of Economic Literature 38(3), p. 77-114.

Schneider, F. (2006). Shadow economies of 145 countries all over the world: what do we really know?. University of Linz: Department of Economics, Discussion paper Linz, Austria.

Sheikh, M. (1974). Smuggling, production and welfare. – Journal of International Economics.

Smith, J.D. (1982). Market motives in the informal economy. – In: Gaertner, W. and Wenig, A. (eds.). The economics of the underground economy, Heidelberg: Springer Publishing Company, p. 161-177.

Stiler, S. (1985). Evidence of a Post-GST increase in the underground economy. – Canadian Tax Journal/ Revue Fiscal Canadians, 41:2, p. 247-258.

Sameti, M.et al. (2009). Estimating the underground economy in Iran (1965-2005) MIMIC method. – Journal of International Economic studies 20 (35), p. 114-189.

Tanzi, V. (1980). The underground economy in the United States: Estimates and implications. – Banca Nazionale Del Lavoro, Vol. 135/4, p. 427-453.

Tanzi, V. (1999). Uses and abuses of estimates of the underground economy. – The Economic Journal 109(3), p. 338-347.

Tanzi, V. (1983). The underground economy in the United States: Annual estimates, 1930-1980. – IMF-Staff Papers, 30/2, p. 283-305.

Thomas, J. J. (1992). Informal economic activity. LSE, Handbooks in Economics.

Taherfar, K. (1998). The role of underground economic activities in Iran, with an emphasis on incentives for tax escape. MA Thesis, Tehran University.

Wang, D. H. M., Lin, J. Y. & YU, T. H. K. (2006). A MIMIC approach to modeling the underground economy in Taiwan. – Physical, Vol. 371, p. 536-542.

Whyte, W. F. (1943). Street corner society: the social structure of an Italian slum. Chicago. University of Chicago Press.

Zarnezhad, M &. Ebrahimi, S. (2012). Smuggling in Iran and its relationship with the formal economy: causality test of Granger. Conference on combating with smuggling in goods and supply, Tehran, Faculty of Judicial Sciences.