G. & L. E. R., Vol. 20 No. 2, 2016

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CURRENCY DEMAND, THE UNDERGROUND ECONOMY AND TAX EVASION: THE CASE OF IRAN

Abstract

In recent years, Iran's government is going to decentralize its financial system from oil revenues and to substitute it by tax revenues. Under such circumstances, due to the existing research gap on the topic, it seems to be an essential necessity to measure the size of underground economy and the level of tax evasion in Iranian economy. To do the task, the present study has used the Currency Demand Approach and VEC Model for 1973-2013 time series data. In this model, "the ratio of currency holdings (C) to money (denoted as M2)" is assumed as the dependent variable and "the ratio of wages and salaries to national income (WSNI)", "real per capita national income (YNR)", "the real rate of interest paid on time deposits (RL)" and "average tax rate (Tax Burden)" are taken as independent variables. Based on the research results, two variables of Tax Burden and WSNI have positive effects on the ratio of C to M2 and the variables of RL and YNR have negative effects on this ratio in the long-run. Moreover, the research results show that the estimated size of underground economy and tax evasion levels have an ascending trend during the period under study.

JEL CLASSIFICATION: C32; H30; H26; O17
KEYWORDS: TAX EVASION, UNDERGROUND ECONOMY, CURRENCY DEMAND APPROACH, VECM, IRAN

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1. Introduction

Previous experiments of most developed countries indicate that taxes comprise one of their most important revenue resources while in developing countries, the governments mostly rely on the revenues derived from the sale of such natural, underground resources as the raw oil which is, in essence, regarded as the sale of capital. Developing countries typically have inefficient tax systems which are incapable of meeting the governments' financial and fiscal objectives. In Iran, too, taxes have not played a significant role in the economy. Due to the lack of economic agents' databases, non-transparency of economic activities, widespread tax exemptions, weakness of laws enforcement guarantees, nonexistence of required trust in the financial system of the government, lack of a fully mechanized tax system, and the incapability of the tax system in the proper identification of taxpayers' income, the tax amounts typically assessed in the Iranian economy are insignificant and are even incapable of being collected in the end.

Since in the Iranian economy, oil revenues play a critical role in financing the government's expenditures and since the global oil prices are affected by various factors including the global demands, economic shocks, OPEC rationing, etc., so the Iranian oil revenues are out of control of the government and, accordingly, the country's development policy of recent years has been under the pressure of economic sanctions, oil price falls and the resulting budget deficits, moved towards further independence of oil revenues and tended to rely on a system based on tax revenues. Thus, a decrease in the tax evasion levels can be taken as an essential priority in achieving the country's economic goals. Taking such a necessity into account, the present study aims at estimating the tax evasion levels in the Iranian economy in order to make known the widespread prevalence of such phenomenon in the country. Estimating this dimension of the hidden economy inevitably requires linking the existing observations and statistical variables of this unobservable variable. In developing countries, the estimation of such unobservable variables is even more complicated since in such countries, having access to the data required is much more limited than in developed countries. Most research works already completed in the area of tax evasion estimation in developing countries have been based on indirect methods including Monetary Approach (Currency Demand Function), Physical Input Approach, Labor Market Approach, Gap Approach, Multiple Indicators and Multiple Causes Approach(MIMIC).

In the present study, underground economy is operationally defined on the basis of definition already given by Tanzi (1982) whereby we have defined it in terms of activities which, by nature and from the standpoint of their sources, are legal but are not registered and reported to formal authorities due to non-payment of the taxes related to them and non-observance of certain laws and regulations[1].

Tax evasion, as defined by Tanzi (1980) and Lyons (1996), refers to any illicit measures taken by an individual or an enterprise aiming at non-payment or underpayment of taxes. In contrast, tax avoidance refers to lawful efforts made by an individual or an enterprise aiming at non-payment or underpayment of taxes. In this regard, such scholars as Alm (1998) and Franzoni (1998) argue that the difference between tax evasion and tax avoidance lies in two aspects of legality and being subject to punishment.

In the present paper, we are going to estimate annual time series on tax evasion by using Tanzi's Currency Demand Approach (1980, 1983) and time series estimations already made using the Vector Error Correction Model (VECM) on the size of underground economy in Iran for the period 1352 to 1392 (roughly corresponding to 1973-2013). Vector Error Correction framework, as Perotti (2004) puts it, apart from the identification of structural shocks, is a more suitable method for the determination of equilibrium in terms of the nature of dynamic adjustments. When we aim to analyze the empirical policy, we will be required to get to the short-run dynamics and the adjustment coefficients, in addition to having access to information about the movement towards equilibrium among a set of variables. Accordingly, the main objective of the present study is finding an answer to this question: what are the quantities of "the underground economy" and "the tax evasion" in Iran in any years of the period in question and what has been the dominant trend in that respect?

The paper is structured as follows: in section 2, we first discuss the literature on tax evasion and the factors affecting it and secondly, report some of the most important domestic and foreign empirical studies that have worked on estimating the size of underground economy and the levels of tax evasion in both developing and developed countries through monetary approaches. In section 3, we first explain about methodologies commonly used for estimating tax evasion particularly Tanzi's Currency Demand Approach (1980, 1983) and then, introduce our own model and data. In section 4, we present the results of the estimation of the VECM for estimating the size of underground economy and the tax evasion levels in the Iranian economy, the

[1]This definition may have a partial overlap with the definition of informal economy provided by Thomas (1992).

results of which are summarized in Section 5. The research findings are expected to be efficiently applied to tax reform programs of the country, increase of the country's tax revenues, more reliability of the existing economic statistics in making macroeconomic policies as well as the state financial policies.

2. Review of Literature

2.1. Theoretical Foundations

By taking a look at the research literature, one may simply recognize two major approaches in explaining tax evasion behavior. On one hand, there are neoclassical models and on the other hand, we can see institutional approaches. The point of departure of theoretical work on tax evasion is the year 1972 when Allingham and Sandmo's famous paper entitled "income tax evasion: a theoretical analysis" was published in the Journal of Public Economics. Their theory was later labeled as "Tax Evasion Standard Model" although Allingham and Sandmo, themselves, prefer to call it as "A-S Analysis". This model is based on Garry Becker's Economics-of-Crime methodology and tries to explain the tax evasion phenomenon. In this model, it is assumed that the taxpayer in question is not affected by social and psychological factors involved in compliance behavior. In contrast, it uses the utility maximization expected from the taxpayer's individual decision. In short, the A-S Model concludes that the higher penalty rates or the probability of being caught decrease the levels of tax evasion while higher tax rates do increase them.

Taking into consideration the multi-dimensional nature of tax evasion, models similar to Tax Evasion Standard Model that focuses on economic factors only have been criticized by many scholars. In a reaction to such criticisms, some neoclassical economists made attempts to manipulate the Tax Evasion Standard Model among them, one may particularly refer to Andreoni, Erard and Feinstein (1998), Slemrod and Yitzhaki (2002), Cowell (2002) and Sandmo (2005) to mention only a few.

In reaction to the non-observance of noneconomic factors affecting tax evasion, a group of other theories were developed that did not attribute tax evasion to mere economic factors but, rather, took into consideration such

behavioral parameters as culture, social norms, moralities, taxpayers' perceptions of the operation of formal institutions, etc.

Among scholars belonging to this approach, Alm and Martinez-Vazquez (2001), Torgler (2003), Gërxhani (2002a, 2002b) and Nerré (2004) have studied the role played by institutions in tax evasion and on that basis, tried to reformulate the Tax Evasion Standard Model. Moreover, Gërxhani (2002), in his PhD thesis, has paid attention to the role of institutional vacuum in the prevalence of tax evasion in transition economics, and more specifically, Albania.

The works by Nerré (2001a, 2001b, 2001c and2004), too, have looked at tax evasion from the standpoint of tax culture and undertook several research works in Russia and Austria. Furthermore, Torgler (2003) has done several case studies about tax moral and tax evasion in the form of survey studies whereby he paid attention to Latin American countries (i.e. Central and South America) in addition to the USA.

2.2. Some Empirical Background of the Study

Tax evasion, as an unobservable phenomenon, has already attracted the attention of many scholars all through the world. In this section, we have reported some of the most important domestic and foreign empirical studies that have worked on estimating the size of underground economy and the levels of tax evasion in developing and developed countries.

Faal (2003) has used the Currency Demand model for estimating the size and consequences of the underground economy in Guyana during 1964-2000. Variables used by him for explicating the Currency Demand Approach include the income, interest rate, tax, inflation rate, and financial innovations. Based on the following equation: $C = f(Y^d, R, \pi, F, T)$, $Y^d = Y - T$,where, *C* is the sum of currency demanded for the economy as a whole (both official and underground), Y^d is the disposable income, *R* stands for the interest rate,π represents the inflation rate, *F* stands for the financial innovations and *T* represents the average tax rate that is calculated as direct taxes on income and imports(current prices) expressed as a percent of GDP. The results reported by Faal (2003) prove the existence of a large underground economy in Guyana. Faal multiplies the size of underground economy by the average tax rate in order to attain the tax evasion time series.

Kemal (2007) has first estimated the size of Pakistani underground economy for the years 1999 and 2005 by using the Currency Demand Approach and then, taking into account the existing tax rates of different years, he has managed to extract the tax evasion levels from the underground

economy in different scenarios. He concludes that in Pakistan, there has been a rapidly ascending trend of both the size of underground and the level of tax evasion in the early 1980s which has been accelerated in the late 1990s, but there has been a decrease in 1990, and, again, an increasing trend in 2003.

Ariyo and Bekoe (2011) have identified the determinants of the underground economy and estimated the size of underground economy and level of tax evasion in Nigeria during the period 1975-2010. They used the Currency Demand Approach and though the VECM methodology, managed to attain the speed of adjustment into a long-run equilibrium. The results of this research show that the size of underground economy and the level of tax evasion during the period in question have been 42.54%-79.32% and 2.09%-6.75%, respectively. The results have also indicated a positive relationship between the tax rate, on one hand, and the size of underground economy and the level of tax evasion, on the other.

In addition to the research works by Cagan (1958), Guttman (1977), Tanzi (1980, 1983) as well as the above-mentioned studies, some other scholars including Schneider (1986), Schneider and Enste (2000), Orviská, et al. (2006), Schneider (2006) and Embaye and Yu (2010) have all resorted to monetary methodologies specially, the Currency Demand Approach for estimating the size of underground economy and the level of tax evasion. The difference between the present study and the above-mentioned research works is using the VECM methodology and the taking into account the short-run and long-run effects of the variables in question on tax evasion in the this study. Recently, of course, such researchers as Basile, et al. (2011) and Chiarini, et al. (2013) have also applied the VECM methodology in their research works on the Italian underground economy and tax evasion.

In addition to the studies already done out of Iran, we may also refer to a couple of empirical works on the level of tax evasion in Iran. Among these works, we may mention the works by Khalatbari (1990), Mohammadi (1998), BagheriGarmaroudi (1998), Ashrafzade and Mehregan (2000), Esfandiari and Jamalmanesh (2002), Azarmand (2007), KarimiPetanlar, et al. (2011) and Abdollahmilani and Akbarpourroshan (2012) have used monetary methods of "the Cash Ratio" and "the Currency Demand Approach" for the estimation of the size of underground economy and the tax evasion level. The overall findings of these studies have indicated that the estimated size of underground economy and tax evasion levels have both had an increasing trend over time. The distinctive characteristic of the present study as opposed to the domestic studies in the area of tax evasion, apart from updated the data a longer period time series, is making use of the

VECM methodology and the variable of "the ratio of wages and salaries to national income[2]"adopted from Tanzi's Monetary Approach (1980, 1983) for estimating the tax evasion which is unique in Iran.

3. Methodologies for estimating tax evation

Many researchers have resorted to either direct or indirect methods for the measurement of tax evasion due to the unavailability of data of tax evasion[3]. In direct methods such as National Accounts Method, Sampling Method, Budget Survey Method, Direct Taxpayer Survey and Tax Capacity, the theories are developed on the basis of the behavior of the individuals evading taxes and then, by replacing suitable variables, tax evasion is measured. In these methods, there is typically a considerable level of information concealment. However, in indirect methods that are very popular in the study of tax evasion, the tax evasion levels are measured through the estimation of underground economy. These methods can be classified into three groups in terms of 1) Reason of Activity [such as Laplace Transform Approach and Fuzzy Logic Method], 2) Consequences [such as Currency Ratio, Gap Approach, Physical Input Approach, and Labor Market Approach] (Bhattacharyya 1990; Thomas 1999), and 3) Cause and Effect [Currency Demand Approach and Multiple Indicators, Multiple Causes Approach (MIMIC&DYMIMIC)](Schneider and Enste 2002; Schneider et al. 2010; Buehn and Schneider 2012; Schneider and Buehn 2013).

Since the estimation methods based on the causes and effects take into consideration the information relevant to the causes and effects of underground economy all at the same time within the framework of one single method, so a major part of the shortcomings with the causes or effects of tax evasion will be removed.

Despite the fact that more than three decades have passed since the Currency Demand Approach has first been introduced but its advantages and the relative ease of its application have derived many scholars to use this method of its revised versions for investigating the size of underground economy in different countries. Taking into accounts such considerations, we have used the Currency Demand Approach to estimate the size of underground economy in Iran. In order to make an estimation of tax evasion accordingly.

[2]For the “operational definition of this variable”, please refer to section 3.2.
[3]For a more detailed discussion, see Richupan (1984) and Alm (2012).

3.1. Currency Demand Approach

Cagan (1958; see also Faal 2003) provided the first effort to explore the size of underground economy using monetary variables as a proxy. Cagan's approach to modeling the underground economy assumed that the ratio of currency to the money supply in a base year was representative of the behavior of economic agents (Ibid). The residuals around this ratio, together with a velocity assumption, were then employed to measure the size of underground economy[4]. Similar approaches based on the assumption that proceeds of the underground economy were laundered through currency and currency substitutes were used by Guttman (1977) and Feige (1979); these approaches did not follow statistical techniques procedures but rather concentrated only on the ratio of currency to demand deposits (Ibid).

Tanzi (1980, 1983; see also Faal 2003) modified Cagan's approach by estimating a currency demand function for the United States for 1930-1980. In his approach, the impact of the underground economy on currency demand, proxied by tax rates to show the incentive to avoid taxes and participate in a cash-based underground economy, was estimated directly in the regressing equation linking currency demand and tax rates. With the key assumption that underground economy transactions are conducted in cash, an increase in the size of underground economy increases the demand for currency and vice versa[5] (Ibid).

The equation is estimated and two estimations for currency holding are made, one when the tax variable is zero and the other when it is not. The difference between the two estimates of currency holding is called the "illegal money" and the difference between M1 and illegal money is taken to be the "legal money" (Tanzi 1980, 1983). The income velocity of money is derived by dividing the GDP by legal money and the size of underground economy is obtained by multiplying the illegal money by the velocity of money. The level of tax evasion is derived by assuming that the incomes in the underground economy would have been taxed at the same average tax rate as income in the regular economy (Ibid).

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[4]The residuals around this ratio were assumed to reflect money laundering, and were used together with the velocity assumption to measure the underground economy.

[5]The Tanzi approach has been criticized by Thomas (1999) and addressed in Bhattacharyya (1999). In general, the Tanzi approach is superior to Guttman's currency deposit ratio in that it does not assume constancy in the currency deposit ratio or a base year.

3.2. Description of the Model and Data

In this section, in order to provide an answer to the research question "what are the quantities of the underground economy and the tax evasion in Iran in any years of the period in question and what has been the dominant trend in that respect", the following research hypothesis was tested: "*the size of underground economy and the extent of tax evasion in Iran have followed an increasing trend over time*". To do the task, we first estimated the size of Iranian underground economy and accordingly, the level of tax evasion (taking into account the average tax rate) by using Tanzi's Monetary Approach, by making reference to the time series data of1973-2013, and through advanced econometric methods of VAR[6] and VECM[7]. The model in question is defined as follows for estimating the underground economy through the regression equations and by using the ratio of Currency Holding (C) to money (denoted as M_2) based on Tanzi's Currency Demand Approach (taking into account empirical studies such as Faal 2003, Kemal 2007 and Ariyo and Bekoe 2011):

$$\left(\frac{C}{M_2}\right)_t = \beta_0 + \beta_1 Log\left(1 + \text{TaxBurden}\right)_t + \beta_2 \left(WSNI\right)_t + \beta_3 Log\left(YNR\right)_t + \beta_4 RL_t + \varepsilon_t$$

Dependent variable:

C/M_2= the ratio of currency holdings (C) to money (denoted as M_2).

Where: C is Currency in Circulation; M_2 is Total Liquidity

Independent variables:

Tax Burden = "average tax rate" proxied by T/GDP ratio.

WSNI= "the ratio of wages and salaries to national income" = [dividing the total annual wages and salaries of public and private sector by national income at current prices] ×100.

YNR= "real per capita national income" = [dividing nominal per capita national income by consumer price index (CPI) at the fixed prices of the year 2004].

RL= "the real rate of interest paid on time deposits" = [The rate of interest paid on time deposits minus the inflation rate].

In the present paper, in order to explore the theoretical foundations of tax evasion and different methods for its measurement, we have used a library method including making reference to relevant articles and books. As

[6]Vector Auto Regressions

[7]Vector Error Correction Model

regards the required statistics and data for the period 1973-2013, we have used the Iranian national accounts as well as the official website of the I.R.I Central Bank[8], the official website of Iran Statistical Center[9], macro level schedules of the public budget resources and expenditures, annual statistical reports published by the Statistical Office of the Presidency, socio-economic computations of Social Security Organization. Excel and Eviews software have been applied to analyze and test the research hypothesis.

4. Finding analysis and Results

4.1 Unit Root Test

The econometric method used in the present research is an estimation based on time series data through the application of the VECM methodology. First of all, in order to explore the stationary of the model variables, we have used the Augmented Dickey-Fuller (ADF) Test which is one of the most valid stationary tests whereby the results show that all variables are non-stationary at their own levels but all of them are stationary at the first difference at 1% level of significance. Thus, it can be concluded that all variables are integrated of order one denoted I (1).

Table 1. The results of Augmented Dickey-Fuller unit root test for the model's time series data

The level of the variable			
The variable's title	The ADF statistic values	critical values of ADF Statistic	Prob.*
CM2	-2.63	-4.20	1%
		-3.52	5%
		-3.19	10%
TaxBurden	-0.87	-2.62	1%
		-1.94	5%
		-1.61	10%

[8]http: // www.cbi.ir/
[9]http: // www.amar.org.ir/

WSNI	-0.01	-2.62	1%
		-1.95	5%
		-1.61	10%
YNR	-1.39	-4.20	1%
		-3.52	5%
		-3.19	10%
RL	-3.12**	-4.20***	1%
		-3.52***	5%
		-3.19***	10%
The first difference of the variable			
DCM2	-7.58	-4.21	1%
DTaxBurden	-8.58	-2.62	1%
DWSNI	-5.73	-2.63	1%
DYNR	-6.47	-4.21	1%
DRL	-9.98**	-4.21***	1%

Source: Author calculations.
** The Phillips-Perron (PP) statistic value.
* MacKinnon (1996) one-sided p-values.
*** critical value of Phillips-Perron (PP) Statistic.

4.2. Determination of Optimal Lag Length

In order to determine the long-run relationships through Johansen's methodology, we first need to estimate the VAR model in appropriateness to the vector of variables (Lütkepohl 1991). The first stage of estimation of the model involves determining the optimal lag length. Therefore, taking into account the results of the test, an optimal lag length quantity was selected for the VAR model the basis of Schwarz information criterion (SC)[10] and, then, we tried to explore the long-run relationships among the variables and to estimate the VECM. Moreover, to explore the normality of residuals, the Auto-correlation Test and Normality Test were administered on the basis of

[10]For more details, see Phillips& Ploberger (1994) and Ivanov & Kilian (2005).

LM and JB[11] tests, respectively, whereby the results obtained verified the optimal lag length selected for the model. A Stability Test was also administered for the estimated model where the results indicated the stability of the estimation system.

Table 2. Determination of optimal lag length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-321.16	NA	25.54	17.43	17.86	17.58
1	-207.54	185.37	0.26	12.77	14.27*	13.30
2	-173.10	47.14*	0.163	12.27	14.85	13.19*
3	-143.4094	32.82	0.160*	12.02*	15.68	13.32

Source: Author calculations

4.3. Johansen's Cointegration Test

For administrating Johansen's Cointegration Test, both the trace statistic and the Max-Eigenvalue Statistic need to be explored. In the present study, Cointegration Test has been under the fourth state circumstances, i.e. when they get into the long-run relationships of the trend and the intercept term enters the short-run relationships. This state is typically used when there is a linear growth in the long-run relationships that cannot be explained by the model variables. According to the results of this test as reported in table (3), the Max-Eigenvalue Statistic which is more valid than the trace statistic, the existence of a long-run relationship among the model variables is verified at a 95% confidence level.

[11]The Jarque-Bera residual normality test.

Table 3. Johansen's Cointegration Test Results

Hypothesized H_0	Hypothesized H_1	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
R=0	R>0	0.69	120.71	88.80	0.000
R=1	R>1	0.55	74.24	63.88	0.005
R=2	R>2	0.46	42.57	42.92	0.054
R=3	R>3	0.27	17.92	25.87	0.349
R=4	R>4	0.12	5.22	12.52	0.565
Hypothesized H_0	Hypothesized H	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
R=0	R>0	0.69	46.47	38.33	0.004
R=1	R>1	0.55	31.68	32.11	0.057
R=2	R>2	0.46	24.64	25.82	0.071
R=3	R>3	0.27	12.70	19.39	0.353
R=4	R>4	0.12	5.22	12.52	0.565

Source: Author calculations.
**MacKinnon-Haug-Michelis (1999) p-values.

Therefore, since the results of Johansen's Cointegration Test verifies the existence of at least one long-run equilibrium relationship among the model variables, an estimation of this relationship under the VEC model (Enders 2004).

4.4. Estimation of Vector Error Correction Model

In order to estimate the VEC model, the first stage is to determine the optimal lag length for the difference of variables in the model. Since the optimal lag length has been selected as "one", so the variables difference lag in the VECM will be "zero". In essence, the VECM was estimated for estimating the tax evasion level in spite of the existence of a long-run relationship, a lag length of zero in the variables difference, and taking into account the trend in the long-run and the intercept term in the short-run relationships where the VECM has been normalized based on the "ratio of currency holding (C) to money (denoted as M_2) or CM2".

The results as reflected in Table (4) show that in the long-run, the tax burden has a positive relationship with the "ratio of currency holding (C) to

money (denoted as M2) or CM2"where an increase of 1% in the tax burden, results in an increase of 11.75 units in the quantity of the CM2. Moreover, the coefficient of the "ratio of wages and salaries to national income (WSNI)" is also positive and equals 0.13 in the sense that an increase of one unit in the WSNI will result in the CM2 for 0.13 units. According to the research results, in the long-run, the "real per capita national income (YNR)"has a negative impact on the CM2 in the sense that one percent of increase in the YNR will result in a decrease of 3.37 units in the CM2.

Accordingly, the coefficient of the "real rate of interest paid on time deposits (RL)" is also negative and equals 0.26. In other words, an increase of one single unit in the *RL*, the quantity of the *CM2* shall decrease for 0.26 units. Furthermore, the trend coefficient, in its long-run relationship with the *CM2*, is negative; too, amounting to 0.24. The coefficient related to error arising from long-run equilibrium relationship is called as adjustment coefficient and indicates the speed adjustment from the deviation from the long-run equilibrium. As shown in Table 4, the ECT coefficient in the model is significant with a value of -0.62. The minus value of this coefficient verifies the existence of a long-run relationship among the model variables and its quantity indicates that the disequilibrium of 0.62 in the long-run relationship is adjusted during one single period. In addition, the dummy variable (D12) for the years leading to the Islamic Revolution and the years when the country was engaged in the war with Iran indicates a positive relationship in short-run with the *CM2* with a coefficient of 4.43. It is worth mentioning that after the estimation of more than twenty VEC models for the estimation of tax evasion levels in the Iranian economy, the final VECM coefficients reported in Table (4) have been perceived as robust. Thus, the results of all these models show that in the long-run, the coefficients of "tax burden" and the "ratio of wages and salaries to national income" have had a positive impact on the *CM2* changing, respectively, on a range of 0.48 to 23.84 units and a range of 0.04 to 1.19 units. Accordingly, the coefficients of the variables "real per capita national income" and the "real rate of interest paid on time deposits" have had a long-run negative impact on the *CM2* changing, respectively, on a range of 1.45 to 13.78 units and on a range of 0.04 to 1.40 units.

The trend coefficient, too, has all the time been negative in its long-run relationship with the *CM2* where it ranges from 0.24 to 0.75. Furthermore, the dummy variable for the years leading to the Islamic Revolution and the years during the Iran-Iraq War, has also had a permanent positive relationship with the *CM2*where it ranges from 1.69 to 5.21. Thus, the results

of the estimation of the VECM for estimating the tax evasion levels in the Iranian economy indicate that the relationships among the variables under study are consistent with the expectations proposed by Tanzi's theory in that the two variables of "real per capita national income" and "the real rate of interest paid on time deposits" are negatively related to the *CM2* whereas the two other variables, i.e. "tax burden" and the "ratio of wages and salaries to national income" are positively related to the *CM2*.

Table 4. The estimation of VEC model results

The variable's title	description	Coefficients	t-statistics
1+TAXBURDEN (-1)	the lagged logarithm of (1+taxburden)	11.75*	-4.10
WSNI(-1)	the lagged logarithm of the ratio of wages and salaries to national income	0.13*	-2.13
YNR(-1)	the lagged logarithm of the real per capita national income	-3.37*	2.43
RL(-1)	the lagged logarithm of the real rate of interest paid on time deposits	-0.26*	5.40
TREND	Trend(long-run)	-0.24*	5.56
ECT	adjustment coefficient	-0.62*	-4.96
D12	dummy variable for the years leading to the Islamic Revolution and the years during the Iran-Iraq War	4.43*	4.14
CONST	intercept term(short-run)	-1.72*	-3.45

Source: Author calculations.
* Coefficients are significant at a 95% confidence level.

Therefore, the final model can be presented as follows:

D(CM2) = - 0.615820*(CM2(-1) - 11.75401*LOG(1+TAXBURDEN(-1)) - 0.131024*WSNI(-1) +

(0.12418)	(2.86503)	(0.06147)
[-4.95893]	[-4.10258]	[-2.13156]

3.372965*LOG(YNR(-1)) + 0.259179*RL(-1) + 0.241634*@TREND(52) + 13.517713) - 1.715554 + 4.429224*D12

(1.39054)	(0.04799)	(0.04348)	(0.49662)	(1.06954)
[2.42565]	[5.40030]	[5.55786]	[- 3.45446]	[4.14122]

4.5. Measurement of the size of Underground Economy and the Level of Tax Evasion

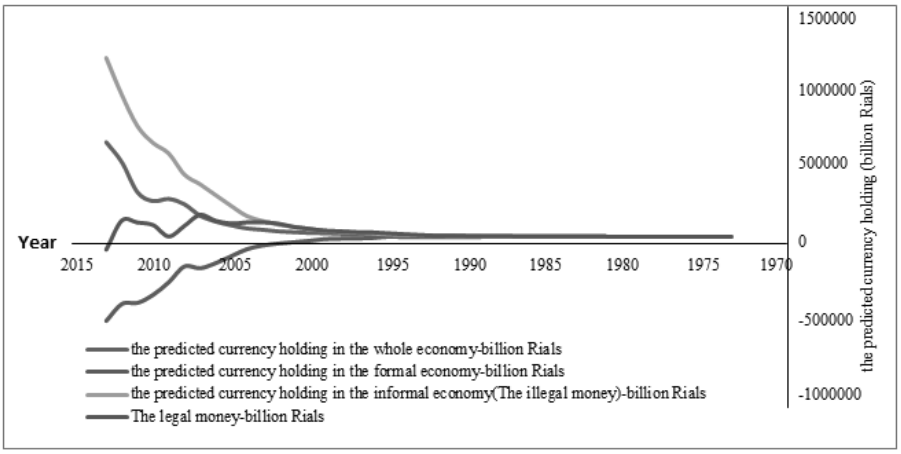
After estimating the parameters of the Currency Demand Function derived from VECM, we can estimate the predicted formal economy currency holding, the predicted informal economy currency holding (i.e. illegal money denoted by IM), legal money denoted by (LM), the income velocity of money (V) and finally, the size of underground economy (UE) through the replacement of variables by respective values, according to Tanzi's Monetary Approach (1980, 1983). In the present paper, we have resorted to the Quantity Theory of Money to calculate the income velocity of legal money through dividing The GDP at current prices by legal money. Assuming that the velocity of illegal money is the same as that of legal money, multiplying velocity of money by illegal money gives the underground economy. In the last stage, we have calculated the tax evasion levels through multiplying the annual sizes of the underground economy by the average tax rate (i.e. T/GDP ratio).

According to the research findings, the Fig (1) reflects the predicted currency holding in the whole economy, the formal economy, the informal economy, as well as the legal money[12]. It can be observed that the trends of changes of the predicted currency holding in the formal economy and those

[12]For more details, see Tanzi (1980, 1983).

of the legal money are almost similar because both the predicted currency holding in the formal economy (since 1995 onward) and the legal money (since 2006 onward) have experienced descending trends. However, the trends of changes of the predicted currency holdings in the informal economy and in the whole economy have generally been ascending since 1995 onward; in other words, the predicted currency holdings in the informal economy (i.e. illegal money) has increased from 15396.4 Billion Rials in1995 to 1285639.3 Billion Rials in 2013. Similarly, the predicted currency holding in the whole economy has increased from 15220.1 Billion Rials in 1995 to 680335.4 Billion Rials in 2013.

Figure 1. Iran-Comparison among the predicted currency holding in the whole economy, the formal economy, the informal economy and the legal money, 1973-2013 (Billion Rials)



Source: Author calculations

In order to save space in the present paper, we have sufficed as follows to a summary table including selected statistical characteristic of the two variables under study, i.e. the "size of underground economy" and the "tax evasion level" along with their ratios to the "total tax revenue" and the GDP:

Table 5. Iran-Estimates of underground economy and tax evasion, 1973-2013 (Billion Rials)

The variable's title	Average	Maximum	Minimum	Standard Deviation
The estimated size of underground economy(Billion Rials)	24950516.5	955285914	-129809038	151018885
The estimated tax evasion level (Billion Rials)	1909810.6	73611161.3	-6866913.3	11558540.7
total tax revenue(Billion Rials)	71703.2	494249.5	131.2	126867.2
The GDP at current prices (GDP_f) (Billion Rials)	1219060.7	9343070	1795.6	2199489.7
The ratio of tax evasion level to total tax revenue (percent)	735.2	24534.2	-1389.4	3823
The ratio of size of the underground economy to GDP_f (percent)	735.2*	24534.2	-1389.4	3823
The ratio of tax evasion level to GDP_f (percent)	54.6**	1890.5	-73.5	294.4

Source: Author calculations

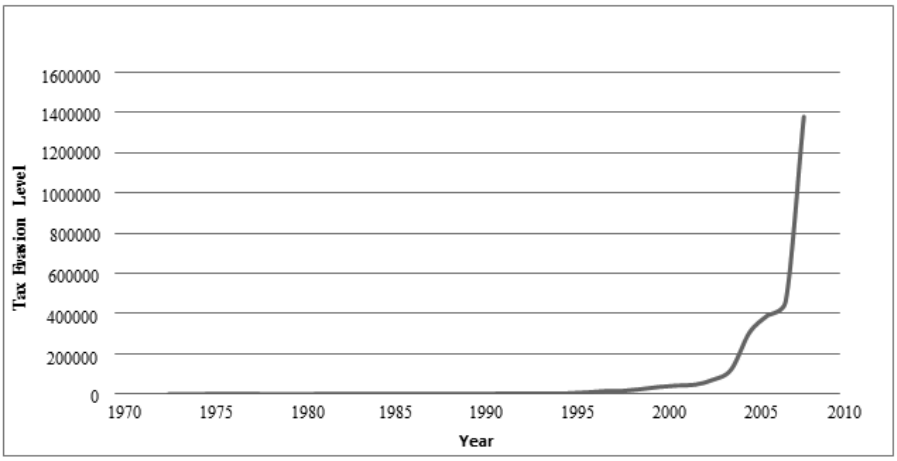
*This average ratio has been calculated in due regards with unexpected rise of the size of underground economy estimated for 2009. If we exclude the data of 2009, then, the average ratio for the other years would be 140.2 %.

**This average ratio has been calculated in due regards with unexpected rise of the level of tax evasion estimated for 2009. If we exclude the data of 2009, then, the average ratio for the other years would be 8.7 %.

The above Table shows that the average and the standard deviation of the size of underground economy and the tax evasion level as compared with the total tax revenue and the GDP at current prices are considerably huge. In other words, the average ratios of estimated tax evasion to the total tax revenue and GDP have been 735.2% and 54.6%, respectively that imply a very high prevalence of tax evasion in the Iranian economy.

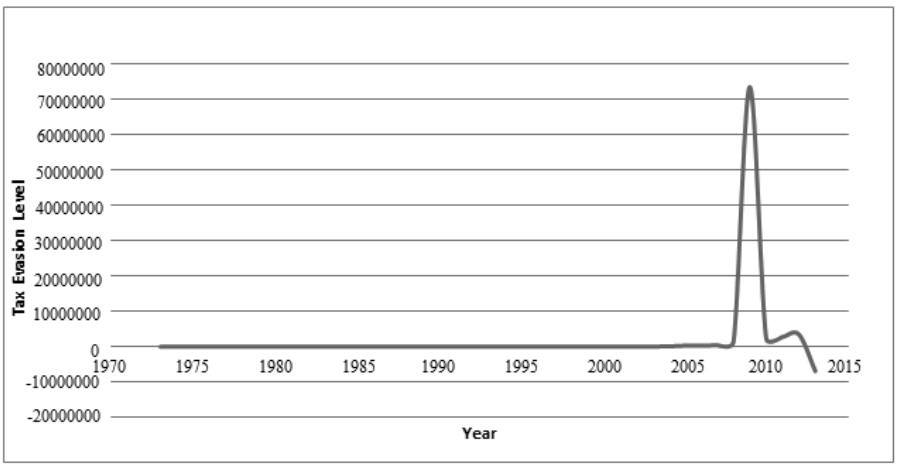
In order to take a deeper look at how tax evasion has moved during the period 1973-2013, we can use descriptivee analyses by the figures below:

Figure 2. Iran-the estimated tax evasion level, 1973-2008 (Billion Rials)



Source: Author calculations

Figure 3. Iran-the estimated tax evasion level, 1973-2013 (Billion Rials)



Source: Author calculations

The figures (2) and (3) show that the estimated tax evasion level has had a gradual ascending trend during the period 1973-2008 but in 2009, the tax evasion level has strikingly reached its highest level all through the period in question with 73611161.3 Billion Rials amounting for 1890.5% of the GDP or 18 times the GDP of the year. In the next subsequent years, however, the figure has been back again to its normal trend. The striking increase of tax evasion in 2009 can be attributed to the increase of velocity of money from 48.1 in 2008 to 1594.2 in 2009, the decrease of legal money from 78043.1 Billion Rials in 2008 to 2468 Billion Rials in 2009, and the heavy tax burden imposed in 2009 as opposed to other years after the Islamic Revolution. In addition to these factors, we may also refer to the absence of financial discipline of both the government and the state-owned companies in 2009 since in the year in question there have been neither substantial changes in the tax structure of the country nor major amendments to the tax laws and regulations. Historically speaking, the striking rise of tax evasion in 2009 reminds us of the period 1989-1990 in the former Soviet Union when the communist regime was collapsed after 69 years of centralized governance and state ownership. Before the collapse of the regime, there had been no

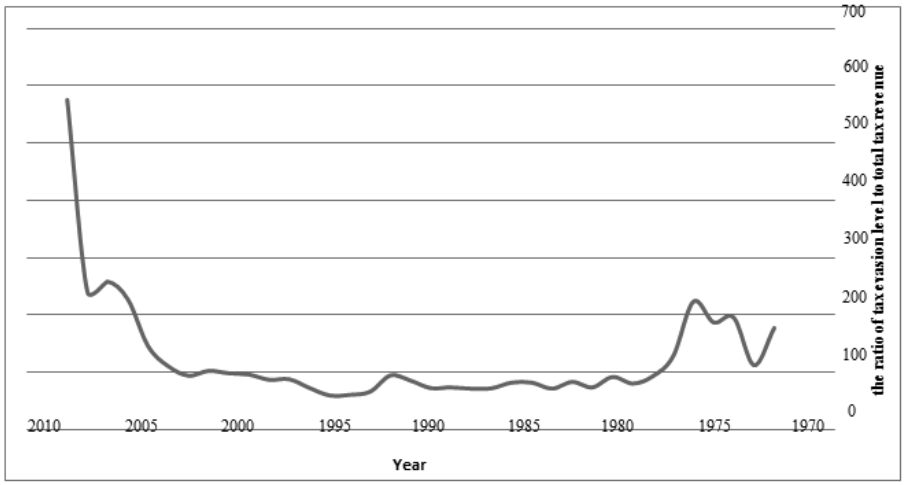
obligatory taxation system in the country and there was only a withholding taxation system whereby a tax on salaries and wages was deducted from the money paid monthly to citizens; as a result, the citizens were not accustomed to any tax compliance norms and accordingly, after the collapse of the regime leading to a shift to self-declaration and voluntary payment of taxes, there was a deep non-compliance shock in post-a collapse Russia resulting in a striking level of tax evasion[13]. Thus, it can be inferred that the severe rise of tax evasion in 2009 has more or less been similar to the non-compliance shock observed in 1989-1990 Russia where under both circumstances, there were a lack of financial discipline on the part of the government and the state-owned companies.

One more point is that for the year 2012, we have observed a negative value for the level of tax evasion that can be attributed to such factors as the negative real economic growth rate (-1.92%), the recession of the market of a large variety of industries, and the decrease in the real per capita national income in the year in question.

Moreover, it can be concluded from the figures (4) and (5) that the trend of changes of the ratio of estimated tax evasion level to the GDP is very similar to the trend of changes of the ratio of estimated tax evasion level to the total tax revenues.

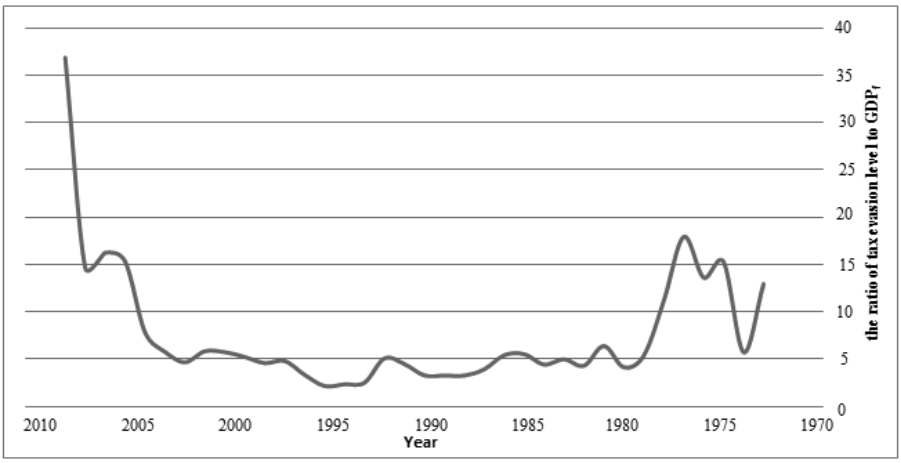
[13] For a more detailed discussion, see Feige (1997), Grossman (1977, 1992) and North (1990, 1994).

Figure 4. Iran-the ratio of tax evasion level to total tax revenue, 1973-2008 (percent)



Source: Author calculations

Figure 5. Iran-the ratio of tax evasion level to GDP_f, 1973-2008 (percent)



Source: Author calculations

5. Concluding Remarks

In the present paper, we have tried to provide an answer for this research question: what are the quantities of "the underground economy" and "the tax evasion" in Iran in any years of the period in question and what has been the dominant trend in that respect? To do the task, we first estimated the size of underground economy in Iran within the framework of Tanzi's Monetary Approach (Tanzi, 1980, 1983) by using advanced econometric methodologies (i.e. VAR and VECM) on the basis of annual time-series data of the period 1973-2013. In this model, the "ratio of currency holding (C) to money (denoted as M_2) or CM2"has been selected as the dependent variable and four variables: the "ratio of wages and salaries to national income (WSNI)", "real per capita national income (YNR)", the "real rate of interest paid on time deposits (RL)" and "average tax rate (Tax Burden)" have been considered as the explanatory variables. Having estimated the size of underground economy based on Tanzi's Currency Demand Approach, tax

evasion levels during the period 1973-2013 were calculated by taking into consideration the average tax rates (i.e. T/GDP ratio) of each year. The results so obtained indicated an ascending trend for most years under study and such a trend verified the research hypothesis. However, the level of tax evasion for the year 2009 was exceptionally high with 73611161.3 Billion Rials amounting for a striking increase of 1890.5% or 18 times the GDP in that year. On the basis of existing evidence in the country's official statistics, we attributed this striking abnormal increase of tax evasion to an increase of velocity of money and a decrease of legal money (in 2009 as compared to 2008), a heavier tax burden (imposed in 2009 in comparison to all other post-revolution years) and the existence of structural problems in the economic system of the country which is the result of a lack of financial discipline on the part of the government and the state-owned companies in that particular year.

Thus, according to the research findings indicating an ascending trend for the size of underground economy and the tax evasion levels and bearing in mind that the Iranian economy has been facing serious budgeting problems during recent years due to specific conditions derived from the economic sanctions imposed on the country and the severe fall of oil prices, the Iranian government is highly recommended to maintain its inflation control policies, follow more disciplinary financial procedures, avoid imposing heavier tax burdens, simplify, make transparent and deregulate the existing rules and regulations, move towards further improvement of the business environment, and plan for the sustainable growth of tax revenues and the decrease of budget deficits through minimizing the tax evasion levels in the country.

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