Estimating the influencing factors on the volume of the underground economy using fuzzy logic

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Abstract

The aim of this research was to estimate the influencing factors on the size of the underground economy using fuzzy logic. The illegal nature of the underground economy also limits private investment and economic growth. For example, companies that operate in the underground economy are not able to use the institutions that support the market economy (judiciary and courts), which makes them less inclined to invest. Therefore, it can be said that one of the most important issues that should be considered in economic policies is the underground sector of the economy. The research method in this research is of a descriptive-survey type, and the type of research in the current research is causal and practical in terms of the purpose, because the expected results of the research can be used in examining the dimensions of the underground economy. It is used in university and economic resources. To estimate the index of the underground economy and examine its trend using fuzzy logic, it is necessary to perform these steps; Accurate determination of indicators, fuzzification, definition of basic rules, inference engine, determinism and sensitivity analysis. To estimate the index of the underground economy with fuzzy logic, they are divided into three sub-criteria including the financial sector, the monetary sector and the real sector. The results showed that the informal sector constitutes an important part of the economy and the labor market in developing countries. This sector plays a major role in production, creating employment and income by producing goods and services, transferring skills by newcomers to the sector, reducing unemployment and using individual capital.

Keywords: underground economy, exchange rate, tax, economic size, structural equation modeling
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1 Introduction

In many developing countries and economies in transition, the size of the underground economy accounts for about 40% of GDP. The trend towards the underground economy reduces the amount of taxes and has a great impact on the public finances at the level of the country, at the same time, it also disturbs the quality of the administration of the country's affairs. The illegal nature of the underground economy also limits private investment and economic growth. For example, companies that operate in the underground economy are not able to use the institutions that support the market economy (judiciary and courts), which makes them less inclined to invest. Therefore, it can be

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said that one of the most important issues that should be considered in economic policies is the underground sector of the economy. One of the most important consequences of the underground economy is the overestimation of the unemployment rate and the underestimation of the economic growth rate, which as two main variables in the economy can affect all economic policies. In fact, economic policymakers need to have a clear picture of different economic sectors in order to increase the possibility of achieving the desired goals by considering it in their policies.

One of the characteristics of Iran's economy is its vast underground economy. The underground economy, also known as informal, parallel, unregistered, gray, and other terms, includes activities that are both legally and illegally exempt from paying taxes. In economic texts, the term underground economy has been used along with hidden economy [6], informal economy [14] and... Before using the definitions of underground economy and hidden economy in economic texts, this concept was defined with the term informal economy. The most important problem that researchers face to measure the underground economy is the lack of a precise definition of the underground economy. A definition that has been mainly used in research is all common unrecorded economic activities that would be counted in GDP if observed [7]. Measuring the size of the underground economy since 1970 has been important for policy makers for various reasons. The existence of a large and growing underground economy understates the size of the economy, and it is a sign of deviation from the market, cumbersome regulations, and increasing government problems, and it shows false signs in relation to the state of the economy, which affects the results and the proposed policies lead to ineffectiveness. Having information about the size and dimensions of the underground economy is very important from the aspect of tax evasion, effectiveness of monetary and financial policies, economic growth and income distribution.

The underground or shadow economy includes those activities that are done legally or illegally and are not registered anywhere [7]. Activities outside the scope of the formal economy can be divided into four sectors: household, informal, irregular and illegal. The hidden nature of the underground economy makes it difficult to directly measure and study it, and for this reason, most of the common measurement methods are indirect estimation methods of these activities and are associated with many limiting assumptions [12]. In the last two decades, measuring the size of the underground economy and investigating its causes and effects have attracted the attention of economists more than in the past, and a larger part of the economic literature has been devoted to the results and studies conducted in this regard. Although the evidence indicates the possibility of the spread of this phenomenon in Iran's economy, the studies conducted on the nature of its causes and effects on the country's economic and social fields have been limited.

In order to express a clear picture of the underground economy in Iran. The status of this type of economy against the law should be investigated in general and the characteristics of the people involved in this type of activity should be analyzed. In general, this circle of society's economy is divided into two parts: the legal part and the illegal part. The legal sector includes inestimable and unrecorded economic activities that can be seen in the economy of the majority of developing countries, and even some developed countries do not record these types of activities in their GDP list. The value of production activities at home, the added value obtained by performing small economic activities outside the home, unregistered and unreported cash transactions, barter transactions between people are included in these activities. In addition to the private monopolies that the government has in foreign trade, exclusive privileges in domestic distribution, the credit network of the market that is outside the country's banking system. Also, some employees, officials and senior managers have facilities such as free housing, government cars, which are not registered in official accounts and are considered as underground economy. The illegal sector and smuggling, in most countries, there are extensive activities that are carried out by hidden individuals individually or in the form of mafia-like networks. Major of these activities are: smuggling of goods and drugs, forgery of documents, violation of property rights, money laundering, dealing in antiques and paying and receiving bribes. Basically, economic activists avoid paying taxes and consider it injustice. This is despite the fact that today people's taxes are used to provide public services. Some ministries and institutions have established private companies at various times with the aim of making money, but the economic micro-activities of these companies are not disclosed. Also, the financial balance sheet of these companies is rarely published in full. In addition, the sale of petrodollars by the central bank on the black market usually causes funds to flee the country without being registered. Having said that, it seems that the underground economy in Iran has a wide network that is rooted in the economic and social structures of Iranian society.

This article seeks to estimate the factors affecting the size of the underground economy with fuzzy logic and seeks to answer the question of what challenges the underground economy in Iran is facing and how to estimate its economic size in Iran be?

2 Theoretical foundations and research background

Understanding the dimensions of the underground economy is important for these reasons that it can reduce costs, increase government revenues, receive the right of the government and provide the right of the society by the government, fair distribution of income and wealth among the strata of society, targeted and appropriate allocation of economic resources and in general to help achieve the triple goals of allocation, distribution and stabilization. Therefore, a correct understanding of the size of the underground economy and its causes and effects can be important for policymakers and macroeconomic modelers. The underground economy is a phenomenon that all the countries of the world are facing, estimates in most countries indicate a significant amount of production activities in the underground economy subcategory. Measuring the size of the underground economy and investigating its causes and effects can be important and of interest to economists and experts because it reveals the root of many economic disorders and criminal communication channels against the law. Therefore, the assessment of this part of the economy is very important from the aspect of identifying the tax gap, the effectiveness of monetary and financial policies, economic growth and income distribution. The dimensions of the underground economy have different effects on the official economy and macro policies of the country. These effects include: disrupting the structure of jobs, safety conditions and legal hours of work, distribution of income and wealth between the social strata, sterilization of the government's stabilization policies, an obstacle to using large scales of production, and the economy not benefiting from the benefits of greater division of labor. And more specialized, improper allocation of economic resources, increase in costs (hidden work), distortion of statistics and statistical information, an obstacle to the optimal use of the advanced exchange system due to the cash and commodity nature of the exchanges, ignoring religious and moral values, and the prevalence of partying.

The evidence indicates the wide existence of these activities in Iran and this is considered as a warning for the policy makers, therefore a comprehensive and accurate study regarding the volume of this part of the economy and the factors affecting it, is necessary.

Based on the existing economic literature, the concept of the informal sector was first proposed by Hart [8]. Hart distinguishes between the formal sector, i.e. the wage-earning sector (in the organized sector of the economy), and the informal sector or self-employment activities (in the unorganized sector) based on empirical studies conducted on the low-income group of the urban workforce. According to him, the activities of the informal sector are divided into two legal and illegal groups. But the term "informal sector" was officially used in 1972 by experts of the International Labor Organization in Kenya. This term was applied to small units that were active in the production of goods and services but could not be recognized, registered, regulated or supported by the government. This section includes a wide range of activities, from street vendors, waxing and other minor activities that do not require skill and capital, to activities that require a little capital and skill such as tailors, repairers of electrical and electronic devices, etc. take in 2002, Bouev [3] mentions the underground economy as a set of transactions that evade taxes. Marler et al. in [12] defines the hidden economy as follows: economic activities that generate income that cannot be measured through so-called information sources used to measure GNP.

In 2006, Tanzi [15] considers the underground economy to be that part of the national gross product that cannot be measured by official statistics due to non-reporting or under-reporting. In another definition of the shadow economy, we have that the shadow economy includes all economic activities that are actually calculated as a share of the gross national product, although they are not calculated.

Kyle et al. [11] in his research regarding the extent of the underground economy reached the conclusion that the main causes of the increase in the shadow economy are the increase in the tax burden and the share of social insurance, the increase in regulations in the formal economy (the number of laws, regulations, regulations, department of letters, etc.) especially in the labor market, they mention forced reduction of weekly working hours, unemployment, social payments (such as unemployment insurance) and factors related to public sector services (such as efficiency and bureaucracy). Ene and Mitroi [6] in his research regarding the assessment of the size of the underground economy reached the conclusion that cumbersome regulations, high tax rates and growing distrust of the government are among the primary factors of the increase in the underground economy. Tedds and Giles [14] in his research related to the underground economy reached the conclusion that by emphasizing the role of the government in the expansion of the underground economy, the public tax burden, the combination of taxes and the application of strict regulations on the labor and product markets are the factors that increase the relative size of this phenomenon. He knows in different countries. Jie et al. [9] in his research on tax evasion and the role of the underground economy claims that government regulations have the biggest effect on the size of the underground economy. Johnson et al. [10] in his research related to the underground economy reached the conclusion that he has studied the effect of income tax rates and punitive policies by the tax audit office on the relative size of the underground economy in the United States. He has come to the conclusion that limiting and reducing the final tax rates does not lead to a decrease in the size of the underground

economy, while the increase in fines and punitive policies leads to a decrease in the size of the underground economy.

Also, Schneider [13] also shows that excessive taxes and regulations imposed by the government, which are less enforceable, are important factors affecting the expansion of the informal economy. Also, his results show that the size of the informal economy has a negative relationship with the quality of government institutions. Chong and Gradstein [5] in a study that used a simple theoretical model to study the relationship between income inequality and the informal economy, showed that income inequality and weak institutions are among the reasons for the increase in the size of the underground economy. Also, their results show that along with these variables, some variables such as taxation and labor market restrictions lose their stability. In a research related to the underground economy, Becker [1] reached the conclusion that the tax burden and regulations imposed on individuals, the amount of tax ethics, unemployment and the level of economic development are among the most important determining factors of the underground economy. Billger and Goel [2] in his research regarding the role of the underground economy in the country's economy claims that high tax rates, unfair tax structure, inefficient government and excessive and inappropriate regulations are among the reasons for engaging in underground activities in Canada and it is in other places. Tedds and Giles [14] in his research related to financial transparency and underground economy concluded that the main reasons for the emergence of underground activities and tax evasion are high and increasing tax burdens, inflation, increasing real disposable incomes and a decrease in compliance and ethical standards. They claim that demographic trends and the increase in the number of family-oriented businesses are important factors affecting the growth of the underground economy in countries such as Canada.

$$\frac{\triangle Q}{\triangle P} \times \frac{P}{Q} = \frac{9}{6.75} \times \frac{4.5}{3} = 2$$

$$\frac{\triangle Q}{\triangle P} \times \frac{P}{Q} = \frac{9}{6.75} \times \frac{3}{5} = 0.8$$

$$\frac{\triangle Q}{\triangle P} \times \frac{P}{Q} = \frac{9}{6.75} \times \frac{3.375}{4.5} = 1$$

$$\frac{\frac{\triangle Q}{Q}}{\frac{\triangle P}{P}}$$

$$\frac{\triangle Q.P}{\triangle P.Q} = \frac{\triangle Q}{\triangle P} \times \frac{P}{Q}$$

$$\frac{3 - 4.5}{(3 + 4.5)/2} \times 100 = -\%40$$

$$\frac{\%40}{\%40}$$

3 Research methodology

The research method in this research is of a descriptive-survey type, and the type of research in the current research is causal and practical in terms of the purpose, because the expected results of the research can be used in examining the dimensions of the underground economy. It is used in university and economic resources. To compile the theoretical foundations in the theoretical chapters, the information contained in the available documents, including books, articles, research reports and treatises related to the subject, were used. To estimate the index of the underground economy and check its trend using fuzzy logic, it is necessary to perform the following steps:

1. Precise determination of indicators
2. Fuzzification
3. Definition of basic rules
4. Inference engine
5. Confirmation
6. Sensitivity analysis

To estimate the index of the underground economy using fuzzy logic, many variables are involved, which in this research are divided into three sub-indices of the financial sector, the monetary sector and the real sector. Since the first step in fuzzy logic is to determine indicators, their precise and complete explanation and definition is very important. According to the definition of each index and their membership function, different outputs can be expected, so the precise selection and definition of indices is very important. According to Buehn et al. [4], the underground economy was explained and according to the mechanism of the underground economy, many variables are involved in the estimation of the index of the underground economy, including 1- the variables of the monetary sector; Relative price index of non-tradable goods to tradable goods, liquidity growth rate, 2- Real sector variables include; trade balance minus oil, the added value of the construction sector to GDP without oil and the added value of agriculture to GDP without oil 3- variables of the financial sector of the economy; They include the ratio of oil revenue to GDP, the ratio of oil revenue to general budget revenues.

In the disambiguation stage, a grade is given to each variable. Then, in the stage of defining linguistic variables, expert experts are asked to fuzzify each of the determined variables. In such a way that these variables are defined as a spectrum (from zero for non-membership to one for full membership) and as a result, they change their previous definitions from deterministic to fuzzy. This work is done by dividing each index into several levels and in the form of a spectrum, in the form of different collections. In this case, each set is defined by appropriate linguistic terms. For example, different indicators can be displayed using the following functions:
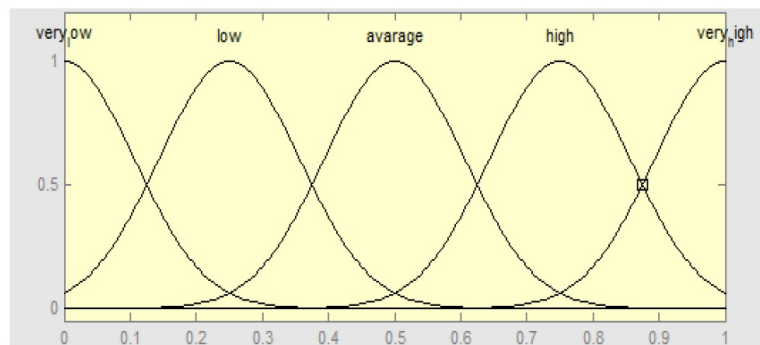

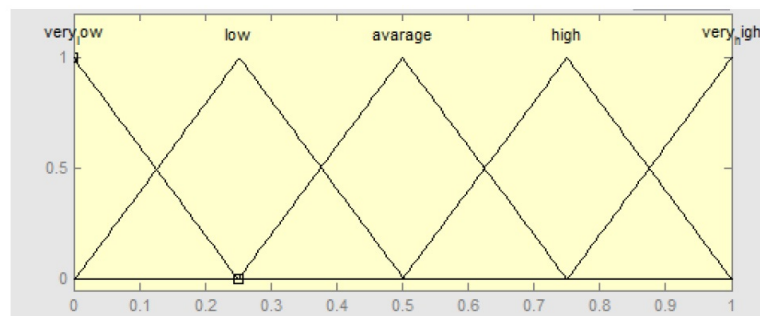Figure 1: Gaussian normal membership function
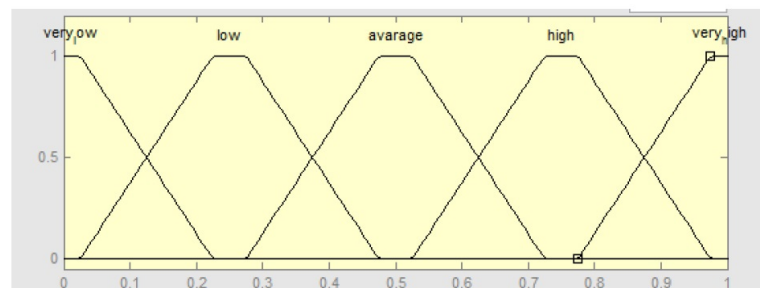

Figure 2: Triangular membership function

Figure 3: Trapezoidal membership function

Gradually, with the completion of the knowledge base, the intelligent system is formed. This is done by the inference engine. When all the possible states for the conditional statements are stated, the inference engine will be able to measure the underground economy in the country instead of humans. In this way, by defining all possible states and arming the system with all propositions, by entering the input variable into the system (since its appropriate sets have already been defined), the inference engine places this input in its appropriate set. This is done for other entries as well. At the end, given the determination of suitable sets for all inputs, the inference engine determines the output set. Determinization is done in different ways, by accurately calculating the output membership degree, first the output set can be determined and finally its exact value can also be calculated. Here, the fuzzy operators MIN and MAX work instead of the usual operators AND and OR. By the end of this stage, the fuzzy controller is practically designed and the desired fuzzy model is completed. In the end, after designing the fuzzy controller and receiving the output, one way to optimize the model is to make slight changes in the input values, with the aim of observing the amount of output changes, this work is called sensitivity analysis. As the term implies, it measures the sensitivity of the system. In this way, it is possible to decide that for reducing or increasing what values in the inputs, the system will still calculate the same output. As a result, this can help optimize the system.
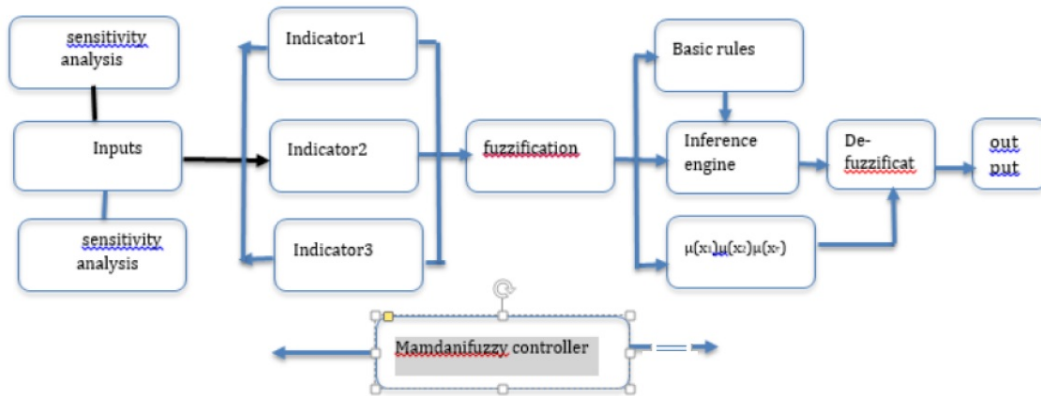
Figure 4: How to do the work

4 Research findings

Estimating the volume of the underground economy means measuring or estimating the volume and monetary value of the activities carried out in the framework of the informal economy in order to identify the economic activities in a country as accurately as possible, although on the surface it seems that the measurement of the activities that are It is impossible that they have a secret and underground, but the studies of the researchers have made them able to get a picture of their shapes and sizes based on the traces that these activities leave behind in different ways. One of the characteristics of estimating the size of the underground economy is comparing it with the official economy and showing its size and importance. If the estimate of the size of the underground economy shows that this type of activity occupies a small share in comparison with the size of the official economy, then there will be no reason to worry. In other words, if it is proven that the amount of economic activities that have been ignored in economic calculations and evaluations is so large that it can affect the entire economic activities, then the omission of the underground sector cannot be justified.

Using Matlab software, the mentioned system was simulated for the years 1387 to 1395 and the fuzzy time series of the financial sector of the underground economy was obtained.

Here, the variables of the ratio of oil income to general budget revenues and the ratio of oil income to GDP are considered as input variables to estimate the index of the underground economy in the financial sector. 1 in the appendix shows the decision rules of this index. The results of estimating the financial sector index using the decision rules of Table 1 are shown in fig 5:

Table 1: Decision rules of the underground economy index in the financial sector

Rules	The share of oil revenue from budget revenue	Oil revenue share GDP	Financial sub-index	Weight
1	very little	very little	very little	1
2	very little	Low	very little	8/0
3	very little	medium	Low	1
4	very little	Much	Low	8/0
5	very little	very much	medium	8/0
6	Low	very little	very little	8/0
7	Low	Low	Low	1
8	Low	medium	Low	8/0
9	Low	Much	medium	1
10	Low	very much	Much	1
11	medium	very little	Low	1
12	medium	Low	medium	8/0
13	medium	medium	medium	1
14	medium	Much	Much	8/0
15	medium	very much	Much	1
16	Much	very little	Low	1
17	Much	Low	medium	1
18	Much	medium	Much	8/0
19	Much	Much	Much	1
20	Much	very much	very much	8/0
21	very much	very little	medium	8/0
22	very much	Low	medium	1
23	very much	medium	Much	8/0
24	very much	Much	very much	8/0
25	very much	very much	very much	1

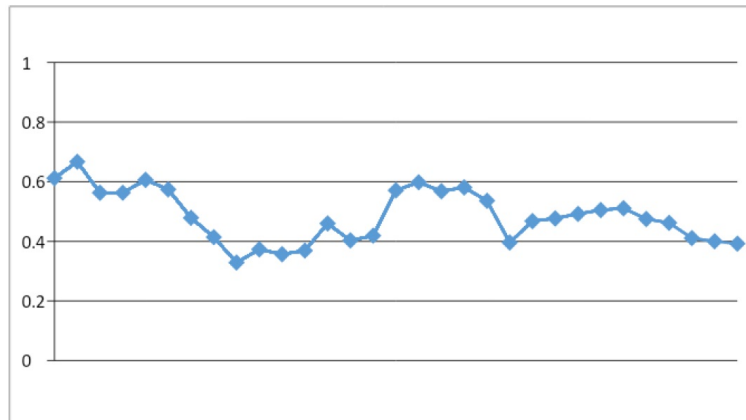Figure 5: the time series trend of numerical values resulting from the estimation of the underground economy index in the financial sector

4.1 Extracting the monetary index of the underground economy

Here, the variables of the relative price of non-tradable to tradable goods and the growth rate of liquidity are considered as variables indicating the underground economy in the monetary sector.

Table 2: decision rules of the underground economy index in the monetary sector

Rules	Liquidity growth rate	Relative price of non-tradable to tradable goods	Sub-monetary index	Weight
1	very little	very little	very little	1
2	very little	Low	very little	8/0
3	very little	medium	Low	1
4	very little	Much	Low	8/0
5	very little	very much	medium	8/0
6	Low	very little	very little	8/0
7	Low	Low	medium	1
8	Low	medium	Low	8/0
9	Low	Much	medium	1
10	Low	very much	Much	1
11	medium	very little	Low	1
12	medium	Low	medium	8/0
13	medium	medium	medium	1
14	medium	Much	Much	8/0
15	medium	very much	Much	1
16	Much	very little	Low	1
17	Much	Low	medium	1
18	Much	medium	Much	8/0
19	Much	Much	Much	1
20	Much	very much	very much	1
21	very much	very little	medium	8/0
22	very much	Low	medium	1
23	very much	medium	Much	1
24	very much	Much	very much	8/0
25	very much	very much	very much	1
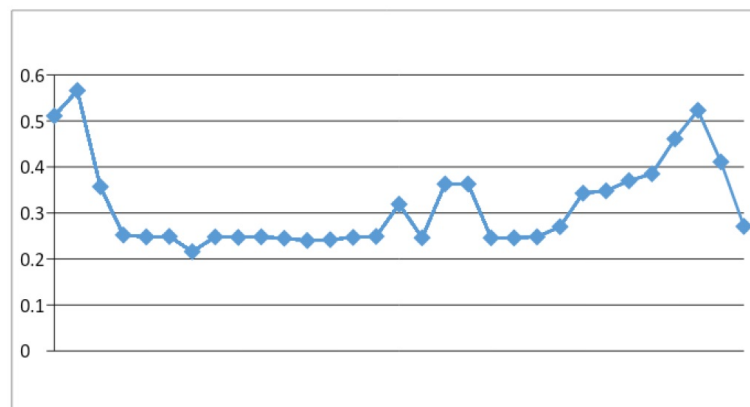
Figure 6: the time series trend of numerical values resulting from the estimation of the underground economy index in the monetary sector

4.2 Extracting the index trend of the real part of the underground economy

Here, the variables of the trade balance minus oil, the ratio of the added value of the agricultural sector to the GDP without oil and the ratio of the added value of the building to the GDP without oil are entered as input variables to determine the underground economy in the real sector. Table 3 shows the decision rules of this index. The results of the estimation of the underground economy in the real part are shown in graph 7:

4.3 Extracting the trend of the underground economy index

As observed, three indicators were obtained using 7 variables of the underground economy, the process of which was described. Now, considering these three indicators, the trend of the underground economy in the country is estimated.

Table 3: decision rules of the underground economy index in the real sector

| Rules	Trade balance without oil	The added value of building from GDP without oil	Added value of agriculture from GDP without oil	Actual sub-index	Weight	Rules	Trade balance without oil	The added value of building from GDP without oil	Added value of agriculture from GDP without oil	Actual sub-index	Weight
1	very much	very much	very little	very much	1	64	Medium	Medium	Much	Low	8/0
2	very much	very much	Low	very much	9/0	65	Medium	Medium	very much	Low	9/0
3	very much	very much	Medium	Much	1	66	Medium	Low	very little	Medium	1
4	very much	very much	Much	Much	9/0	67	Medium	Low	Low	Low	9/0
5	very much	very much	very much	Medium	1	68	Medium	Low	Medium	Low	8/0
6	very much	Much	very little	very much	8/0	69	Medium	Low	Much	Low	9/0
7	very much	Much	Low	Much	1	70	Medium	Low	very much	Low	1
8	very much	Much	Medium	Much	8/0	71	Medium	very little	very little	Medium	9/0
9	very much	Much	Much	Medium	1	72	Medium	very little	Low	Low	8/0
10	very much	Much	very little	Medium	8/0	73	Medium	very little	Medium	Low	9/0
11	very much	Medium	very little	very much	8/0	74	Medium	very little	Much	Low	1
12	very much	Medium	Low	Much	8/0	75	Medium	very little	very much	very little	8/0
13	very much	Medium	Medium	Medium	1	76	Low	very much	very little	Much	9/0
14	very much	Medium	Much	Medium	8/0	77	Low	very much	Low	Medium	1
15	very much	Medium	very much	Low	1	78	Low	very much	Medium	Medium	8/0
16	very much	Low	very little	Much	9/0	79	Low	very much	Much	Low	8/0
17	very much	Low	Low	Medium	1	80	Low	very much	very much	Low	9/0
18	very much	Low	Medium	Medium	8/0	81	Low	Much	very little	Much	8/0
19	very much	Low	Much	Low	8/0	82	Low	Much	Low	Medium	1
20	very much	Low	very much	Low	9/0	83	Low	Much	Medium	Medium	8/0
21	very much	very little	very little	Medium	1	84	Low	Much	Much	Low	8/0
22	very much	very little	Low	Medium	8/0	85	Low	Much	very much	Low	9/0
23	very much	very little	Medium	Low	8/0	86	Low	Medium	very little	Medium	1
24	very much	very little	Much	Low	9/0	87	Low	Medium	Low	Medium	9/0
25	very much	very little	very much	Low	1	88	Low	Medium	Medium	Low	1
26	Much	very little	very little	very much	8/0	89	Low	Medium	Much	Low	9/0
27	Much	very much	Low	Much	1	90	Low	Medium	very much	Low	1
28	Much	very much	Medium	Much	8/0	91	Low	Low	very little	Low	8/0
29	Much	very much	Much	Medium	1	92	Low	Low	Low	Low	9/0
30	Much	very much	very much	Medium	8/0	93	Low	Low	Medium	Low	1
31	Much	Much	very little	Much	1	94	Low	Low	Much	Low	9/0
32	Much	Much	Low	Much	1	95	Low	Low	very much		8/0
33	Much	Much	Medium	Much	9/0	96	Low	very little	very little	Medium	8/0
34	Much	Much	Much	Medium	8/0	97	Low	very little	Low	Medium	9/0
35	Much	Much	very much	Medium	9/0	98	Low	very little	Medium	Low	1
36	Much	Medium	very little	Much	1	99	Low	very little	Much	very little	8/0
37	Much	Medium	Low	Much	8/0	100	Low	very little	very much	very little	9/0
38	Much	Medium	Medium	Medium	1	101	very little	very much	very little	Medium	1
39	Much	Medium	Much	Low	8/0	102	very little	very much	Low	Medium	8/0
40	Much	Medium	very much	Low	1	103	very little	very much	Medium	Low	8/0
41	Much	Low	very little	Much	8/0	104	very little	very much	Much	Low	9/0
42	Much	Low	Low	Medium	1	105	very little	very much	very much	Low	1
43	Much	Low	Medium	Medium	8/0	106	very little	Much	very little	Medium	1
44	Much	Low	Much	Low	1	107	very little	Much	Low	Medium	9/0
45	Much	Low	very much	Low	9/0	108	very little	Much	Medium	Low	8/0
46	Much	very little	very little	Medium	1	109	very little	Much	Much	Low	9/0
47	Much	very little	Low	Medium	9/0	110	very little	Much	very much	Medium	1
48	Much	very little	Medium	Medium	8/0	111	very little	Medium	very little	Medium	8/0
49	Much	very little	Much	Low	9/0	112	very little	Medium	Low	Medium	9/0
50	Much	very little	very much	Low	1	113	very little	Medium	Medium	Low	8/0
51	Medium	very much	very little	very much	8/0	114	very little	Medium	Much	Low	9/0
52	Medium	very much	Low	Much	8/0	115	very little	Medium	very much	very little	8/0
53	Medium	very much	Medium	Medium	1	116	very little	Low	very little	Medium	8/0
54	Medium	very much	Much	Medium	8/0	117	very little	Low	Low	Low	8/0
55	Medium	very much	very much	Low	9/0	118	very little	Low	Medium	Low	9/0
56	Medium	Much	very little	Much	1	119	very little	Low	Much	Low	1
57	Medium	Much	Low	Much	8/0	120	very little	Low	very much		9/0
58	Medium	Much	Medium	Medium	1	121	very little	very little	very little	Low	8/0
59	Medium	Much	Much	Low	8/0	122	very little	very little	Low	Low	9/0
60	Medium	Much	very much	Low	1	123	very little	very little	Medium	very little	8/0
61	Medium	Medium	very little	Medium	8/0	124	very little	very little	Much	very little	9/0
62	Medium	Medium	Low	Medium	9/0	125	very little	very little	very much	very little	1
63	Medium	Medium	Medium	Medium	1						
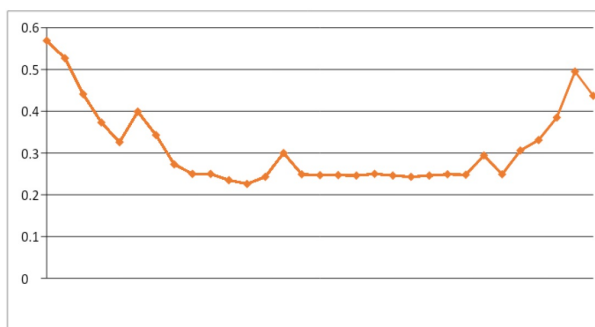
Figure 7: the time series trend of numerical values resulting from the estimation of the underground economy index in the real sector

To calculate the index of the underground economy, the decision rules given in table 4 have been used. The trend of the underground economy in the country during the years 1375 to 1395 is drawn in graph 8.

Table 4: decision rules of the underground economy index

| Rules	Sub money index	Actual sub-index	Financial sub-index	Index of the underground economy	Weight	Rules	Under the monetary index	Actual sub-index	Financial sub-index	Index of the underground economy	Weight
1	Very much	Very much	Very much	Very much	1	64	Medium	Medium	Low	Low	8/0
2	Very much	Very much	Much	Very much	9/0	65	Medium	Medium	Very little	Low	9/0
3	Very much	Very much	Medium	Much	1	66	Medium	Low	Very much	Medium	1
4	Very much	Very much	Low	Much	8/0	67	Medium	Low	Much	Medium	9/0
5	Very much	Very much	Very little	Medium	1	68	Medium	Low	Medium	Low	8/0
6	Very much	Much	Very much	Very much	9/0	69	Medium	Low	Low	Low	9/0
7	Very much	Much	Much	Much	1	70	Medium	Low	Very little	Low	1
8	Very much	Much	Medium	Much	8/0	71	Medium	Very little	Very much	Medium	9/0
9	Very much	Much	Low	Medium	1	72	Medium	Very little	Much	Low	8/0
10	Very much	Much	Very little	Medium	8/0	73	Medium	Very little	Medium	Low	9/0
11	Very much	Medium	Very much	Very much	8/0	74	Medium	Very little	Low	Low	1
12	Very much	Medium	Much	Much	8/0	75	Medium	Very little	Very little	every little	8/0
13	Very much	Medium	Medium	Medium	1	76	Low	Very much	Very much	Much	9/0
14	Very much	Medium	Low	Medium	8/0	77	Low	Very much	Much	Medium	1
15	Very much	Medium	Very little	Low	1	78	Low	Very much	Medium	Medium	8/0
16	Very much	Low	Very much	Much	9/0	79	Low	Very much	Low	Low	8/0
17	Very much	Low	Much	Medium	1	80	Low	Very much	Very little	Low	9/0
18	Very much	Low	Medium	Medium	8/0	81	Low	Much	Very much	Much	8/0
19	Very much	Low	Low	Low	8/0	82	Low	Much	Much	Medium	1
20	Very much	Low	Very little	Low	9/0	83	Low	Much	Medium	Medium	8/0
21	Very much	Very little	Very much	Medium	1	84	Low	Much	Low	Low	8/0
22	Very much	Very little	Much	Medium	8/0	85	Low	Much	Very little	Low	9/0
23	Very much	Very little	Medium	Low	8/0	86	Low	Medium	Very little	Medium	1
24	Very much	Very little	Low	Low	9/0	87	Low	Medium	Much	Medium	9/0
25	Very much	Very little	Very little	Low	1	88	Low	Medium	Medium	Low	1
26	Very much	Very much	Very much	Very much	8/0	89	Low	Medium	Low	Low	9/0
27	Much	Very much	Much	Much	1	90	Low	Low	Very little	Low	1
28	Much	Very much	Medium	Much	8/0	91	Low	Low	Very little	Medium	8/0
29	Much	Very much	Low	Medium	1	92	Low	Low	Much	Medium	9/0
30	Much	Very much	Very little	Medium	8/0	93	Low	Low	Medium	Low	9/0
31	Much	Much	Very much	Very much	8/0	94	Low	Low	Low	Low	1
32	Much	Much	Much	Much	1	95	Low	Low	Very low	Very little	8/0
33	Much	Much	Medium	Much	9/0	96	Low	Very little	Very much	Low	8/0
34	Much	Much	Low	Medium	9/0	97	Low	Very little	Much	Low	9/0
35	Much	Much	Very little	Medium	8/0	98	Low	Very little	Medium	Low	1
36	Much	Medium	Very much	Much	1	99	Low	Very little	Low	Very little	8/0
37	Much	Medium	Much	Much	8/0	100	Low	Very little	Very little	Very little	9/0
38	Much	Medium	Medium	Medium	1	101	Very little	Very muc	Very much	Medium	1
39	Much	Medium	Low	Low	8/0	102	Very little	Very muc	Much	Medium	9/0
40	Much	Medium	Very little	Low	1	103	Very little	Very muc	Medium	Medium	8/0
41	Much	Low	Very much	Much	8/0	104	Very little	Very muc	Low	Low	9/0
42	Much	Low	Much	Medium	1	105	Very little	Very muc	Very little	Low	1
43	Much	Low	Medium	Medium	8/0	106	Very little	Much	Very much		1
44	Much	Low	Low	Low	9/0	107	Very little	Much	Much	Medium	9/0
45	Much	Low	Very little	Low	8/0	108	Very little	Much	Medium	Low	8/0
46	Much	Very little	Very much	Medium	1	109	Very little	Much	Low	Low	9/0
47	Much	Very little	Much	Medium	9/0	110	Very little	Much	Very little	Low	1
48	Much	Very little	Medium	Low	8/0	111	Very little	Medium	Very much	Medium	9/0
49	Much	Very little	Low	Low	9/0	112	Very little	Medium	Much	Low	8/0
50	Much	Very little	Very little	Low	1	113	Very little	Medium	Medium	Low	9/0
51	Medium	Very much	Very much	Very much	8/0	114	Very little	Medium	Low	Low	1
52	Medium	Very much	Much	Much	8/0	115	Very little	Medium	Very little	Very little	8/0
53	Medium	Very much	Medium	Medium	9/0	116	Very little	Low	Very much	Low	8/0
54	Medium	Very much	Low	Medium	8/0	117	Very little	Low	Much	Low	9/0
55	Medium	Very much	Very little	Low	8/0	118	Very little	Low	Medium	Low	1
56	Medium	Much	Very much	Much	1	119	Very little	Low	Low	Very little	8/0
57	Medium	Much	Much	Much	8/0	120	Very little	Low	Very little	Very little	9/0
58	Medium	Much	Medium	Medium	9/0	121	Very little	Very little	Very much	Very little	8/0
59	Medium	Much	Low	Low	8/0	122	Very little	Very little	Much	Low	8/0
60	Medium	Much	Very little	Low	1	123	Very little	Very little	Medium	Medium	9/0
61	Medium	Medium	Very much	Medium	8/0	124	Very little	Very little	Low	Very little	8/0
62	Medium	Medium	Much	Medium	9/0	125	Very little	Very little	Very little	Very little	1
63	Medium	Medium	Medium	Medium	1						
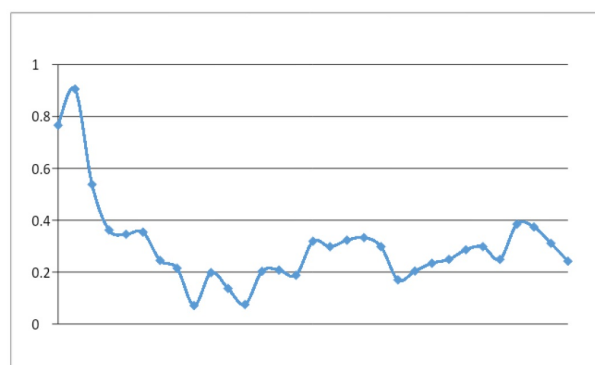
Figure 8: the time series trend of numerical values resulting from the estimation of the underground economy index

5 Conclusion

According to the studies, the historical trend of changes in the size of the underground economy can be explained as follows. During the early years of the Islamic revolution, the hidden economy has taken a large share of the country's economic activities, and the reason for this should be found in the fundamental changes that have taken place in the policies and structure of the economy. In this era, we are facing social and political changes, which have caused a decrease in people's trust and in particular, trust in the banking system, and therefore, in this era, bank deposits have decreased. On the other hand, in this era, due to the relatively high internal inflation, even despite the increase in the price of imported goods due to the increase in global inflation and the imposition of import restrictions (increasing customs duties) after the revolution and the rationing of some goods during the imposed war, the difference between domestic prices and imported prices has increased. The existence of import restrictions (restrictions on the entry of many luxury goods, etc.) due to the war conditions of the country and its high costs, the increase in the profitability of imports has led to a sharp increase in import smuggling. On the other hand in the early years after the Islamic revolution and the Holy Defense era, due to the application of currency restrictions (reduction of currency supply in the market) which led to an increase in the exchange rate in the free market, the margin of the exchange rate increased. But these changes increased the export incentive to a type that caused many export goods to leave illegal channels (smuggling). In other words, the increase in the hidden economy in these years was due to the increase in import and export smuggling.

In recent years, although the increase in the gap between imported goods can indicate an increase in import smuggling, this brief increase has not been able to increase the volume of the hidden economy to a significant extent due to the limitation of informal currency activities in addition to the relative reduction of tax evasion (compared to GDP). To impress a consideration. The underground economy, like the official economy, is an obvious reality. Like other countries, Iran is not safe from the expansion of this type of economy in the heart of the official economy, and although there is no written information about this type of economic activity or it is very little, many experts acknowledge its spread in all aspects of economic life. Lack of access to the size, dimensions and causes of the emergence of the underground economy in Iran disrupts any economic planning and policy-making and will make the available information from national accounts less effective. This issue has received serious attention in developed countries after the 1970 crisis and has received a lot of research, but this research has not been included in the classic literature of economics education and has often played a marginal role. On the other hand, in developing countries, the dimensions is wider. In recent years, there have been many financial bottlenecks in Iran, which could have been more limited if there was no underground sector. Unfortunately, information and information in Iran is in such an unfavorable situation that a detailed examination of the activities of the official economy is associated with many problems. Therefore, in such an atmosphere, it is certainly difficult to do an economic investigation that has a hidden and invisible nature.

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