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Salah Salimian (salahsalimian@yahoo.com)
Urmia University

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New Analysis of the Laffer Tax Curve and Determination of the Optimal Performance Tax Rate in Triangular Distribution Conditions (Game Theory Approach)

Salah Salimian

PhD in Economics, Department of Economics, Urmia University, Urmia, Iran
Email: salahsalimian@yahoo.com
https://orcid.org/0000-0002-4938-950X

Abstract

Today, financing the government's expenses through taxes is the most important and at the same time the most stable and with the least negative consequences on the economy and by adopting optimal policies in recession and inflation conditions, it can stabilize the economic conditions. Due to the extent of the government's obligations in the economic and social fields, the costs for the government have also increased and obtaining resources to cover these costs requires the implementation of ways to increase tax revenues. This paper deals with the modeling of the game between the taxpayers and the tax administration in order to achieve the factors affecting the optimal performance tax rate and also to determine the optimal performance tax rate. It is assumed that the income of the tax affairs organization (government) is distributed triangularly in the interval $[0, 1]$ and the quality of the investigating group is not known to the taxpayers, then by solving the proposed game, the theorems have been presented. The results showed that the income of the tax affairs organization has an inverse relationship with the costs of the investigating and a direct relationship with the fines received from the taxpayers. Also, under certain conditions, the income of the tax affairs organization increases with the increase in the quality of the assessment groups and finally, the relationship between the optimal tax rate and the variables of investigating quality and diagnostic tax is inverse.

JEL Classification: C70, O11, C63, H21.
Keywords: Game Theory, Triangular Distribution, Modeling, Optimal performance Tax Rate.

1. Introduction

Today, in most countries of the world, a major part of the government's revenue sources is provided through taxes, and this share depends on the level of economic development and the economic structure of those countries (Delgado et al., 2019). Take a look at this important source of income for countries makes it clear that whatever the share of taxes in providing government expenses should be more, significantly prevents the creation of adverse economic effects (Khalilzadeh Silabi et al., 2022). The reduction of economic corruption and the efficient linkage between the private and public sectors depend on the optimal tax rate, this will
lead to the distribution of income in a way that will be a tool for solving economic difficulties and instabilities (Dadgar et al, 2013).

Economic theorists believe that a suitable tax system has conditions, the most important of which are justice and efficiency. The principle of justice discusses the ability of taxpayers to pay and the principle of the effectiveness of taxes received on the economic system. Therefore, in order not to disrupt this process, the tax rate should be chosen optimally to provide sufficient income to the government and have minimal social consequences (Hozhabr Kiani et al., 2009). On the other hand, the disproportionate increase in income tax rates will have many social effects on income distribution and public welfare, and it is necessary to calculate the optimal rate of this type of tax according to the maximization of the social welfare function (Hadiyan & Ostadzad, 2015).

Tax policies are one of the most important tools whose fair implementation brings about the correct allocation of resources, income distribution and economic stability, with the aim of distributing the benefits of economic development fairly (Hudson & Teera, 2004). It should also be noted that the efficiency of the tax system is one of the important factors of sustainable economic growth, but this efficiency, which is achieved due to the increase in tax revenue, happens when it is spent on research and development and the hiring of specialized personnel to increase productivity in all production sectors. Personal income tax is also one of the main tools for income redistribution in developed economies (Joumard et al., 2012). The effective marginal tax rate is also suitable and applicable for the analysis of research on the effect of tax incentives for new investment (Gupta & Newberry, 1997). It should also be noted that whatever the tax rate is, some economic factors still tend to evade taxes or pay less than the actual amount they have to pay. According to these conditions, governments consider fines for tax evasion, which are compared to the effects of benefits caused by non-payment or late payment of taxes. In other words, if these crimes are more than benefits, economic factors have less motivation for tax evasion and vice versa (Allingham & Sandemo, 1972).

One of the most important characteristics of supply-side economics, its followers firmly believes in the Laffer curve. This means that government tax revenues do not necessarily increase with an increase in the tax rate (because an excessive increase in the tax rate reduces the motivation for economic activities) and there is an optimal tax rate for which the tax revenue is maximized. The ideas about the optimal tax rate do not have a long history and are among the new ideas in economics. The first attempt in this regard goes back to Frank Ramsey (1927) and the most important research in this regard was carried out by Diamond and Mirrlees (1971). Next, Saez (2001) proposed the method of income elasticities to solve the problem of Mirless model (community limitation).

In the following, a number of studies have been done regarding to researched topic are mentioned. Before referring to the research, it should be mentioned again that that from the limited research done on the optimal tax rate, very few have been on the issue of performance tax rates and most of the studies on the
optimal value added tax rate and with the elasticity approach (based on the model) econometrics) has been done.

Hozhabr Kiani et al. (2008) calculated the income tax rates of businesses and companies in a research. Their statistical population for calculating the optimal rates was individuals of Tehran and legal persons of Tehran and Kermanshah (a sample of approximately 300). Their results determined the minimum and maximum optimal tax rate of individuals (performance) based on their method and said that these new tax rates, in addition to improving income distribution, increase the government's tax income by more than 1.5 times.

Espanhol (2014), in her research, empirically estimated the Laffer curve for the member countries of the Eurozone. For this purpose, panel data were used during the period of 1995-2011 for direct taxes and 2000-2011 data for indirect taxes. The results showed that after calculating the optimal tax rate, the countries of Greece, Portugal, Slovenia and Spain are within the Laffer curve.

Guedes and Costa (2015), in a research, examined and determined the optimal value added tax rate. For this purpose, they considered the member countries of the European Union and estimated and analyzed the results using the panel data method and based on the Laffer curve. Their results showed that the optimal value added tax rate for EU member states is equal to 22% in economic prosperity and 21% in economic recession.

Altunoz (2017), in her research, estimated the Laffer curve for all types of taxes in Turkey. For this purpose, tax policies during the period of 1980-2014 for the Turkish economy were examined through 4 different models. The variables of total tax, direct tax and income tax were tested for each model to determine whether the tax policies implemented in Turkey are compatible with the Laffer curve or not. The results of the research showed that all 4 models are compatible with the theoretical foundations of the Laffer curve, but the two tax rates that maximize and minimize tax revenues are not compatible with these theoretical foundations.

Lundberg (2017), in a study, investigated the relationship between the Laffer curve and high incomes in 27 OECD countries. The results showed that the simulated Laffer curve with high incomes reaches its maximum at the 64% point, while the analytical Laffer curve reaches its maximum value at the 61% point. Also, the average effective tax rate for this set of countries is 57%.

Aklund and Malmsten (2019), in their research, in an experimental study, investigated the optimal tax rates and their changes at the peak of the Laffer curve using the regression method. For this purpose, they considered 288 municipalities in Sweden during the period of 2000-2017. Their results showed that the Laffer curve does not have a maximum value and depending on the considered conditions, it will have differences in the optimal rate.
Sanz-Sanz (2022), in a research of an analytical model (by developing a complete microeconomic model) for the Laffer curve in the case of personal income tax and considering the fact that the marginal rates of personal income tax, apart from the effect on the collection of personal income tax has an effect on the collection of other taxes as well. The results showed that the omissions (ignoring the consumption tax and etc) create a false illusion in the Laffer curve, and the maximum income above a prohibited range is narrower than what it is. If these omissions are made, the maximum income will occur by reducing the tax rate from 62.5% to 20.28%.

According to the surveys, a lot of research has been done in the field of taxation, however, limited tax studies have been conducted on the tax rate, and out of these limited studies, only a handful have determined the optimal tax rate (Studies in the field of tax rate are also based on value added tax and have mostly dealt with regression and econometric methods). On the other hand, no model considering with the utility functions and especially the game theory method has been presented in this field. Also, the existing studies have not addressed the important issues of taxpayers' expression, the collection function of the tax affairs organization and the quality of the investigating groups, which of course are the most important issues in the game between the tax affairs organization and the taxpayers. Therefore, by using these important cases and presenting several theorems by obtaining Nash equilibrium points, the aspect of novelty and innovation is this research.

This article is organized in 5 sections. After the introduction, the theory of games is presented in the second part. In the third part, the game modeling used in two subsections, in the fourth part, the collection function of the tax affairs organization is presented along with the proposed theorem and in the fifth and final section, there are conclusions and suggestions.

2. Game Theory

Benefit maximization is one of the most important assumptions in neoclassical economics, and this maximization is based on rational decisions that economic agents (under the influence of the behavior of other agents) make. One of the most important tools in this situation is game theory. Game theory seeks to mathematically model and logically solve situations where a number of (more than one) players interact with each other under specific rules and the desirability of each of them is affected by the behavior or choice of another (Osborne, 2004). Some researchers compare the importance of game theory design to the discovery of the double DNA spirals and often refer to it as “a theory that can explain everything” (Varoufakis, 2008).

Game theory modeling has become common in international economics, labor economics, macroeconomics, and public finance, and is progressing toward development economics and economic history. Many modelers use game theory because it allows them to think like an economist when value (price) theory is not the answer (Gibbons, 1997). Game theory tries to model situations where people's
interests conflict together. The ultimate goal of this knowledge is to find the optimal strategy for the players (Shahbazi & Salimian, 2017).

One of the most common types of games is static games with complete information. The basic assumption in these games is that each side of the game does not know the choice of the other side (opponent) and in fact, it is as if each of them makes their choice simultaneously. Another basic assumption in these games is that all the consequences of the game are known to all players (Mas-Colell et al., 1995). \( \hat{a} = (\hat{a}^1, \hat{a}^2, ..., \hat{a}^N) \) outcome (for every \( i=1,2,\ldots,N \), \( \hat{a}^i \in A^i \)) is called a Nash Equilibrium (NE) if a deviation from the corresponding outcome does not benefit any player, assuming that other players do not deviate from the strategy played in the Nash outcome. In other words, for each player \( i, i=1,2,\ldots,N \), and for all behaviors \( a^i \in A^i \),

\[
\begin{align*}
\pi^i(\hat{a}^i, \hat{a}^{-i}) &> \pi^i(a^i, \hat{a}^{-i}) \quad \text{for some } a^i \in A^i \\
\pi^i(\hat{a}^i, \hat{a}^{-i}) &= \pi^i(a^i, \hat{a}^{-i}) \quad \text{for some } a^i \in A^i
\end{align*}
\]

(Shy, 1995).

Finally, it should be said that if game theory tries to provide a unique solution for a game, that solution must be a Nash equilibrium. The Nash equilibrium is reached when each player, according to his belief about the opponent's choice, choose the strategy that will get the most outcomes, secondly, the player's belief is correct, which means that the opponent chooses the strategy formed in the player's belief. The strategies that the players choose in this way constitute their Nash equilibrium strategy (Mas-Colell et al., 1995).

3. Game Modeling

Before presenting the model, an explanation about the density function of the triangular distribution (and then the desired model) will be provided:

3.1. Density function of asymmetric triangular distribution

According to the below figure, the coordinates of points A and B are known, and in order to know the coordinates of point C, we set the area of the whole triangle equal to one. Here, a is the starting point and b is the ending point, and it is assumed that x has the highest value at a point like c. Therefore, we have:

\[
h = \frac{2}{b-a}
\]
Diagram 1: Asymmetric triangular distribution diagram

\[ S_{ABC} = \frac{1}{2} (b - a) \ h = 1 \]

\[ \Rightarrow h = \frac{2}{b - a} \]

The probability of x variable distribution in the subinterval \([a, c]\) increases linearly, that means, the closer we get to c, the value of x increases. Also, in the subinterval \([c, b]\), the probability of distribution of x variable decreases linearly, and the value of x decreases as move away from point c. Therefore, the density function of this variable has a triangular shape. In order to obtain the density function of this distribution, it is necessary to calculate the equation of two lines \(\Delta\) and \(\Gamma\). For this purpose, we first calculate the slope of each of these two lines and then obtain its equation.

Equation of line \(\Delta\) with coordinates \((a, 0)\) and \((c, h)\):

\[ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{h - 0}{c - a} = \frac{h}{c - a} \]

\[ y - y_0 = m \ (x - x_0) \]

\[ \Rightarrow y - 0 = \frac{h}{c - a} \ (x - a) \]

Now, if we put the value of h in the equation, we have:

\[ y = \frac{2(x - a)}{(b - a)(c - a)} \]

Equation of line \(\Gamma\) with coordinates \((c, h)\) and \((b, 0)\):

\[ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - h}{b - c} = \frac{-h}{b - c} \]

\[ y - y_0 = m \ (x - x_0) \]

\[ y - 0 = \frac{-h}{b - c} \ (x - b) \]

Now, if we put the value of h in the equation, we have:

\[ y = \frac{-2(x - b)}{(b - a)(b - c)} \]

Two equations form the density function of the asymmetric obtained triangular distribution, so we have:
\[ f(x) = \begin{cases} \frac{2(x-a)}{(b-a)(c-a)} & \text{if } a \leq x < c \\ \frac{-2(x-b)}{(b-a)(b-c)} & \text{if } c < x \leq b \\ 0 & \text{if } x < a, x > b \end{cases} \]  \quad (1)

(Shahbazi & Salimian, 2017).

Here it is assumed that, b=1, a=0, c=c, the triangular density function (according to the desired independent variable) will be in the form of the following relationship (Relation 2)

\[ f(t)= \begin{cases} \frac{2t}{c} & \text{if } 0 \leq t \leq c \\ \frac{2(1-t)}{1-c} & \text{if } c \leq t \leq 1 \end{cases} \]  \quad (2)

### 3.2. Game Modeling

Suppose the taxpayers are uniformly distributed in the range [0, 1]. On the other hand, the utility function for the tax affairs organization is defined as follows:

\[
\begin{cases}
    te & \text{in case of not investigation} \\
    t(e + q(d - e)) + f - a & \text{in case of investigation}
\end{cases}
\]  \quad (3)

Where t is the tax rate (0 \leq t \leq 1), e is the expressed tax of the taxpayers, q is the quality of the investigating groups, 0 \leq q \leq 1, d is the amount of diagnostic tax (after being examined by the investigating group), f is the amount of the fine (If there is a difference between the tax diagnostic and declaration and the time required for payment, etc.) and finally, a is the cost of the investigation for the tax affairs organization.

This function shows that, if the tax affairs organization will not investigated tax cases, then it will have a utility (income) equal to te, in which, as mentioned, t is the tax rate and e is the amount of tax expressed by the taxpayer.

The second part also shows that if the tax affairs organization wants to investigated tax cases, it will get a utility (income) equal to \( t(e + q(d - e)) + f - a \). The first part of this relationship shows the same tax rate multiplied by the expressed tax and the difference between the diagnostic tax and the expressed tax, which is multiplied by the value of q. Since the amount of detection of taxpayers' violations (the difference between tax diagnostic and declaration tax) depends on the quality of the investigating group, this amount is multiplied by that difference.

If the quality of the investigating group (in violation detection) is high, this value tends to 1, and if the quality of them low, this value tends to 0. Also, if q is equal to 0, then the amount of tax affairs organization utility will return to the previous state and only the amount of the fine (added to it) and the costs of the investigation will be reduced (from it).
Now the point of indifference for the tax affairs organization can be obtained. The point of indifference to taxes is the expression that there is no difference for the tax affairs organization in not investigating the cases or do them. In other words, how much should the taxpayer declare until the tax affairs organization it doesn't matter if it is investigated or not. Equating these two values, we have:

$$e^* = -\frac{a - f - tdq}{tq}$$  \hspace{1cm} (4)

In the following, the optimal tax rate for the tax affairs organization will be obtained. For this purpose and in order to be as realistic as possible and to fully adapt to the real world, it has been assumed that with the increase in the tax rate, the willingness of taxpayers to pay will increase, and as a result, tax revenues for the tax affairs organization will increase. This is because of it if the tax rate is zero means that there is no government and for the reasons of lack of economic security and so on incentive for economic activity and as a result tax will not be paid. With the increase in the tax rate and as a result, more activities of the government in the field of economic issues of companies, as well as creating a safe environment for economic activities (spending tax received for security, especially in the economic environment) the willingness of taxpayers to pay taxes also increases. Of course, it should be noted that this increase in income is up to a certain point and after that, with the increase in the tax rate, the willingness of taxpayers to pay will decrease, and as a result, the tax revenues for the tax affairs organization will also decrease. This is because of that reason if the tax rate rises above a certain threshold, then the incentives for producers will become less and less and finally, if the tax rate is equal to 1 (all taxpayers' income is spent on taxes), then the tax revenue of the tax affairs organization (government) will be zero because there is no production for which taxes are paid. Therefore, in today's world where taxes are the basic foundation of economies (governments), the most important and key economic variable is the optimal tax rate. The importance of this issue will be much higher in economies that are moving towards an economy based on tax revenues.

4. Income (collection) function of the Tax Affairs Organization

In order to obtain the effect of the uncertainty of the quality of the investigating groups on the expression of the taxpayers, it is assumed that $q_i$ is a random value, which is unknown to the taxpayers during the expression. In this situation, the game will be as follow conditions:

1. The difference in the quality of investigating groups is obvious and in the form of common knowledge.
2. Taxpayers choose their expression at the same time.

The tax affairs organization seeks to maximize its expected income, and on the other hand, every taxpayer seeks to maximize her net surplus after paying taxes. This idea shows that changing the procedure for the tax affairs organization after
determining the quality of the investigating groups for the taxpayers is very costly for them (Salimian et al., 2023).

The expected income (receipt) of the tax affairs organization is represented by $EI(t)$, which is random based on how the indifferent taxpayer is placed (whether she is placed in the ascending or descending part of the density function of the triangular distribution). Depending on whether the tax affairs organization wants to investigate the tax cases of the taxpayers or not and also which part of the probability density function the taxpayer is in (ascending or descending), the expected income of the organization is divided into two parts and according to the relationship 4 will be as follows:

$$I_1 = \begin{cases} 
I_{11} = \int_0^c t e^* dT = -\frac{c^2(4a-3cdq-4f)}{12cq} \\
I_{12} = \int_c^1 (t(e^* + q(d-e^*)) + f - a) dT = \frac{4a(c^3-1)-3c^4dq-4c^3f+4eq+3dq}{12cq}
\end{cases}$$

$$\Rightarrow I_1 = -\frac{4a-4f-3dq}{12cq}$$  (6)

Where $D(T) = \frac{t^2}{c}$ is the cumulative distribution function of parameter $t$.

On the other hand, for the second part of mentioned function we have:

$$I_2 = \begin{cases} 
I_{21} = \int_0^c t e^* dT = \frac{c^3(4a-3cdq-2(2f-dq))}{12q(1-c)} \\
I_{22} = \int_c^1 (t(e^* + q(d-e^*)) + f - a) dT = \frac{(c-1)(4a(c+2)-3c^2dq-4c(f+qd)-8f-5dq)}{12q}
\end{cases}$$

$$\Rightarrow I_2 = \frac{4a(3c-2)-6c(2f+qd)+8f+5dq}{12q(1-c)}$$  (8)

Where $D(T) = 1 - \frac{(1-t)^2}{1-c}$, is the cumulative distribution function of parameter $t$.

Finally, the revenue function of the tax affairs organization (the sum of relations 6 and 8) will be as follows:

$$I = \frac{4a(3c^2-c-1)-6c^2(2f+qd)+2c(2f+qd)+4f+3dq}{12cq(1-c)}$$  (9)

Now, according to the obtained function, the following theorems can be presented:

**Theorem 1**

The income of the tax affairs organization has an indirect (inverse) relationship with the costs of conducting investigations (the number of investigations) and a direct relationship with fines received from taxpayers ($f$).

**Proof:**

To prove this Theorem, it is sufficient to derive the revenue (collection) function of the tax affairs organization (Relation 9) toward costs of conducting proceedings
(a) and fines received from taxpayers (f) and solve the relationship. Therefore, we have:

\[
\frac{\partial I}{\partial a} = \frac{3c^2 - c - 1}{3cq(1 - c)}
\]

\[
\frac{\partial I}{\partial f} = \frac{3c^2 - c - 1}{3cq(c - 1)}
\]

According to the obtained results, it is clear that the income of the tax affairs organization has an inverse relationship with the costs of conducting investigations. Therefore, conversely, if the number of investigations is reduced, then the income of the tax affairs organization will increase. These results confirm the results of Salimian et al. (2023). On the other hand, the second relationship also shows that the income of the tax affairs organization has a direct relationship with the fines received from taxpayers. Also, these results confirm the results of Movahedi Beknazar et al. (2022). They showed that with the current rate of fines, taxpayers have enough desire to prolong their complaint process until the final stages of the complaint, and the main reason for that is the low rate of these fines. Therefore, with the increase in tax fines, while the process of dealing with cases will be shortened, the revenues of the tax affairs organization will also be collected in a better (shorter) time.

**Theorem 2**

**With the increase in the quality of investigation by the investigative groups, the income of the tax affairs organization increases, if the investigation costs (a) are more than the fines received from the taxpayers (f).**

**Proof:**

To prove this theorem, it is enough to derive the income (collection) function of the tax affairs organization (relation 9) toward the quality of the investigating groups (q) and solve the relationship. Therefore, we have:

\[
\frac{\partial I}{\partial q} = \frac{(a - f)(3c^2 - c - 1)}{3cq^2(c - 1)}
\]

Since the tax rate is in the range of zero and one (and usually less than half a unit), therefore, for the above relationship to be positive, the costs of conducting investigating (a) should be more than the fines received from taxpayers (f). This means if the tax affairs organization wants to increase its revenues by increasing the quality of investigating, it should allocate more expenses (higher number of referrals to companies for investigating, holding more courses for these groups, etc.) in order to improve the quality of investigating groups. In other words, if the tax affairs organization wants to increase its revenues due to the higher quality of
The investigating groups, it is necessary to spend more cost to achieve this goal. Tax affairs organization should not be satisfied only with the current knowledge of this group and to improve the quality of this group, should spend more on the things mentioned earlier.

**Theorem 3**

The relationship between the tax rate and the variables of investigating quality and diagnostic tax is inverse. Also, the tax revenues of the tax affairs organization are maximized for a tax rate of 31% (if \( a = f = 1 \)).

**Proof:**

To prove this theorem, it is enough to derive the revenue (collection) function of the tax affairs organization (relation 9) toward to the tax rate (c) and solve the relationship in terms of c:

\[
c = \frac{\sqrt{(4a-4f-3dq)} - \sqrt{(-4a-4f+dq)}}{4(2a-2f-dq)}
\]

or

\[
(10)c = \frac{\sqrt{(-4a+4f+dq)} + \sqrt{(4a-4f-3dq)}}{4(2a-2f-dq)}
\]

After calculating the optimal tax rate and then deriving it, in relation to the quality of investigation (inverse relationship) and in relation to diagnostic tax (inverse relationship) will be obtained.

The inverse relationship between the quality of investigating and the tax rate can be interpreted in such a way that whatever quality of the investigating group be more, then the undiscovered sources (taxpayers' violations to pay less taxes) will be less. Therefore, this factor has caused the real discovery of taxable income and with a lower rate, even higher income can be obtained and vice versa. Inverse relationship between diagnostic tax and tax rate can be interpreted this way that whatever amount of diagnostic tax is more (as in the previous case, it can be said due to the high quality of the investigating group), then the increase of diagnostic tax will make it possible to obtain a higher income even with a lower tax rate and vice versa.

To prove the second part of Theorem 3, it is first assumed for the sake of simplicity that the costs of the investigating (a) and the fines received from the taxpayers (f) are alike and equal to one. So:

\[
I = \frac{d(6c^2 - 2c - 3)}{12c(1 - c)}
\]

Now, by deriving this relationship toward to c, have:
By solving this relationship in terms of $c$, the optimal value will be obtained approximately equal to 31%. These results are consistent with the results of Hozhabr Kiani et al. (2018). They calculated the minimum optimal tax rate of 31% and stated that the obtained rates can be justified and interpreted based on a generalized form of the Laffer curve. Also, these results confirm the results of Moosavi Mohseni & Norouzi (2011). They showed that Iran operates at level 1 of the Laffer curve (low tax rate).

**Theorem 4**

The relationship between the tax rate and the quality of the investigating group is inverse.

**Proof:**

To prove this theorem, it is enough to derive the relation 10 toward to the quality of the investigating group. The results show an inverse relationship between the tax rate and the quality of the investigating groups. This result is very important for the tax affairs organization, because the tax affairs organization can reduces the tax rate in different economic conditions to help producers and grow production. This means that a reduction in the tax rate will not necessarily mean a reduction in tax revenues (collected by the tax affairs organization) and by reducing the tax rate and on the other hand increasing the quality of the investigating group, whilst helping the economic factors (by reducing the tax rate) also tax affairs organization achieve higher incomes. For example, suppose the tax rate is 25% and the quality of the handling group is 60% (60% can detect the real taxable income), so the diagnostic tax will be equal to 60 units (if the real income of the taxpayer is 400 and with a tax rate of 25%, the amount of real tax that taxpayer should be pay is equal to 100 units). On the other hand, if the quality of the investigating group is equal to 95%, then the amount of income including diagnostic tax will be equal to 380 units, which in the tax rate of 25%, the amount of tax will be equal to 95 units. In other words, an income of 60 units can be obtained with a group with high quality of investigating at the tax rate of approximately 15%. This important result can be used in recession conditions as well as for optimism about tax policies.

**5. Conclusion and Suggestions**

Determining the optimal tax rate is one of the most important parameters affecting the economy in terms of economic efficiency, influencing production, income distribution and controlling economic instability. This article has addressed the modeling of the game between taxpayers and the tax affairs organization in order to achieve the revenue function (collection) and determine the factors affecting these revenues as well as determining how they affect of the tax affairs organization revenues. For this purpose, it has been assumed that the income of
the tax affairs organization (Government) is distributed triangularly in the interval [0, 1] and the quality of the investigating group is not known for the taxpayers, then, by solving the proposed game, the theorems have been presented. The results showed that the income of the tax affairs organization has an indirect (inverse) relationship with the costs of conducting investigations (the number of investigations) and a direct relationship with the fines received from taxpayers. With the increase in the quality of the investigating of the investigating groups, the income of the tax affairs organization increases, if the costs of carrying out the investigating are more than the fines received from the taxpayers. Finally, the relationship between the tax rate and the variables of investigating quality and diagnostic tax is inverse. Also, if the costs of conducting investigating and the fines received from taxpayers are considered equal to the unit, the tax revenues of the tax affairs organization will be maximized for the tax rate of 31%. Also, as one of the most important results, we can mention the inverse relationship between the tax rate and the quality of the investigating groups, this means that if the quality of the investigating group increases, higher incomes can be achieved or the same amount of tax revenue can be obtained by reducing the tax rate.

Conflict of interest

We, the authors of this article, declare that in relation to the publication of the presented article, they have completely avoided publishing ethics, including avoiding plagiarism, misbehavior, falsification of data, or double submission and publication, and there are no commercial interests in this regard.

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