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Tax Evasion in Oil-Exporting Countries: The Case of Iran

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Abstract

Numerous studies have been conducted about the determinants of tax evasion. In all of these studies, this phenomenon has been taken into account in the framework of balanced budget and a non-oil economy. In this study the determinants are examined by extending an endogenous growth model and considering two cases for the government budget in an oil-exporting country along with its budget deficit. In addition, optimal tax rate, effective tax rate, economic growth rate, and rate of tax evasion are estimated. Based on Iran's economy, the results show that the probability of detecting individuals and fine rate lead to an ambiguous effect on the rate of tax evasion, and furthermore, depending on the targeting, it could be positive or negative. Meanwhile the relationship between the changes in the parameter of private sector's cost for tax evasion and changes in tax evasion is negative.

Keywords: Endogenous Growth, Tax Evasion, Oil-Exporting Countries, Iran.

JEL Classification: H11, H22, H31, H32, H53, C61, C63, O41.

1. Introduction

Tax evasion is an illegal phenomenon which exerts significant negative socio-economic effects on society. Gary Becker first introduced the economic theory of crime in 1968 and based on that, Allingham and Sandmo (1972) provided an economic model for tax evasion in which they consider both the income and substitution effect in their analysis. Two years later, contrary to Allingham and Sandmo, & Yitzhaki (1974) ignored the substitution effect and stated that there

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was only the income effect; because fines were imposed upon concealed income and therefore, there only would be income effect. In order to categorize the studies that have been conducted to investigate tax evasion phenomenon, it is stated that these studies can be divided into three branches. Firstly, determinants of tax evasion (e.g. Nicolini, 1998; Yaniv, 1990; MosaviJahromi et al., 2009; Ostad Mohammad and Farhoodi, 2010; Fakhari et al., 2010, Ghorbani and Alilo, 2010; Tonin, 2011; Levaggi and Menoncin, 2012; 2013; Pickhardt and Prinz, 2014; Samadi and Tabandeh, 2013; Hadian and Tahvili, 2013). Secondly, the impact of tax evasion on other economic variables (e.g. Kesselman, 1989; Haj Mohammad and Aghai, 2010; Rezai et al., 2010; Blackburn et al., 2012; Freire-Serén and Panadés i Martí, 2013; Samadi and Tabandeh, 2014). Thirdly, measuring the tax evasion (e.g. Cagan, 1958; Feige, 1989; Zelner, 1970; Seyyed Nourani, 2009; Samadi and Tabandeh, 2014).

In particular, some studies have conducted about the effect of tax evasion on economic growth which indicate the positive effect of tax evasion on growth (e.g. Eichhorn, 2004; Aziz Khani and Afshari, 2007; Zodrow and Diamond, 2013) or negative effect (e.g. Kato and Yanagihara, 2005; Gillman and Kejak, 2008; Seyyed Nourani, 2009) or ambiguous effect (e.g. Chen, 2003). These kinds of studies consider the economies in which the balanced budget is established and oil revenues have not taken into account as an income source for the government.

Due to two main reasons, discussing about these subjects is of high importance. On one hand, balanced budget does not make sense for many countries. On the other, owing to the dependence on oil revenues and oil products, the government budget of most oil-exporting countries confronted with significant fluctuations. Furthermore, the Dutch disease is observed in most of these countries. Thus, most of these countries have low economic growth rate. Accordingly, as the main problem of these countries is inefficient government and hence inefficient tax system, these countries' dependence on an efficient tax system and more reliance on tax incomes will be very necessary and effective. So, the main objective of this study is to examine these problems in Iran as an oil-exporting country. Furthermore, the contribution of this study is considering tax evasion phenomenon in an oil exporting country with budget deficit, Iran, in an endogenous growth model framework.

Thus, the present study explores the determinants of tax evasion in the framework of an endogenous growth model for an oil-exporting country with budget deficit. Additionally, by Iran's data as an oil-exporting country, the model is calibrated and the optimal values of variables are obtained.

The rest of the paper is organized as follows. In the second section, the endogenous growth model which is in accordance with economic conditions of an oil-exporting country, Iran is extended and solved. In the third section, based on Iran's economy, the model is calibrated and the result is presented. In the last section, the summary and policy considerations are provided.

2. Model

It is assumed that time is continuous and the private sector consists of household and firms – households that live in an infinite lifetime horizon with no population growth. In addition, the firms act competitively in product market. Moreover, capital depreciation is zero and households own stocks of firms and in this case the private sector are actually a representative household-firm agent. The government purchase part of private sector's products and provides free services to private sector. Given the existence of tax evasion, the government punishes identified lawbreaking individuals.

Following Skinner and Slemrod (1985), it is assumed that rate of the expected fine is less than 1 and the administrative cost of fines is minor, and thus can be ignored. Furthermore, based on Lin and Yang (2001), each generation has a sense of altruism toward the next generation and their tax evasion does not transfer to the next generation.

Another distinctive assumption of this study is the consideration of an oil-exporting country with budget deficit. In addition to tax revenues from income tax, there are other tax revenues. Moreover, for eliminating the effect of inflation in the model, it is assumed that all variables are real.

2.1. Private Sector

It is assumed that the discounted lifetime utility of households, following numerous studies, is presented as:

$$\int_0^{\infty} e^{-\rho t} \frac{c(t)^{1-\sigma}-1}{1-\sigma} dt \tag{1}$$

Where $\rho > 0$ represents the instantaneous time preference rate, σ is the reverse of intertemporal elasticity of substitution and c (t) refers to instantaneous private per capita expenditure. The production function, following Barro (1990), is shown in Eq. 2 and assumed has constant returns to scale:

$$y(t) = Ak^{\eta}(t)g^{1-\eta}(t) \tag{2}$$

Where y (t), k (t), g (t) and A represent non-oil Gross Domestic Product (GDP) per capita, per capita capital, productive government services per capita and the parameter of efficiency, respectively. In addition, (1-η) refers to the degree of government externality. The government services (g) are regarded as an input of private sector production and is a flow variable.

Assuming that the percentage of revealed income for taxation is β, the amount of tax revenue will be $\tau\beta y$ in which τ is the tax rate and y is non-oil GDP per capita.

Furthermore, in order to be compatible with steady-state, it is assumed that the cost of tax evasion is equal to $h_0(1-\beta)^2$, where $h_0 > 0$ is the cost parameter of private sector for tax evasion[1]. There are two cases of success and failure tax evasion for individuals. Therefore, the detection and arrest of these household or firms will be with probability. In fact, if an individual is identified as criminal or he/she concealed a part of their income ($(1-\beta)y$), that individual must pay both the unpaid tax ($(\tau(1-\beta)y)$) and the fixed fine (π). In this case, the disposable income of private sector will be as Eq. 3:

$$y_d=(1-p)\left[(1-\tau\beta)-h_0(1-\beta)^2\right]y + p\left[(1-\tau\beta)-h_0(1-\beta)^2-\pi\tau(1-\beta)\right]y \Rightarrow y_d=(1-\tau_E)y \tag{3}$$

Where p refers to probability of detection, τ_E is the effective tax rate[2] and other variables are defined as before. In this case, the investment will be $\dot{k} = (1-\tau_E)y - c$. With these assumptions, the individual not only choose c (private expenditure per capita) and k (capital input per capita), but also chooses β (percentage of revealed

1. Costs of hiring a lawyer or bribing the tax auditors to enable tax evasion
2. Which is $\tau_E = \tau\big(1-(1-\beta)(1-p\pi)\big) + h_0(1-\beta)^2$

income) so as to maximize the discounted lifetime utility in regard to the following restrictions (Eqs. 4, 5, and 6), given p (probability of detection), π (fine rate) and g (government services):

$$y_t = Ak_t{}^{\eta} g_t{}^{1-\eta} \quad (4)$$

$$y_d = (1-\tau_E)y \quad (5)$$

$$\dot{k} = (1-\tau_E)y - c \quad (6)$$

By solving this model, Eqs. 7, 8 and 9 will be extracted:[1]

$$1-\beta^* = \tau\frac{(1-p\pi)}{2h_0} \quad (7)$$

$$\frac{\dot{c}}{c} = \frac{1}{\sigma}\left[A\eta\left(1-\tau(1-(1-\beta)(1-p\pi))-h_0(1-\beta)^2\right)\left({}^{g}/_{k}\right)^{1-\eta}-\rho\right] \quad (8)$$

$$\lim_{t\to 0} k_t\lambda_t = 0 \quad (9)$$

Eq. 7 determines the rate of tax evasion in which the marginal benefit of the reduction of the tax is equal to the marginal cost of tax evasion. Eq. 8 represents the consumption growth rate. It also determines the income growth rate. Additionally, Eq. 9 represents the transversality condition which restricts capital input per capita from rapid growth.

2.2. Government

Given the private sector's budget constraint and that the household optimally respond to fiscal policy by modifying tax evasion and consumption-savings (Eqs. 7 and 8), the government seeks to determine the optimal tax rate in a way that maximizes the private sector's discounted lifetime utility.

According to the point that the government has two revenue sources to provide services, the proposed model in this paper significantly differs from other studies especially Barro (1990) and Chen (2003). In addition, the government have encountered budget deficit, and the government are financed by income tax and oil revenues. In this model, the tax revenues are divided into two categories of income tax and other tax revenues. This classification is presented, due to the emphasis of this paper on tax evasion resulting from income tax. Therefore, it is assumed that the cost of tax audit is

1. See appendix, equations (A.5) to (A.18)

$f_0 py$, where $f_0 > 0$ is the parameter of government expenditures to do tax audit, p refers to the probability of detecting tax evasion and y refers to GDP without oil.

Accordingly, two sources of tax revenues are considered for the government budget; the first is tax revenues of income tax which is $\tau[\beta + p\pi\,(1\text{-}\beta)]y$. The second is the other tax revenues defined as αy where α is the ratio of other tax revenues of non-oil GDP. This model seeks to examine the tax evasion in an oil-exporting country, Iran. Therefore, the oil revenues should be considered in the model. In this case, oil revenues are defined as χy, where χ is the ratio of oil revenues to non-oil GDP. Also, given the budget deficit of the government, it can be defined as γy, where γ is the ratio of budget deficit to non-oil GDP. Thus, the government budget constraint is as follows:

$$\tau[\beta \ + \ p\pi\,(1-\beta)]y + \alpha y + \chi y \equiv T \equiv f_0 py \ + \ g - \gamma y \qquad (10)$$

Where τ is rate of income tax, β is the percentage of private sector's revealed income, p is the probability of detection, π is the fine rate and g represents the government services. The rest are defined as before.

In this study, two cases for government budget are considered:

1. Government budget regarding tax revenues and excluding oil revenues (First Case)
2. Government budget simultaneously regarding tax and oil revenues (Second Case)

Accordingly, the government budget constraint is discussed as:

2.2.1. Government Budget Excluding Oil Revenues

In this case, the government budget will be:

$$[\beta \ + \ p\pi\,(1-\beta)]y + \ \alpha y \equiv T \equiv f_0 py \ + \ g - \gamma y \qquad (11)$$

Where τ is the tax rate, β refers to revealed income, p is the probability of detection, π refers to fine rate, y refers to non-oil GDP, f is the parameter of government expenditure for tax auditing, g refers to government services, α is the rate of income tax to non-oil GDP, and γ refers to rate of budget deficit to non-oil GDP.

As mentioned before, it is assumed that the government have to deal with the budget deficit and the government's total tax revenues consists of income tax and other tax revenues. In this case, the equation of the government budget can be rewritten as Eq. 12[1]:

$$\left((\tau[\beta + p\pi(1-\beta)] - f_0 p + \alpha + \gamma)A\right)^{1/\eta} = \frac{g}{k} \quad (12)$$

Therefore, considering the first case of the government budget, the problem of the government will be as the following:

$$max_{\{\tau\}} \frac{\dot{c}}{c} = \frac{1}{\sigma}\left[A^{1/\eta}\eta\left(1-\tau+\frac{\tau^2(1-p\pi)^2}{4h_0}\right)\left(\left(\tau-\frac{\tau^2(1-p\pi)^2}{2h_0}-f_0p+\alpha+\gamma\right)\right)^{1-\eta/\eta} - \rho\right] \quad (13)$$

By solving it, we have:[2]

$$\frac{1-\eta}{\eta}\left(1-\frac{(1-p\pi)^2}{h_0}\tau^*\right)\left(1-\tau^*+\frac{(1-p\pi)^2}{4h_0}\tau^{*2}\right) = \left(\tau^*-\frac{(1-p\pi)^2}{2h_0}\tau^{*2}-f_0p+\alpha+\gamma\right)\left(1-\frac{(1-p\pi)^2}{2h_0}\tau^*\right) \quad (14)$$

In order to find the optimal tax rate, the roots of this equation must be obtained.

2.2.2. Government Budget regarding Oil Revenues

In this case, the government budget will be:

$$\tau[\beta + p\pi(1-\beta)]y + \alpha y + \chi y \equiv T \equiv f_0 py + g - \gamma y \quad (15)$$

Where χ is the ratio of oil revenues to non-oil GDP and the rest of the parameters are defined as before.

In this case, it is also assumed that the government has to deal with the budget deficit and the government's total tax revenues consist of income tax and other tax revenues. The difference of this case from the previous one is that the government not only possesses tax revenues, but also considers oil revenues as financing sources. Therefore, it is assumed that the government's total revenue are financed by both tax and oil revenues. As a result, the government budget will be:[3]

$$\left((\tau[\beta + p\pi(1-\beta)] + \chi - f_0 p + \alpha + \gamma)A\right)^{1/\eta} = \frac{g}{k} \quad (16)$$

Now, maximization problem is:

1. See appendix, equations (A.19) to (A.29)
2. See appendix, equations (A.30) to (A.39)
3. See appendix, equations (A.40) to (A.44)

$$\max_{\{\tau\}} \frac{\dot{c}}{c} = \frac{1}{\sigma}\left[A^{1/\eta}\eta\left(1-\tau+\frac{\tau^2(1-p\pi)^2}{4h_0}\right)\left(\left(\chi+\tau-\frac{\tau^2(1-p\pi)^2}{2h_0}-f_0p+\alpha+\gamma\right)\right)^{1-\eta/\eta}-\rho\right] \quad (17)$$

Now, after derivation of growth rate of per capita consumption with respect to tax rate, the equation will be:[1]

$$\frac{1-\eta}{\eta}\left(1-\frac{(1-p\pi)^2}{h_0}\tau^*\right)\left(1-\tau^*+\frac{(1-p\pi)^2}{4h_0}\tau^{*2}\right)=\left(\chi+\tau^*-\frac{(1-p\pi)^2}{2h_0}\tau^{*2}-f_0p+\alpha+\gamma\right)\left(1-\frac{(1-p\pi)^2}{2h_0}\tau^*\right) \quad (18)$$

In sum, the government seeks to determine the optimal tax rate in a way that maximizes the private sector's welfare. Thus, the government, based on the budget constraint, maximizes the growth rate of per capita consumption. In this model, two cases are considered for the government budget; both cases deal with the budget deficit. As mentioned before, in order to determine the optimal tax rate, we need to relate the government budget to economic growth rate. Therefore, the optimal tax rate and economic growth rate are affected by presence or lack of oil revenues. With the effect of oil revenues on optimal tax rate, the rate of tax evasion and the optimal effective tax rate are also affected. Accordingly, by adding oil revenues to the model, both the private and the public sector of the economy are also affected. Adding budget deficit and other tax revenues such as oil revenues will affect the whole economy.

3. Empirical Results[2]

This paper attempts to cast light on the economic growth rate, optimal tax rate, effective tax rate and rate of tax evasion, by the proposed model along with MATLAB software based on Iran's economy. After changing the policy parameters (i.e. probability of detection, fine rate, private sector's cost parameter for tax evasion), their effects on tax evasion will be investigated. In this section, after defining the variables and the parameters in the model (table 1), with the help of annual data of 2003-2013 of Islamic Republic of Iran, the numerical solution and the analysis of the model will be manipulated.

1. See appendix, equations (A.45) to (A.47)
2. It should be noted that these results are based on Iran's economic data. So, it is possible that the results wouldn't be consistent with economic structure of all the oil exporting countries.

Table 1: Definition and Values of Parameters

Row	Definition	Symbol	Value	Source
1	Parameter of Government Cost for Tax Auditing	f_0	0.0002	Annual Government Budget
2	Probability of Detecting Offenders	P	0.71	Research Estimations*
3	Fine Rate of Offenders	π	0.4	Law of Direct Taxes, Islamic Republic of Iran
4	Inverse of Intertemporal Elasticity of Substitution	σ	0.93	Shahnazi et al. (2012)
5	Time Preference	ρ	0.01	Shahnazi et al. (2012)
6	Degree of Government Externality	$1-\eta$	0.1-0.45	Assumption**
7	Parameter of Private Sector's Cost of Tax Evasion	h_0	0.01-1	Assumption***
8	Efficiency Parameter	A	2.7631	Arabi (2008)
9	Ratio of Oil Income to GDP without Oil	χ	0.11	Research Estimations
10	Ratio of Budget Deficit to GDP without Oil	Υ	0.04	Research Estimations
11	Ratio of Other Tax Revenues to GDP without Oil	α	0.05	Research Estimations****

Source: Research Findings

Notes:

* Best indicator for denoting the probability of detecting offenders is the value of verified cases to total value of cases. Due to confidentiality of statistics and its unavailability, the probability of detecting offenders is estimated by equation $p < \frac{1}{1+\pi}$ introduced by Hindriks and Myles (2006) which signifies the existence of tax evasion.

** Barro and Sala-i-Martin (2004) regard the government externality to be very low. This is while Aschauer (1989) believed that the government externality is high. In this study, just like these researchers, the lowest limit of external effects is 0.1 and its highest limit is 0.45.

*** The maximum value of household costs to tax evasion could be 0.35. This value is determined by Eq.7.

**** The values of rows 9, 10, 11 are determined by estimating geometric mean during the intended period.

Now, by considering two cases of the government budget, the general state of Iran's economy is investigated. To this end, the government externality is considered from 25%. Moreover, to give a crystal clear analysis, by considering government externality with 0.05 steps (i.e. from 25%, 5% to 5%, the government externality will be increased to 45%), along with the two objectives including achieving maximum economic growth and minimum tax evasion, a summary of the results will be provided. It should be noted that the government externality in Iran's economy is equal to 0.31 as the benchmark.[1]

3.1. First Case: Government Budget Excluding Oil Revenues

In this case, it is assumed that the only financing source for the government is tax revenues. In this section, the effects of three policies i.e. increasing probability of detecting individuals, fine rate of individuals, and private sector's cost parameter for tax evasion to tax evasion are taken into account.

3.1.1. Increase Possibility of Detection from 31% to 71% (Objective: Maximum Rate of Economic Growth)

Table 2 shows the effect of increase in the parameter of detection probability. It should be noted that the parameter of detection probability increases from 31% to 71% with 10% steps.

As shown in Table 2, when the objective is the maximum economic growth, the effect of increase in probability of detection on tax evasion is direct. In other words, when probability of detection increases, the tax evasion increases as well.

3.1.2. Increase Possibility of Detection from 31% to 71% (Object: Minimum Tax Evasion)

Table 3 shows the effect of increase in parameter of detection probability.

As shown in Table 3, the effect of increase in probability of detection on tax evasion is inverse when the objective is minimum tax evasion. In other words, when the probability of detection increases, tax evasion decreases.[2]

1. This is determined by the estimation of algebraic mean of rate of expenditure and investment of public sector to non-oil GDP in the intended period.
2. According to Chen (2003), the ambiguity of effect of detection probability on the rate of economic growth and tax evasion is provided. The results of this study concerning the ambiguous effect of detection probability on optimal tax evasion level are evident. Based on the objective, this effect could be positive. The decreased probability of detection is followed by decreased tax evasion.

Table 2: Effect of Increase in Detection Probability on Tax Evasion in First Case of Government Budget (Object: Maximum Rate of Economic Growth)

Row	Degree of Government Externality	Detection Probability	Optimal Economic Growth Rate	Optimal Rate of Tax Evasion
1	0.25	0.71	0.0582	0.2132
		0.61	0.0582	0.2031
		0.51	0.0582	0.1947
		0.41	0.0582	0.1875
		0.31	0.0582	0.1813
2	0.3	0.71	0.093	0.2264
		0.61	0.093	0.2246
		0.51	0.0929	0.2226
		0.41	0.0926	0.2207
		0.31	0.0923	0.2187
3	0.31	0.71	0.1005	0.2366
		0.61	0.1004	0.2345
		0.51	0.1001	0.2324
		0.41	0.0997	0.2303
		0.31	0.0992	0.2281
4	0.35	0.71	0.1308	0.2766
		0.61	0.13	0.2737
		0.51	0.129	0.2708
		0.41	0.1278	0.2729
		0.31	0.1264	0.2647
5	0.4	0.71	0.1683	0.3253
		0.61	0.166	0.3211
		0.51	0.1633	0.3168
		0.41	0.1605	0.3123
		0.31	0.1574	0.3078
6	0.45	0.71	0.2035	0.3721
		0.61	0.1987	0.3661
		0.51	0.1936	0.36
		0.41	0.1882	0.3537
		0.31	0.1827	0.3474

Source: Research Findings

Table 3: Effect of Increase in Detection Probability on Tax Evasion in First Case of the Government Budget (Object: Minimum Tax Evasion)

Row	Degree of Government Externality	Detection Probability	Optimal Economic Growth Rate	Optimal Rate of Tax Evasion
1	0.25	0.71	0.0574	0.1725
		0.61	0.0578	0.1828
		0.51	0.0581	0.1899
		0.41	0.0582	0.1964
		0.31	0.058	0.2024
2	0.3	0.71	0.093	0.2264
		0.61	0.0929	0.2354
		0.51	0.0922	0.2435
		0.41	0.091	0.2506
		0.31	0.0893	0.2566
3	0.31	0.71	0.1005	0.2366
		0.61	0.1001	0.2458
		0.51	0.0991	0.254
		0.41	0.0975	0.261
		0.31	0.0953	0.2669
4	0.35	0.71	0.1308	0.2766
		0.61	0.1289	0.2863
		0.51	0.126	0.2945
		0.41	0.1222	0.3011
		0.31	0.1176	0.3061
5	0.4	0.71	0.1683	0.3253
		0.61	0.1631	0.3348
		0.51	0.1564	0.3421
		0.41	0.1485	0.3471
		0.31	0.1397	0.35
6	0.45	0.71	0.2035	0.3721
		0.61	0.193	0.3804
		0.51	0.1808	0.3856
		0.41	0.1675	3.8809
		0.31	0.1537	3.881

Source: Research Findings

3.1.3. Fine Rate Increases from 10% to 40% (Object: Maximum Rate of Economic Growth

Table 4 shows the effect of increase in fine rate with the objective of maximum economic growth. It should be noted that in this case, the parameter of fine rate increases from 10% to 40% with 10% steps.

Table 4: Effect of Increase in Fine Rate on Tax Evasion in First Case of the Government Budget (Object: Maximum Rate of Economic Growth)

Row	Degree of Government Externality	Fine Rate	Optimal Economic Growth Rate	Optimal Rate of Tax Evasion
1	0.25	0.4	0.0582	0.2132
		0.3	0.0582	0.1981
		0.2	0.0582	0.1787
		0.1	0.0582	0.1678
2	0.3	0.4	0.093	0.2264
		0.3	0.093	0.2209
		0.2	0.0925	0.2201
		0.1	0.0919	0.2148
3	0.31	0.4	0.1005	0.2366
		0.3	0.1002	0.2307
		0.2	0.0995	0.2296
		0.1	0.0986	0.2239
4	0.35	0.4	0.1308	0.2766
		0.3	0.1295	0.269
		0.2	0.127	0.2666
		0.1	0.1248	0.2591
5	0.4	0.4	0.1683	0.3253
		0.3	0.1646	0.315
		0.2	0.1587	0.3104
		0.1	0.1537	0.3002
6	0.45	0.4	0.2035	0.3721
		0.3	0.196	0.3586
		0.2	0.1849	0.3508
		0.1	0.1762	0.3375

Source: Research Findings

Based on Table 4, when the objective is maximum economic growth, the effect of fine rate on tax evasion is direct. In other words, when fine rate increases, tax evasion also increases.

3.1.4. Fine Rate Increase from 10% to 40% (Object: Minimum Tax Evasion)

Table 5 shows the effect of increase of fine rate with minimum tax evasion.

Table 5: The Effect of the Decrease of Fine Rate on Tax Evasion in First Case of the Government Budget (Object: Minimum Tax Rate)

Row	Degree of Government Externality	Fine Rate	Optimal Economic Growth Rate	Optimal Rate of Tax Evasion
1	0.25	0.4	0.0574	0.1725
		0.3	0.0581	0.1884
		0.2	0.0581	0.1998
		0.1	0.0574	0.2093
2	0.3	0.4	0.093	0.2264
		0.3	0.0924	0.2418
		0.2	0.0902	0.2541
		0.1	0.0863	0.263
3	0.31	0.4	0.1005	0.2366
		0.3	0.0994	0.2523
		0.2	0.0964	0.2645
		0.1	0.0916	0.273
4	0.35	0.4	0.1308	0.2766
		0.3	0.1267	0.2928
		0.2	0.1198	0.3041
		0.1	0.1105	0.3103
5	0.4	0.4	0.1683	0.3253
		0.3	0.158	0.3407
		0.2	0.1437	0.349
		0.1	0.1272	0.3509
6	0.45	0.4	0.2035	0.3721
		0.3	0.1837	0.3847
		0.2	0.1599	0.3884
		0.1	0.1355	0.385

Source: Research Findings

Based on Table 5, when the objective is minimum tax evasion, the effect of the increase of fine on tax evasion is inverse. In other words, it is observed that in the case of different government externality, the effect of the increase of fine rate leads to decrease of tax evasion. In these conditions, the effect of increase of fine rate on tax evasion is in accordance with the previous studies (e.g. Allingham and Sandmo 1972; Witte and Woodbury 1985; Lin and Yang, 2001; Cule and Fulton, 2009) which signifies that when fine rate increase, tax evasion decreases.

3.1.5. Increases the Private Sector's Cost Parameter for Tax Evasion from 10% to 30%

In this section, the effect of increase on the private sector's cost parameter for tax evasion is investigated. In this regard, this parameter is increased from 10% to 30% with 10% steps. The obtained results are shown in Table 6.

Table 6: Effect of Increase of Household Cost for Tax Evasion on Tax Evasion in First Case of the Government Budget

Row	Degree of Government Externality	Household Cost for Tax Evasion	Optimal Economic Growth Rate	Optimal Rate of Tax Evasion
1	0.25	0.1	0.043	0.4308
		0.2	0.061	0.289
		0.3	0.062	0.2077
2	0.3	0.1	0.051	0.4942
		0.2	0.0885	0.3586
		0.3	0.0967	0.2647
3	0.31	0.1	0.0517	0.5045
		0.2	0.0934	0.3714
		0.3	0.1037	0.2758
4	0.35	0.1	0.0525	0.5396
		0.2	0.1103	0.419
		0.3	0.1313	0.3193
5	0.4	0.1	0.0494	0.573
		0.2	0.124	0.4699
		0.3	0.163	0.3709
6	0.45	0.1	0.0433	0.5982
		0.2	0.1292	0.5122
		0.3	0.1892	0.4187

Source: Research Findings

Based on Table 6, it is observed that when the private sector's cost parameter increase, tax evasion rate decreases.

In this section, the effects of policy parameters of detection probability, fine rate and the private sector's cost parameter for tax evasion on tax evasion were examined. The analysis of the effects of detection probability signified that when the objective is maximum economic growth, there is not a reverse relationship between probability of detection and tax evasion. Meanwhile, when the objective is to minimum tax evasion, the inverse relationships between probability of detection and tax evasion is established. Moreover, the effect of fine rate on tax evasion is similar to detection probability. Additionally, the relation between the private sector's cost parameter for tax evasion and rate of tax evasion is inverse.

3.2. Second Case (Government Budget regarding Oil Revenues)

In this case, it is assumed that oil revenues and tax revenues are the financing sources for the government budget. In this section, the effects of three policies including increasing the probability of detecting individuals, fine rate of individuals, and the private sector's cost parameter for tax evasion to tax evasion are investigated.

3.2.1. Increase Probability of Detection from 31% to 71% (Objective: Maximum Economic Growth Rate)

Table 7 shows the effect of increase of probability of detection. It should be noted that the probability of detection increases from 31% to 71% with 10% steps.

As shown in Table 7, when the objective is maximum economic growth, the effect of increase of detection probability on tax evasion is positive. In other words, when probability of detection increases, tax evasion also increases.

3.2.2. Increase of Probability of Detection from 31% to 71% (Object: Minimum Tax Evasion)

Table 8 shows the effects of increase of detection probability with the objective of minimum tax evasion.

As shown in Table 8, when the objective is minimum tax evasion, there is a reverse relationship between variation of probability of detection and tax evasion.

3.2.3. Increase of Fine Rate from 10% to 40% (Object: Maximum Economic Growth)

Similar to the previous section and analysis of effects of policy parameter of detection probability on tax evasion, the effect of fine rate on other variables are investigated in two cases. In this case, the objective is maximum growth rate. The results are shown in Table 9.

Table 7: Effect of Increase of Detection Probability on Tax Evasion in Second Case of the Government Budget (Object: Maximum Economic Growth Rate)

Row	Degree of Government Externality	Detection Probability	Optimal Economic Growth Rate	Optimal Rate of Tax Evasion
1	0.25	0.71	0.0102	0.0961
		0.61	0.0102	0.0927
		0.51	0.0102	0.0898
		0.41	0.0102	0.089
		0.31	0.0101	0.0883
2	0.3	0.71	0.0388	0.1458
		0.61	0.0387	0.1444
		0.51	0.0386	0.1431
		0.41	0.0385	0.1417
		0.31	0.0383	0.1404
3	0.31	0.71	0.0456	0.1566
		0.61	0.0455	0.1551
		0.51	0.0454	0.1536
		0.41	0.0452	0.1521
		0.31	0.045	0.1507
4	0.35	0.71	0.0762	0.1998
		0.61	0.0758	0.1976
		0.51	0.0753	0.1996
		0.41	0.0747	0.1933
		0.31	0.0741	0.1912
5	0.4	0.71	0.1202	0.253
		0.61	0.1189	0.2498
		0.51	0.1175	0.2466
		0.41	0.116	0.2433
		0.31	0.1143	0.24
6	0.45	0.71	0.169	0.305
		0.61	0.166	0.3004
		0.51	0.1628	0.2957
		0.41	0.1595	0.291
		0.31	0.156	0.2863

Source: Research Findings

Table 8: Effect of Increase of Detection Probability on Tax Evasion in Second Case of the Government Budget (Object: Minimum Tax Evasion)

Row	Degree of Government Externality	Detection Probability	Optimal Economic Growth Rate	Minimum Optimal Rate of Tax Evasion
1	0.25	0.71	0.0101	0.0913
		0.61	0.0102	0.095
		0.51	0.0102	0.0984
		0.41	0.0101	0.1016
		0.31	0.0101	0.1046
2	0.3	0.71	0.0388	0.1458
		0.61	0.0386	0.1513
		0.51	0.0383	0.1563
		0.41	0.0379	0.1609
		0.31	0.0373	0.1649
3	0.31	0.71	0.0456	0.1566
		0.61	0.0454	0.1625
		0.51	0.0449	0.1678
		0.41	0.0443	0.1725
		0.31	0.0436	0.1766
4	0.35	0.71	0.0762	0.1998
		0.61	0.0752	0.2067
		0.51	0.0739	0.2127
		0.41	0.0723	0.2179
		0.31	0.0703	0.2222
5	0.4	0.71	0.1202	0.253
		0.61	0.1174	0.2606
		0.51	0.1138	0.2669
		0.41	0.1096	0.2717
		0.31	0.1048	0.2753
6	0.45	0.71	0.169	0.305
		0.61	0.1625	0.3125
		0.51	0.1548	0.318
		0.41	0.1463	0.3216
		0.31	0.1373	0.3233

Source: Research Findings

Table 9: Effect of Increase of Fine Rate on Tax Evasion in Second Case of the Government Budget (Object: Maximum Economic Growth Rate)

Row	Degree of Government Externality	Fine Rate	Optimal Economic Growth Rate	Optimal Rate of Tax Evasion
1	0.25	0.4	0.0102	0.0961
		0.3	0.0102	0.0891
		0.2	0.0102	0.0889
		0.1	0.0102	0.0869
2	0.3	0.4	0.0424	0.1518
		0.3	0.0387	0.142
		0.2	0.0384	0.1413
		0.1	0.0382	0.1379
3	0.31	0.4	0.0494	0.1626
		0.3	0.0454	0.1525
		0.2	0.0451	0.1517
		0.1	0.0448	0.1479
4	0.35	0.4	0.0802	0.2055
		0.3	0.0755	0.1942
		0.2	0.0744	0.1925
		0.1	0.0734	0.1873
5	0.4	0.4	0.1241	0.2584
		0.3	0.1182	0.2451
		0.2	0.115	0.242
		0.1	0.1124	0.2345
6	0.45	0.4	0.1721	0.3101
		0.3	0.1643	0.2944
		0.2	0.1574	0.2889
		0.1	0.1519	0.2787

Source: Research Findings

Based on Table 9, when the objective is maximum economic growth and the policy of the increase of fine rate is considered, with increasing of this policy parameter, tax evasion rate increases.

3.2.4. Increase of Fine Rate from 10% to 40% (Object: Minimum Tax Evasion)

Table 10 shows the effect of increase of fine rate with objective of minimum tax evasion.

Table 10: Effect of Increase of Fine Rate on Tax Evasion in Second Case of the Government Budget (Objective: Minimum Tax Evasion)

Row	Degree of Government Externality	Fine Rate	Optimal Economic Growth Rate	Optimal Rate of Tax Evasion
1	0.25	0.4	0.0101	0.0913
		0.3	0.0102	0.0977
		0.2	0.0101	0.1033
		0.1	0.0099	0.1082
2	0.3	0.4	0.0424	0.1518
		0.3	0.0384	0.1553
		0.2	0.0376	0.1632
		0.1	0.0363	0.1695
3	0.31	0.4	0.0494	0.1626
		0.3	0.0451	0.1666
		0.2	0.044	0.1749
		0.1	0.0423	0.1813
4	0.35	0.4	0.0802	0.2055
		0.3	0.0743	0.2115
		0.2	0.0712	0.2204
		0.1	0.0672	0.2265
5	0.4	0.4	0.1241	0.2584
		0.3	0.1147	0.2656
		0.2	0.1071	0.2739
		0.1	0.098	0.278
6	0.45	0.4	0.1721	0.3101
		0.3	0.1567	0.317
		0.2	0.1414	0.3228
		0.1	0.1249	0.3233

Source: Research Findings

Based on Table 10, it is evident that when the objective is minimum tax evasion, the relationship between variations of fine rate and tax evasion is negative. Here, the effect of increase of fine rate on tax evasion is analogous with the previous studies. It is meant to suggest that with increasing of fine rate, tax evasion decreases.

3.2.5. Increase of the Private Sector's Cost Parameter from 10% to 30% for Tax Evasion

In this section, the effects of increase of the private sector's cost parameter for tax evasion are examined. In this regard, the value of this policy parameter has been increased from 10% to 40% with 10% steps and is shown in Table 11.

Table 11: Effect of Increase of Household's Cost Parameter for Tax Evasion on Tax Evasion in Second Case of the Government Budget

Row	Degree of Government Externality	Household Cost for Tax Evasion	Optimal Economic Growth Rate	Optimal Rate of Tax Evasion
1	0.25	0.1	0.0091	0.2421
		0.2	0.0126	0.1546
		0.3	0.0129	0.1114
2	0.3	0.1	0.0261	0.3448
		0.2	0.0394	0.2353
		0.3	0.0421	0.1727
3	0.31	0.1	0.0291	0.3623
		0.2	0.0453	0.2508
		0.3	0.0489	0.1849
4	0.35	0.1	0.0395	0.4234
		0.2	0.0694	0.3096
		0.3	0.0787	0.2327
5	0.4	0.1	0.0478	0.4827
		0.2	0.0981	0.3758
		0.3	0.1195	0.2907
6	0.45	0.1	0.0512	0.5277
		0.2	0.122	0.4332
		0.3	0.162	0.346

Source: Research Findings

We can conclude that from Table 11 in different levels of the external effects of the government, when the private sector's cost parameter for tax evasion, tax evasion decreases.

In this section, by considering the second case of the government budget, the effects of policy parameters of detection probability, fine rate, and the private sector's cost for tax evasion on the tax evasion were examined. At first, by investigating the effect of parameter of detection probability, it became clear that when the objective is the maximum economic growth, there is an inverse relationship between probability of detection and tax evasion; but when the objective is minimum tax evasion, there is a reverse relationship between probability of detection and tax evasion. Therefore, regarding the government externality, we conclude that the effect of variation of probability of detection on tax evasion is ambiguous, and based on the objective may be positive or negative. This conclusion is also similar to the effect of fine rate on tax evasion. Additionally, the relationship between the private sector's cost parameter for tax evasion to tax evasion is reverse. It should be noted here that the results of policy parameters on tax evasion in two cases of the government budget are similar.

4. Conclusion

In this study, the effects of policy parameters including probability of detection, fine rate and the private sector's cost parameter for tax evasion to tax evasion were investigated. Thus, the effects of these policy parameters in the two cases of the government budget were examined. Results show that in both cases, based on the objective of economic growth maximization or tax evasion minimization, the effect of detection probability and fine rate on tax evasion is different. When the objective is maximum economic growth, the effect of these two policy parameters on tax evasion is positive. Otherwise, when the objective is minimum tax evasion, the relationship between two policy parameters with tax evasion is negative.

Accordingly, considering different levels of the government externality, the overall conclusion is that the effect of variation in the parameter of detection probability and fine rate on tax evasion is ambiguous and based on the objective, may be positive or negative. Furthermore, by exploring the effect of increase of the private sector's cost parameter of on tax evasion, we conclude that by increasing of this policy parameter in different levels of the government externality, tax evasion decreases. Thus, with the difference that the rates of economic growth in the second case of the budget are lower than the first case, the economic conditions in both cases of government budget could be the same. This implies the restrictive effect of oil revenues on economic growth in Iran.

To put it another way, entering oil revenues into government budget leads to Dutch disease and decreases economic growth. Consequently, in order to achieve higher economic growth rate, the government budget need to be more dependent on tax revenues. Another result is that due to the presence of oil revenues in the second case of government budget, tax evasion will be lower; because the dependence of government budget on tax incomes is lower and as a result the tax evasion decreases.

It should be noted that based on Chen (2003), the ambiguity of effect of detection probability and fine rate on tax evasion was observed, and the results of this study signify the ambiguous effect of these two factors on optimal amount of tax evasion. Besides, based on Gillman and Kejak (2008), for a certain policy, tax evasion leads to the decrease of effective tax rate and the result shows that in the case of minimum tax evasion, the relationship between tax evasion and effective tax rate is reverse. In addition, Allingham and Sandmo (1972), Witte and Woodbury (1985), Lin and Yang (2001), and Cule and Fulton (2009) signified the reverse relationship of variation of detection probability and fine rate with tax evasion and the result of this study demonstrates that based on targeting, this relationship can be reverse.

For further studies, by calibration, the researchers can focus on the analysis of the effects of increase of government expenditure or revolve around model analysis by adding government services in utility function of private sector and investigation of tax evasion in the framework of Dynamic Stochastic General Equilibrium (DSGE).

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