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Assessing the Iranian Fiscal Sustainability in Past and Future through Tax Side of the Economy

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Abstract

In this paper, I have focused on the tax side of the fiscal policy to investigate the past and future behavior of fiscal sustainability in Iran. To do so, I have employed two different forward-looking and backward-looking approaches. First, the backward-looking approach is the fiscal policy rule proposed by Daving & Leeper (2011). Precisely, this rule determines that whether the fiscal policy is active (unsustainable) or passive (sustainable). To estimate the fiscal policy rule, I have exploited Markov switching model (MSM) which examines the tax rate response to debt dynamics under multiple regimes. Second, the forward-looking approach is the modified Blanchard's tax gap indicator (1990) for an oil-producing country. In fact, this indicator predicts the amount of tax adjustment required to stabilize the future amount of government's debt back to its value in a particular base year. I have used time series data over the period spanning from 1993(Q1) to 2013(Q4).

Keywords: Backward-Looking Approach, Forward-Looking Approach, Tax Gap Indicator, Fiscal Policy Rule, Markov Switching Model.
JEL Classification: E62, E63.

1. Introduction

Fiscal sustainability is a long-run issue that each country is struggled with. Although there is no exact definition of fiscal sustainability, it is known as a situation in which government does not face increasing debt to GDP ratio.

Government debt to GDP ratio in Iran averaged 19.1 percent from 1993 until 2013, reaching an all-time high of 24.14 percent in 2002. In fact, during the early part of 1990 decade, the Iranian government's expansionary policies became unsustainable. Moreover, increasing strict US and EU sanctions during the last decade coupled with a failed subsidy reform program took a toll on Iranian economy. On the other hand, Iran's economy relies heavily on

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crude oil export revenues, representing on average, 60% of government revenues in annual budgets (central bank of Iran). Precisely, possible sources of financing the annual budget deficits in Iran include issuing state bonds, foreign borrowing, privatization, and withdrawals from the Oil Stabilization Fund (OSF). Table1 shows that a very big portion of annual budget deficits in Iran is financed through withdrawals from the Oil Stabilization Fund (OSF). This is similar to spending the oil revenues directly and has strong inflationary effects through increasing money supply in the economy. Consequently, a comprehensive analysis of Iranian fiscal sustainability is the one that considers the role of oil revenues in government budget financing.

Table 1: Financing Budget Deficit (Iranian fiscal year (FY))

Financing sources	2005-2006		2006-2007		2007-2008		2008-2009		2009-2010	
	budget	actual	budget	actual	budget	actual	budget	actual	budget	actual
State bond	6.1%	8.2%	5.1%	3.1%	3.2%	3.8%	1.8%	0.0%	0.0%	0.0%
Foreign borrowing	2.7%	0.8%	3%	0.4%	2.1%	0.0%	1.6%	0.0%	1.4%	0.1%
Privatization	26%	2.1%	4.5%	0.5%	30.9%	3.1%	20.6%	5.0%	43.7%	15.3%
Oil stabilization fund (OSF)	61%	83.3%	83.6%	88.5%	57.5%	85.6%	71.5%	83.1%	49.8%	70.6%
others	4.3%	5.6%	3.7%	7.5%	6.2%	7.5%	4.5%	11.8	5.1%	14.0%
total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: survey of the Iranian economy, Karafarin Bank, Online E-library, accessed on April 10, 2012.

In this paper, I have examined the fiscal sustainability in Iran by using two different analyses of tax rate behavior. The first one is fiscal policy rule of Daving & Leeper (1991). According to this rule, fiscal sustainability / unsustainability is defined as the response of tax rate to government debt dynamics. And the other one, modified Blanchard's tax gap indicator (1990), is the prediction of tax adjustments in order to sustain the future path of government's debt back to its amount in a particular base year.

The main contribution of this paper is determining the Iranian fiscal sustainability by backward- looking and forward-looking considerations. Precisely, fiscal policy rule is the backward-looking approach that is estimated the by MSM. Estimating this rule by using MSM allows me to assess the past behavior of Iranian fiscal policy under different regimes. Moreover, as forward-looking aspect, I have used the modified Blanchard (1990)'s tax gap indicator. Calculations of this indicator provide the required tax adjustments for debt stabilization in long-run and medium-run.

To the best of my knowledge, no empirical work has been done in assessing the Iranian fiscal sustainability just by considering the tax side of the economy. More importantly, this is the first work that has employed the fiscal policy rule, MSM and Modified Blanchard (1990)'s tax gap indicator to examine the Iranian fiscal sustainability.

The results of the backward-looking approach, the fiscal policy rule, indicate that the Iranian fiscal policy was so far an active (unsustainable) policy. This means that the Iranian fiscal authorities did not care about the growing level of debt to GDP ratio. Moreover, the results of the forward-looking approach show that the tax gap indicator is positive for long-run and medium-run. These positive values imply that government needs immediately and continuously tax adjustments in order to stabilize its future debt values back to a particular base year. Consequently, Iranian government has had an unsustainable fiscal policy. And in order to alter this unsustainable policy to a sustainable one in future, the government should use tax adjustments based on the modified Blanchard's (1990) tax gap indicator.

The remainder of this paper is organized as follows. Section two is devoted to literature review. Section three analyzes the theoretical background. Section four formulates the model and explains the methodology. Section five focuses on data and empirical results. Finally, section six provides some concluding remarks.

2. Literature Review

Different economic and econometric approaches have been developed to address the question of fiscal sustainability. For instance, most of the empirical works focuses on cointegration methodology (for example, Trehan & Walsh, 1988; Martin, 2000; and Cunado et al., 2004, failed to reject inter-temporal budget balance for United States. While, other studies including Hamilton and Flavin, 1986; Wilcox, 1989, rejected it. Moreover, Westerlund & Prohl, 2008; Afonso & Rault, 2010; Mahdavi & Weterlund, 2011, have applied panel unit root and panel cointegration tests to analyze the long-run sustainability of government deficits. Also, Escario et al. (2012) used multicointegration methodology in assess the long-run fiscal sustainability in Spain. Mendoza & Ostry (2008) conduct a cross-country empirical analysis of fiscal solvency. Additionally, Ito et al., (2011) and Doi et al., (2011) have employed switching models to investigate the stance of Japan's fiscal policy under different regimes. Miyazaki (2014) used dynamic OLS to show that how the adoption of fiscal reform affects the sustainability of fiscal policy in OECD countries. Antelo at al., (2014) examined the sustainability of public debt in GIPSI countries under different scenarios of growth, inflation, fiscal and monetary policies. Moreover, different approaches have been used to measure the sustainability gaps (see, Blanchard et al., (1990)'s tax gap; Buiter (1985)'s primary gap; and Kotlikoff et al., (1991)'s fiscal gap). Zaidi

& Rejniak (2010)'s paper emphasizes the strong impact of population ageing on fiscal policy sustainability. Instead of analyzing fiscal sustainability in time domain, Cascio (2015) reassessed the relationship between primary deficit and lagged debt to GDP ratio to test for US debt sustainability based on wavelet domain. Kia (2008) examined fiscal sustainability in Iran and Turkey by multicointegration method and found that the fiscal policy in Tureky is weakly sustainable, but not in Iran.

3. Theoretical Background

I discuss the theoretical model as follows:

• Blanchard (1990)'s Tax Gap Model

I start with dynamic government budget constraint. Precisely, the change in nominal value of debt (B) over time $(s)$is given by:

$$d_B/d_s=G+H-T+iB \tag{1}$$

The right hand side of equation (1) corresponds to the usual definition of deficit. The value of spending plus transfers (G+H) minus taxes (T), i.e., primary deficit, is denoted by D below. We rewrite the budget constraint in terms of ratios to GDP (denoted by lower case letters). Equation (1) becomes:

$$d_b/d_s=g+h-t+(r-\theta)b=d+(r-\theta)b \tag{2}$$

Where r denotes the real interest rate and θ is the real rate of GDP growth. According to equation (2), the evolution of the ratio of debt to GDP (b) over time (s) depends on primary deficit ratio to GDP (d) and the product of the ratio of accumulated debt to GDP (b) times the difference between the real interest rate and the growth rate. The debt to GDP ratio at any time n is then given by:

$$b_n=b_0\,exp(r-\theta)\,n+\int_0^n d_s exp(r-\theta)(n-s)ds \tag{3}$$

This equation states that the debt to GDP at time n is equal to the value of the initial ratio at time zero, accumulated at a rate equal to the difference between the interest rate and the growth rate, plus the accumulated value, at the same rate, of the primary deficits along the way. By pre-multiplying the both side of equation (3) by $exp\text{-}(r\text{-}\theta)n$ (which means that both side of the equation is discounted to time zero), we have:

$$\int_0^n d_s exp\text{-}(r-\theta)sds=-b_0+b_n exp\text{-}(r-\theta)n\text{`} \tag{4}$$

To calculate the tax gap indicator, let t^* be the constant tax rate such that, given forecasts of government spending under current policy rules, the ratio of debt to GDP at time n is equal to the ratio at time zero. Manipulating equation (4) gives the following expression for t^*:

$$t^*=(r\text{-}\theta)\left[b_0+[1\text{-}exp\text{-}(r\text{-}\theta)n]^1\right][\int_0^n(g+h)exp\text{-}(r\text{-}\theta)sds] \tag{5}$$

This equation states that the constant tax rate (t^*) must cover the amount needed to keep the debt to GDP ratio constant in the absence of a primary deficit. Then, it must also cover average spending and transfers over the period. So the tax gap indicator becomes $(t^*\text{-}t)$, which t is the tax revenue to GDP ratio in current period (Blanchard 1990).

4. Empirical Approaches

Understanding the past and predicting the future is the main point in fiscal sustainability determination. Consequently, in order to make a comprehensive benchmark, I have applied two different approaches. The first operational approach is the estimation of fiscal policy rule with MSM following Daving and leeper (2011). And the second one is the Broda and Weinstein (2005)'s methodology (which is the same as Blanchard (1990)'s model, but in summation form). Furthermore, I have adjusted the Broda and Weinstein (2005)'s methodology to exploit a realistic model for an oil-producing country.

• First Approach: The Fiscal Policy Rule

Definition of fiscal sustainability under fiscal policy rule implies on a functionally sustainable policy. This means that a country has a set of rules and decision-making procedures that adjust fiscal parameters over time to serve some rational public purposes. In other words, this approach focuses on the adjustments of the tax rate in response to debt dynamics. Hence, in this approach, I employ MSM used by Daving & Leeper (2011) to examine the sensitivity of tax rate to debt dynamics. The novelty of their work is that the coefficients in this rule are modeled as Markov chains:

$$\tau_t=\gamma_0(S_t)+\gamma_b(S_t)b_{t-1}+\gamma_Y YVAR_t+\gamma_g(S_t)g_t+\varepsilon_t \tag{6}$$

S_t is the switching dummy variable which denotes the policy regime and follows a two-state Markov chain with transition probability matrix. I estimate this Markov switching rule, equation (6), showing how each rule has switched back and forth between active and passive. According to the terminology originally developed by Leeper (1991), an "active" policy is not constrained by the level of government debt, i.e., a non-positive estimate of debt coefficient in equation (6) is interpreted in terms of an active policy regime. In contrast, a "passive" policy responds prudently to shocks to the government debt. This means that a fiscal policy rule that reacts positively to debt dynamics is a passive policy. According to equation (6), the tax revenue to GDP ratio (τ_t) is a function of the lagged debt to GDP ratio (b_{t-1}), output gap ($YVAR_t$) and government purchases (g_t). We calculate the output gap ($YVAR_t$) as the deviation of GDP from its Hodrick- Prescott trend. In this paper, in contrast to Daving and leeper (2011) and according to the Iranian fiscal history, we do not use switching dummy variable for the output gap ($YVAR_t$).

• Second Approach: The Tax Gap Indicator

I use the Broda and Weinstein (2005)'s methodology to calculate the sustainable tax rate and the tag gap indicator in long-run (20 years) and medium-run (5 years). In this approach, the amount of calculated tax rate is the constant tax rate that stabilizes future values of debt back to its value at the base year 2013 (I have considered 2013 as the base year for debt stabilization). In particular, I want to determine that under the situation in which government benefits from its oil revenues, how much tax adjustment is required to sustain the future values of debt back to its value in a base year?

In order to justify the Broda & Weinstein model for an oil producing country, I add oil revenues in government inter-temporal budget constraint as follows:

$$G_t-T_t+i_tB_{t-1}=\left(B_t-B_{t-1}\right)+R_t \tag{7}$$

G_t ,T_t, i_t and B_t stand for the government's expenditure (except interest), tax revenues, interest rate on debt and the level of government debt, respectively. And R_t is the share of oil revenues in the government's budget financing. Equation (7) states that fiscal deficits (the left-hand side) can be financed by issuing new debt, $(B_t - B_{t-1})$ or by using oil revenues (R_t). By rewriting this equation in terms of ratio to GDP we have

$$g_t-\tau_t+i_tb_{t-1}=(b_t-b_{t-1})+r_t \tag{8}$$

Then, by rearranging the government budget constraint, the following expression of the government debt-to-GDP ratio, b_t, obtains:

$$b_t=\left(g_t-\tau_t\right)-r_t+\frac{1+i_t}{1+\eta_t}b_{t-1} \tag{9}$$

Which r_t indicates the oil revenue share in government budget as ratio to

GDP. τ_t is T_t/GDP_t and η_t is the growth rate of nominal GDP. Equation (9) can be easily expanded to examine the relationship between debt-to-GDP ratios n years into the future (b_n) with today's debt-to-GDP ratios (b_0). It is assumed that i_t and η_t are constant over time, and that today's level of debt-to-GDP is given by b_0. Then the level of debt-to-GDP in period n can be expressed as:

$$b_n=\sum_{t=1}^{n}\left(\frac{1+i}{1+\eta}\right)^{n-t}\left[\left(g_t-\tau_t\right)-r_t\right]+\left(\frac{1+i}{1+\eta}\right)^{n}b_0 \tag{10}$$

This equation is central for the definition of fiscal sustainability that has adopted as below. It states that the level of debt-to-GDP n period into the future is the sum of the accumulated primary deficits minus the oil revenue's share in deficit financing that grow at the rate $\left(\frac{1+i}{1+\eta}\right)$, and the value of the initial level of debt raised by the same rate. Now the fiscal sustainability indicator can be constructed. Formally, by rearranging and pre-multiplying both sides of equation (10) by $\left(\frac{1+\eta}{1+i}\right)^{n}$ we obtain the crucial equation for sustainability:

$$\sum_{t=1}^{n}\left(\frac{1+\eta}{1+i}\right)^{t}\left[\left(\tau_t-g_t\right)+r_t\right]\geq b_0-b_n\left(\frac{1+\eta}{1+i}\right)^{n} \tag{11}$$

According to Blanchard (1990), the condition for fiscal sustainability n years into the future is $b_n = b_0$. In other words, based on equation (11), a fiscal policy is sustainable in time of n-years if the present discounted value of the ratio of primary surpluses to GDP plus the ratio of oil revenues to GDP in budget financing is greater than or equal to difference between the current level of debt-to-GDP ratio and the desired discounted debt-to-/GDP ratio n periods ahead. Simply put, this implies that a government with outstanding debt (the first term on the right hand side) that faces interest rates in excess of growth rates must eventually run a primary surplus and also use the oil revenues as amount equal to or greater than its liabilities in order to achieve fiscal sustainability. The index of fiscal sustainability is given by $(\tau^* - \tau)$, where τ^* is the constant tax rate that solves equation (11) and τ is the actual tax revenues-to-GDP ratio. Formally,

$$\tau^*=\frac{i-\eta}{1+\eta}\left[b_0+\left(1-\left(\frac{1+\eta}{1+i}\right)^{n}\right)^{-1}\sum_{t=1}^{n}\left(\frac{1+\eta}{1+i}\right)^{t}\left(g_t-r_t\right)\right] \tag{12}$$

τ^* is the sustainable/constant tax rate that achieves an unchanged debt-to GDP ratio in future, given the forecasts of government spending minus the oil revenue's share in government budget financing. The difference between τ^* and τ, the tax gap, is a measure of the size of the tax adjustment needed to attain the fiscal sustainability under using oil revenues. In other words, the equation states that the sustainable tax rate must cover the debt to GDP ratio constant in the absence of a primary deficit. And then, it must also cover average spending and transfers minus the oil revenue share in budget financing over a specific period. The first term on the right hand side ($\frac{i-\eta}{1+\eta}$) is the ratio of interest rate gap to GDP, which we will discuss it in next section.

From equation (12), a good approximation to the medium-run (five year) sustainable tax rate is given by:

$$\tau_5^*=\left[\left(\text{average over the next 5 years of } g_t\text{-}r_t\right)+\left(\frac{i-\eta}{1+\eta}\right)b_0\right] \tag{13}$$

So the medium-run tax gap is given by:

$$\tau_5^*\text{-}\tau=\left[\left(\text{average over te next 5 years of} g_t\text{-}r_t\right)+\left(\frac{i-\eta}{1+\eta}\right)b_0\text{-}\tau\right] \tag{14}$$

The calculated value of the above equation is the required tax adjustment in order to stabilize the level of debt in 5 years ahead under the situation that government uses oil revenues.

5. Empirical Methodology

A. Data

Data are largely taken from Central Bank of Iran (CBI), International Financial Statistics (IFS) and statistics center of Iran. I take the fiscal year 2004 as the base year. Government expenditures are measured by current payments[1]. In order to make the current payments real, I divide them by consumption index (which comes from dividing the gross national expenditures at current price by its value at 2004 constant prices). About real taxes, I use all tax revenues divided by consumer price index (CPI) based on 2004 constant prices. About the government's debt variable, I used the total debt ratio to GDP available in IMF. All the variables are as the ratio of GDP, so I divide them all by GDP at 2004 constant prices.

Calculations of the tax gap indicator consider the future expenditures of the

1. I have also used development payments as a part of government expenditures. In order to make development payments real, I have used the capital index (which is the ratio of gross fixed capital formation at current prices to its value at 2004 constant prices). To reach the total real expenditures, I have summed up the real current and development payments.

government. Therefore, I use demographic changes to expand the government expenditures into future. Precisely, I expand the last quarter of 2013 by the predicted population growth rate adopted from Statistics center of Iran.

B. First Approach: The Fiscal Policy Rule

In this section, estimation results of fiscal policy rule based on MSM under two regimes (regime one and two) is presented. Table 1 reports the estimation results by maximum likelihood estimation (MLE).

Table1. Estimation Results for the Fiscal Policy Rule [c]

Switching variables	**Regime 0**	**Regime 1**
Transition probability	0.9742 (0.0267)	0.9264 (0.0514)
C	0.0258 (0.0052)	0.0517 (0.0108)
Lagged debt ratio to GDP	-0.0278 (0.0230)	-0.0726 (0.0170)
Government expenditure to GDP	0.2171 (0.0191)	0.0342 (0.0499)
Non- switching variables		
Output gap($YVAR_t$)	0.0042 (0.0084)	
Log- likelihood	281.12051	
Likelihood ratio test	29.911(P-Value:0.0000)	

c. Estimated by the MLE assuming normality. The dependent variable is the tax revenues divided by GDP. Numbers in the parentheses are standard errors. GDP gap is measured as the deviation from the Hodrick–Prescott trend.

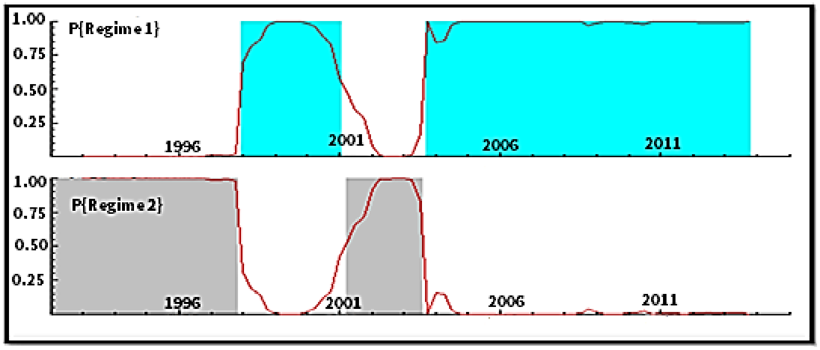
According to table 1, the results of likelihood ratio test indicate that the null hypotheses of the existing a linear model has rejected. Moreover, the MSM estimation results show that in regime one, the estimated coefficient on the lagged debt to GDP ratio is negative. This suggests that tax revenues fall when debt to GDP ratio increases. So according to the terminology originally developed by Leeper (1991), the fiscal policy in regime one is active. Additionally, the coefficient on debt to GDP ratio in regime two is also negative. Thus, regardless of the state, the tax revenue fails to increase when the debt to GDP ratio rises. Moreover, in both regimes, the tax revenue increases when the government expenditure increases but by much less than one-to-one. In other words, fiscal dynamics of Iranian government does not exploit tax adjustments to make the fiscal policy sustainable. Consequently, as the results show, fiscal policy in Iran does not alternate between “active” and “passive” phase, but had just followed an active phase for 20 years ago.

Transition probability matrix associated with estimation of fiscal policy rule is:

$$P_{ij} = \begin{pmatrix} 0.9742 & 0.0735 \\ 0.0257 & 0.9264 \end{pmatrix}$$

This matrix indicates that the summation of the arrays on every column is equal to one. With probability 0.0735 we switch from regime two to regime one and with probability 0.0257, we switch from regime one to regime two. Hence, the transition probability matrix shows that with higher probability in regime one, the sample period follows this regime.

Fig.1. Smoothed Probability for Fiscal Policy Rule [d]



d. Smoothed probability of two regimes for the fiscal policy rule. The horizontal axis is the sample time period and the vertical axis is the probability. The red lines are cumulative distribution functions which show the distribution of the sample period between regime one and two.

Figure1 shows the smoothed probability of two regimes. We can see that Iranian fiscal policy is more unsustainable in regime two than in regime one. The first period associated with regime two is 1372(1)-1376(4), which corresponds to the most reduction in tax ratio in Iran (i.e. the tax ratio in this period is about 4.9 percent). The other tax reduction is related to period 1380-1382, in which the tax ratio is about 5.3 percent (CBI data).

C. Second Approach: Tax Gap Indicator

In this section, the computation of sustainable tax rate for an oil producing country has been addressed. In tax gap calculations, one must determine the current (base) year of debt and tax to GDP ratio, what economic growth and interest rate is likely to look like, what the evolution of government expenditure is likely to be and what is likely to happen with oil revenues. I will discuss each of them in turn.

First, we consider year 2013 as the base year for debt and tax ratio to GDP. The amount of debt to GDP ratio in 2013 is 11% and tax ratio to GDP is 5%.

The common assumption in assessing fiscal sustainability is that interest rate and economic growth rate are exogenous; so sustainable tax rate calculations take the forecast of these two rates as given. In other words, what matters in sustainable tax rate computations is not the value of economic growth rate and interest rate, but it's the interest rate/growth rate differential (i.e. interest rate gap). The basic intuition behind this tax gap arises from that the economy needs to raise its capital to GDP ratio. Obviously, forecast of interest rate gap can be little more than educated guesswork. In fact, the results are too sensitive with respect to alternative assumptions about the two rates. One of the assumptions is about to set the interest rate and economic growth as their historical values. Historical values do not always provide the best clue for making assumptions about future developments. Because the average growth rate observed over the past 10 years is substantially lower than the growth rate projected for future. As Blanchard et al. (1990) note, a higher interest rate gap tends to raise the sustainable tax rate because it raises the cost of servicing any existing level of debt. Blanchard et al. (1990) recommend using a gap between interest rate and growth rate of 2% points for long-run. So in this paper, in order to compute the sustainable tax rate for medium-run (five years), I use historical values of interest rate gap (10 years average of economic growth rate and nominal interest rate, which are 3% and 16%, respectively). Therefore, the historical interest rate gap ratio to GDP is 12%. Then by Blanchard et al. (1990)'s advice for long-run (twenty years), we cut this historical gap down to 2%. Hence, for long-run, first I compute the sustainable tax rate under the historical interest rate gap ratio to GDP (12%). Then I show changes in sustainable tax rates associated with cutting the interest rate gap (I do this way because in long-run government has enough time to change the economic condition).

Tax gap indicator intrinsically takes account of the future evolution of public spending. It follows that computation of tax gaps rests on the availability of long-run fiscal projections. In fact, public spending has to be projected over a long-run horizon covering several decades. The most important driver of public spending in the long run is demographic developments. Non-demographic factors (e.g. the evolution of relative prices, efficiency gains in the provision of public spending, the income elasticity of demand for public goods, etc.) may also play a significant role. However, their role is usually suppressed, since the direction and magnitude of their impact are highly uncertain. Consequently, in this paper, in order to forecast the government expenditures, I assume that these expenditures grow at population growth rate.

• Computing Unsustainability

In second approach, government applies its oil revenues in its budget financing. By taking into account the dependency of oil revenues on political conditions and world's economy, it is not rational to forecast these revenues base on the past oil revenues' share in budget. Therefore, in order to project oil revenues' share in budget, I consider different shares of it and for each share the results are as below (I assume that maximum amount of oil revenue's share in budget is 50% and then I lower this amount down to 10% in order to present different tax rates associated with different oil revenue's share in budget).

Table2. Sustainable Tax Rate-Scenario2-Lomg-Run (2014-2033)

Interest rate gap	Sustainable tax rate with respect to different oil revenue shares					Tax gap with respect to different oil revenue shares				
	0.50	0.40	0.30	0.20	0.10	0.50	0.40	0.30	0.20	0.10
0.12	0.36	0.43	0.50	0.56	0.63	0.31	0.38	0.45	0.51	0.58
0.10	0.30	0.35	0.41	0.47	0.53	0.25	0.30	0.36	0.42	0.48
0.08	0.24	0.28	0.33	0.37	0.42	0.19	0.24	0.28	0.32	0.37
0.06	0.18	0.21	0.25	0.28	0.31	0.13	0.17	0.20	0.23	0.26
0.04	0.12	0.14	0.16	0.18	0.21	0.07	0.09	0.11	0.13	0.16
0.02	0.06	0.07	0.08	0.09	0.10	0.01	0.02	0.03	0.04	0.05

Table2 presents the results of the sustainable tax rate (τ^*) and tax gap indicator (τ^*-τ) in long-run. The results of the sustainable tax rate are calculated from equation (12) and values of the tax gap indicator have obtained by subtracting the current tax rate (2013 tax to GDP ratio (5%)) from the computed sustainable tax rate. According to table 2, different values of tax gap indicator show the required tax adjustment under different economic situations (i.e., different amount of the interest rate gap ratio to GDP corresponds to different economic situations). The results show that at 12 percent interest rate gap ratio to GDP and fewer than 50 percent share of oil revenues in budget, the sustainable tax rate is 36 percent. And consequently, the tax gap is 31 percent which means that government should raise current taxes by 31 percent to stabilize the debt to GDP ratio in 20 years ahead back to its value in 2013. Moreover, if we take interest rate gap fixed at 12 percent and cut the oil revenues share in budget financing, we see that sustainable tax rate and consequently tax gap rise. This means that under same economic situation, as oil revenues falls, government should raise alternative revenue (tax) to afford its obligation. On the other hand, if we consider the same amount of oil revenues' share (e.g., 50%) in budget, while cutting the interest rate gap (improve in economic situation), we see that as interest rate gap falls government needs less and less tax rate to afford its obligations. This happens because the interest rate gap reduction occurs by increase in economic growth or decrease in interest rate, which lowers the government obligations.

Table3. Sustainable Tax Rate-Scenario2- Medium-Run (2014-2019)

Interest rate gap	Sustainable tax rate with respect to different oil revenue shares					Tax gap with respect to different oil revenue shares				
	0.50	0.40	0.30	0.20	0.10	0.50	0.40	0.30	0.20	0.10
0.12	0.10	0.12	0.14	0.16	0.18	0.05	0.07	0.09	0.11	0.13

Table 3 presents the results of the sustainable tax rate in medium-run, which have calculated by equations (13) and (14). According to this table, by considering 50 percent share for oil revenues in budget financing and 12 percent interest rate gap for 5 years ahead, sustainable tax rate and tax gap are 10 and 5 percent, respectively. This means that Iranian government should increases current tax rate by 5 percent in order to keep the amount of debt ratio in five years ahead as its value in 2013. As the oil revenue share in government budget falls, the sustainable tax rate and tax gap increase because government should compensate the reduction in oil shares through taxes.

All in all, the results of long-run and short-run time periods indicate that the Iranian government needs tax adjustments in order to stabilize its fiscal policy in future.

6. Implications and Conclusions

In this paper, two different approaches are used to investigate the public finance sustainability in Iran. For the first approach, I have estimated Daving and Leeper (1990)’s fiscal policy rule by MSM to determine the fiscal policy phase (i.e., whether it is an active policy or a passive one). The second approach is the modified Blanchard (1990)'s tax gap indicator for an oil producing country. This indicator measures the amount of fiscal unsustainability in Iran for long-run and medium-run. The results of the first approach, backward-looking approach, imply that fiscal policy in Iran is an active policy. In other words, the Iranian authorities do not afford their accumulated debt by using taxes. And the results of forward-looking approach, Blanchard (1990)’s tax gap indicator, show that the indicator is positive under the two time horizons. In fact, positive tax gap indicator for long-run and medium-run proposes that public finance in Iran is unsustainable and government should use tax adjustments in future.

In general, the backward-looking approach (fiscal policy rule) indicates that the Iranian public finance was unsustainable in past. And to make it sustainable in future, the government should raise the production and taxes for budget affordance and consequently economic resilience which affects the government budget through smoothing the economic shocks.

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