Government Expenditure and Revenue Relation and Fiscal Sustainability in Iran

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Abstract

Economic and social development in developing countries are dependent on the government's ability to make enough revenue for providing necessary programs- service programs like health, training, transportation and communication. Therefore, the relationship between government revenue and expenditure in every country is a scale for measuring the level of development and growth. Data of 1970-2002 was used. At first we use unrestricted error correction model (UECM) that has been suggested by Pesaran et al for testing cointegration between government revenue and expenditure, then we use inter-temporal budget constrain (IBC) for fiscal sustainability. The results show that government revenue is changed to government expenditure quickly, but it takes long for government expenditure to change to government revenue, although there is no fiscal sustainability in Iran.

Introduction

Monetary and fiscal policies have direct and indirect important roles in government actions for spreading economic activities in unemployment periods, capacity surplus and decreasing activities when there is inflation and excess demand. When there is no regular and internal supervised monetary market in developing countries, these countries have to equip internal resources with fiscal policies. Economic and social development in developing countries are dependent on the government's ability to make enough revenue for providing necessary programs- service programs like health, training, transportation and communication.

In a developing country's economy, the government ownership share and government control are so high. Therefore, the correct use of internal saving and external resources for the projects of governmental investment and mobilizing and leading rare resources to domains that help more to reach long-run economic goals, preparing the

limited resources to ways that provide the more necessary constructional changes for a sustainable and symmetrical economic growth (17) and planning and investing on cases that they have are causes increase in productivity and producing income for government in developing countries economic are very necessary.

A lot of studies have been done on fiscal policies on the government roles for expending revenue to reaching the economic growth and development. Narayan (12) investigated evidence for cointegration and causality between government revenue and expenditure for nine Asian countries. Gupta and Verhoeven (10) assessed the efficiency of government expenditure on education and health in 37 countries in Africa in 1984-1995 with free disposal hull method (FDH). Garscia and Henin (8) have used a divariated VECM representation for the joint government revenue- government expenditure dynamics for five the main OECD countries. Santos Bravo and Silvestre (16) have tested sustainability performing an empirical analysis of co integration between public expenditure and revenue as ratios of GDP in 11 European Union members. Goyal and Khudrakam and Ray (9) have assessed the Indian fiscal trends in terms of inter-temporal budget constraint (IBC) for the central and state government separately. Abu-Bader and Abu-Bader (2) investigated the causal relationship between government expenditure and economic growth in Egypt, Israel and Syria. Folster and Henrekson (7) have studied on growth effects of government expenditure and taxation in OECD. Fetres (6) investigated the effects of the government monetary and fiscal policies on agriculture's value added, investment and export Bakhtiari and Haghi (4) have focused on the effects of increase in oil revenue on agriculture sector in Iran. Bakhshodeh (3) investigated on forecasting the elimination of government's interferences from wheat market and welfare effects of wheat liberalization in Iran.

With consideration on the point that government revenue has an important role in growth and development and the way that revenue changes to expenditure is more important, this study has focused on government revenue and expenditure relationship and finance sustainability in Iran.

Methodology

In this study we focus on government revenue and expenditure relationship and finance sustainability. For this aim Iran center bank data of 1970-2002 have been used. Variables were GE is the logarithmic of government expenditures to GDP ratio and GR is the logarithmic of government revenues to GDP ratio. All equations have been estimated by Microfit 4.0 Software. All variables are changed to constant of 1997.

Cointegration

Our sample is relatively small (33 observations). Therefore we use the bound testing approach to cointegration as it is suitable for small sample size (13) and were explored by Pesaran et al (13) to examine the long run relationship

between government revenue and expenditure. They suggested Unrestricted Error Correction Model (UECM) for testing co-integration between variables, and they showed this method is suitable for small sample. Pesaran et al suggested their method based on Auto Regressive Distributed Lag (ARDL), and separated it to section:

1- Co-integration test 2-estimate the long run coefficients. In first stage the relation between variables is tested and in the second stage the coefficients are estimated.

So ARDL model is changed to error correction model like below:

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \sum_{j=1}^{p} \Phi_j \Delta Y_{t-j} + \sum_{j=0}^{q} \beta_j \Delta X_{t-j} + \Psi_0 Y_{t-1} + \sum_{i=1}^{k} \Psi_i X_{i,t-1} + \varepsilon_t \qquad (1)$$

K is the number of variables. Δ Is the difference operator, α_0 is drift, α_1 is the time's coefficient, Φ and β are long run multipliers. The cointegration test hypothesis is:

$$H_0 : \Psi_i = 0 \qquad i=0, 1\ldots, k$$

If the null hypotheses is rejected, then there is long-run relation between variables, but is accepted there is not any long-run relationship between variables. The F-test which has a non- standard distribution depends upon: 1- the non-stationary properties of the data 2- the number of independent variables and 3- the sample size. The critical values are available in Pesaran and Pesaran (15) for 500 observations and Pesaran et al (14) for 1000 observations, but our sample is small, then we use the critical values that estimated by Narayan (12).

Two sets of critical values are generated. One set refers to I(1) series and the other for I(0) series. here, the critical values for I(1) series are referred to as the upper bound critical values while the critical values for I(0) series are referred to as the lower bound critical values. When the calculated F-statistic is greater than the upper bound critical values the null hypotheses of "no co-integration" is rejected, and when the calculated F-statistic is lower than the lower bound critical values the null hypotheses of "no cointegration" is accepted (1). The UECM method has several advantages over alternatives such as Engle-Gerenger and Johanson- Joselios methods, like below:

1- The variables can be I(0) or I(1).
2- It is really more suitable than another method for small sample size.
3- It can distinguish dependent and independent variables. For instance, by taking variable GR_t as a dependent variable and GE_t as an independent variable, if one finds that based on the bounds F-test there is cointegration between the variables then it implies that GR_t is the dependent variable in this relationship (12).

In this study, while the government revenue is independent variable, model is like below:

$$\Delta GR_t = \beta_0 + \Psi_{GR} GR_{t-1} + \Psi_{GE} GE_{t-1} + \sum_{i=1}^{p} \theta_i \Delta GR_{t-i} + \sum_{j=0}^{q} \phi_j \Delta GE_{t-j} + \varepsilon_t \quad (2)$$

That GE and GR are logarithmic government expenditure and revenue to GDP ratio, β_0 is drift, Ψ_{GE} and Ψ_{GR} are long-run coefficients, θ_i and ϕ_j are short-run coefficients.

But when government expenditure is the independent variable, the model becomes like below:

$$\Delta GE_t = \beta_0' + \Psi_{GE}' GE_{t-1} + \Psi_{GR}' GR_{t-1} + \sum_{i=0}^{p} \theta_i' \Delta GR_{t-i} + \sum_{j=1}^{q} \phi_j' \Delta GE_{t-j} + \varepsilon_t' \quad (3)$$

β_0' Is drift, Ψ_{GE}' and Ψ_{GR}' are long-run coefficients, θ_i' and ϕ_j' are short-run coefficients.

We don't use trend in this study because variables don't have a regular trend, and lags have been chosen by AIC. That has been selected p=2**.**

Granger Causality

There are a lot of methods for testing the causality between variables like Granger, Hisao and error correction methods. If variables aren't cointegrated, the Granger or Hisao are suitable. Granger proved when variables are cointegrated we can't use Granger or Hisao methods because they don't use error correction terms. Thus he formulated the causality equations in error correction models way (11). In this study we use the error correction models to distinguish the causality of variables.

Finance Sustainability

The term fiscal or debt sustainability perhaps implies a set of fiscal policies that could be continued unaltered without jeopardizing the economic policy objectives such as economic growth, price stability and external balance. Traditionally, the ability of the government to maintain its fiscal policies are measured in terms of $\frac{debt}{GDP}$ doesn't grow to explosive proportions over time. There are, however, alternative approaches to test the sustainability of debt. One approach is the steady-state Domar condition in which rate of growth of income must exceed the interest rate on public debt, subject to the condition that primary balance is either positive or zero. Measuring the sustainability of deficit from the Domar condition could be naive; after all, a $\frac{debt}{GDP}$ might be stable at 200%. However, this may be quite unsustainable. In order to get rid of such incredible outcomes, the standard approach in the literature is measuring inter-temporal budget constrain (IBC). In IBC approach, a sustainable debt would require

(4)

not only that $\frac{debt}{GDP}$ is stable in the future, but it must be ensured that the outstanding debt is finally repaid. Thus the gap between government revenue and expenditure is very important. If there is no cointegration between revenue and expenditure, the result is lack of sustainability (9). IBC approach:

$\Delta B_t = G_t - R_t - r_t B_t$

B_t is the government debt at the end of t, G_t is government expenditure interest payments, R_t is government revenue and r_t is the rate of interest payable on outstanding government debt at t. government is always faced with a similar constraint for period t+1,t+2,…., so expressing (4) as a ratio of GDP

$$\Delta b_t = e_t - T_t + \lambda b_{t-1} \tag{5}$$

Where

$$\lambda_t = \frac{(r_t - g_t)}{(1+g_t)} \qquad e_t = \frac{G_t}{Y_t} \quad \text{And} \quad T_t = \frac{R_t}{Y_t}$$

With this assume that λ_t is stationary around a mean λ_0, so equation 5 is changed to:

$$\Delta b_t = e'_t - T_t + \lambda b_{t-1} \tag{6}$$

Where

$e'_t = e_t + (\lambda_t - \lambda_0) b_{t-1}$

Iterating equation (6) forward yields:

$$b_t = \sum_{j=0}^{\infty} \gamma^{j+1} (T_{t+j} - e'_{t+j}) + \lim_{j \longrightarrow \infty} \gamma^{j+1} b_{t+j+1} \tag{7}$$

Where $\gamma^{j+1} = (1+\lambda)^{-(j+1)}$

Equation below from taking expectations in (7) is resulted:

$$b_t = E_t \sum_{j=0}^{\infty} \gamma^{j+1} (T_{t+j} - e'_{t+j})$$

Eq. (5) is equal with transversal condition, $E_t \lim_{j \longrightarrow \infty} \gamma^{j+1} b_{t+j+1} = 0$. Economic interpretation of the above condition is that for debt process to be sustainable, current debt must be equal to expected present value of future primary surplus.

So from eq. (7) we have $\Delta b_t = e_t^R - T_t = \sum_{j=0}^{\infty} \gamma^{j+1} (\Delta T_{t+j} - \Delta e'_{t+j}) + \lim_{j \longrightarrow \infty} \gamma^{j+1} b_{t+j+1}$ where

$e_t^R = e_t + \lambda b_{t-1}$ that it is government expenditure plus interest payments and $E_t \lim \gamma^{j+1} \Delta b_{t+j+1} = 0$. From eq. (7) we have for debt process to be sustainable, the current debt must be equal to the expected present value of future primary surpluses. So e_t^R and T_t can't deviate from each other over time. If e_t^R and T_t are I (1) so we must test Δb_t stationary.

So

$$T_t = \alpha + \beta e_t^R + \varepsilon_t \tag{9}$$

If e_t^R and T_t are I(1), but they are co-integrate, the null hypothesis for sustainability is $\beta = 1$. If we impose eq. (9) to (4) we have

$$\Delta b_{t+1} = (1 - \beta) e_t^R - \alpha - \varepsilon_t \tag{10}$$

If e_t^R is I(1) and $0 < \beta < 1$, we can conclude that Δb_t is I(0), and budget deficit is sustainable weakly. If $\beta = 1$ and government revenue and expenditure are co-integrate, ε_t is I(0). Then Δb_t is I(0) and budget deficit is sustainable strongly. If ε_t is not I(0) and $\beta = 1$, then sustainability is weak. When public debt is weakly sustainable, implying that the speed at which the inter-temporal borrowing constraint is satisfied is quite slow and is likely to result in higher growth rate of debt (16).

Measuring the Degree of Sustainability

At first the cointegration between e_t^R and T_t must be checked. If two variables are I(1) for measuring sustainability, variables must be checked like eq.15. If variable are not co-integrate, then budget deficit is not sustainable. But when variables are co-integrate, we must test null hypothesis $H_0 : \beta = 0$ opposite to $H_1 : \beta < 1$. If null hypothesis is accepted, then sustainability is strong, but if it rejects sustainability is weak. Table 1 shows the stage of sustainability:

TABLE 1: CO-INTEGRATION ANALYSIS AND DEGREE OF SUSTAINABILITY

β	Co- integration	Δb_t	Sustainability
1	Yes	I(0)	Strong
$0< \beta <1$	Yes	I(0)	Weak
- - - -	No	I(1)	Unsustainable

Reference: Goyal et al (10)

Results

Unit Root Test

Augmented Dickey – Fuller test (ADF) was used for stationary test of variables. Variables are non-stationary in level but their differences are stationary. Table (2) shows this test results.

TABLE 2: RESULTS OF ADF TEST

GR		DGR		GE		DGE	
ADF	CV	ADF	CV	ADF	CV	ADF	CV
-2.23	-2.9706	-2.24	-2.9706	-5.31*	-2.975	-5.86*	-2.975

*at 5% significance level

Estimate of Unrestricted Error Correction Model

The cointegration test in this study is based on UECM approach. F-statistic for our equations is compared with the critical values that have been supposed by Narayan (12) for 33 observations. When government revenue is the

independent variable, F is 5.8, while if it is independent variable, F is 53.3. They are bigger than the critical value in 5% and 1% level. Table 3 shows the critical values that have been suggested by Narayan (12).

TABLE 3: BOUND F-TEST FOR CO-INTEGRATION

N	%1		%5		%10	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
33	5.7630	6.48	3.957	4.53	3.233	3.757

Reference: Narayan (12)

Long Run Coefficient Estimation

Coefficients have been estimated by autoregressive distributed lag (ARDL). The results on long run coefficients are reported in table 4. We find that an increase in government expenditure has a statistically significant positive effect on government revenue and vice versa.

TABLE 4: LONG-RUN COEFFICIENT

Dependent variable	Long-run coefficient	t- statistics
GR	0.9577	5.8*
GE	1.42	5.38*

* at 1% significance level

Granger Causality Test Results

We use error correction model for causality, because GR and GE are co-integrate. ECM (-1) in table 5 is residual of long-run equation when GE is explanatory variable, and ECM (-1) in table 6 is residual of long-run equation when GR is explanatory variable. Table 5 shows GR is long-run and short-run causality. Speed of adjustment to equilibrium is significant in 1% level. Table 6 shows GE is long-run causality for government revenue but significant isn't high. On the other hand it is not true for short-run, because ΔGE coefficient isn't significant. Speed of adjustment to equilibrium is slow, thus government expenditure in the long run changes to government revenue.

TABLE 5: GRANGER CAUSALITY TEST RESULTS FOR VARIABLE GE

	ΔGR [t]	ECM(-1) [t]
ΔGE	0.73 1.71**	-0.93 -5.1*

* at 1% significance level

** at 5% significance level

TABLE 6: GRANGER CAUSALITY TEST RESULTS FOR VARIABLE GR

	ΔGE [t]	ECM(-1) [t]
ΔGR	0.803 1.48ns	-0.184 1.84*

* at 5% significance level

ns not significant

Sustainability of Finance

For testing if budget deficit is sustainable or not, at first, the cointegration between variable must be tested. In this study variables are I(1), but they are co-integrating, thus with the information in table 4 the null hypothesis $H_0 : \beta = 0$ \must be tested opposite of $H_1 : \beta \neq 0$. In the first row of table 4 when GR is dependent variable, t-statistic is 5.8 and so is significant. So we test null hypothesis $H_0 : \beta = 1$ opposite of $H_1 : \beta$ <1. So we have:

$$t = \frac{\beta - 1}{s(\beta)}$$

T-statistic according to equation above is 0.26, that we can reject the null hypothesis; so β is between zero and one. Budget deficit in Iran has weak sustainability and deficit in one year causes the deficit for next years. Continual growth of debt could increase interest rate, which might eventually create problems for marketing or rolling over of public debt in future. In other words, while fiscal stance of government is sustainable at least in the short- run, for long-run sustainability government needs to other its fiscal policies to prevent any adverse repressions (9).

Conclusions

The main aim of this study has been exploring on government revenue and expenditure relationship and the degree of fiscal sustainability for 1970-2002. To test the cointegration between variables, we use the UECM. The results of this model showed that variables are co-integrate in 5% significant level. After that the Granger causality was tested. The results showed that government revenue is changed so fast to government expenditure, while it takes a long time for government expenditure to change to government revenue. On the other hand fiscal sustainability in Iran is weak, thus persevering budget deficit becomes a cause of increase in interest rates, has negative effect on market mechanism, and becomes the budget deficit in the next periods. With these results, it is suggested that the government revenue must expend in subtraction sectors, because investing in subtractions causes increase in productivity and increase in government revenue. Government should decrease expenditure in consumption matters, because they don't have revenue for government. Decrease in government incumbency and decrease in government volume can decrease from massive government expenditure in matters. The results showed that there is no fiscal sustainability in Iran. Therefore, we suggest that the experts must consider to the effect of fiscal policy's results for various matters for a long period, not just for one year, because the budget deficit in one year becomes budget deficit in next years. To reach on the sustainable fiscal, fiscal policies must enact in that manner, which budget deficit in one year doesn't become the budget deficit in the next years and revenue must grow faster than expenditure, because continual debt for many years becomes cause for increasing interest rates and problems for market mechanism.

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