GOVERNMENT SIZE AND ECONOMIC GROWTH IN IRAN
Mohsen Mehrara
Faculty of Economics, University of Tehran, Tehran, Iran
Email: mmehrara@ut.ac.ir
AliReza keikha
Faculty of agriculture, University of zabol, Iran
alirezakeikha@gmail.com

Abstract
The Armey curve shows that there is a non-linear relationship between government size and economic growth. This paper uses threshold regression model to study relationship between government size and economic growth during 1967-2007 in Iran. The results show that linear methods are not capable to explain the relationship between government expenditure (including investment expenditure, consumption expenditure and total expenditure) and economic growth. The findings indicate government expenditure has positive effect on economic growth, but after crossing a threshold, this effect turn reversed. The thresholds are estimated 22.8% for total expenditure ratio, 9.8% for investment expenditure and 12.9% for consumption expenditure. The ratio of consumption expenditure is far away the threshold in 2007. Therefore, reconsidering in quantity, quality and efficiency of this expenditure is necessary.

JEL classification:

Keywords: government expenditure; economic growth; threshold regression model

1. Introduction
Different theories about the role of government in the economy are expressed through economic history. Keynes makes out Capitalist regime from Great Depression of 1929 by this recommendation: more government intervention in the economy. Since then, the question "Are you in favor the government or the market?" is obsolete because both market without government and government without market suffer from market or government failure. Now, another question must be answered "where and how does government intervene in the economy?" or" What is the optimal size of the government?" Obviously, the optimal size of each country is different because different countries have different institutions. The reasons of government existence have been revised many times over the past century.

Changing attitudes will change the roles of government and thus they will alter the size and composition of government expenditure. In the context of these attitudes, there are factors that can explain the change of government size across countries and over time. Among these factors can be pointed to per capita income, openness, Degree of urbanization, Demographic variables and Political Rights (Gunalp, 2005).

The purpose of this study is to find the optimum size of government by threshold model. The optimum size is the threshold beyond that the government expenditure has a negative effect on economic growth. There is an example for negative effect of government size, crowding out effect that can prevent the activity of private sector. In this study, two important hypotheses will be reviewed: a. there is a non-liner relationship between government size and economic growth b. The size of government in Iran is higher than optimal size.
This paper is classified into five sections: the first section is the introduction which presents the papers incentives and purpose; the second section is the review of literature; the third section is the model and methodology; the fourth section is the empirical result; and the final section is the conclusion.

2. Review of literature

Extensive studies have been conducted on the effects of government size on economic growth that the first study is Myrdal research in 1960. He believed that government intervention can exacerbate economic growth because government intervention can reduce Social inequality. Kaldor (1966) also showed that government intervention has positive impact on the growth and long-run productivity and Emphasized that increased government expenditure has a positive effect on economic growth. There is another opinion that approves of expanding government size which will promote economic growth. For instance, Ram (1986), Kormendi and Meguire (1986), Caner (2001), chen (2005), find a positive relationship between government size and economic growth. They write that expanding government size provides an insurance function to private property, and public expenditure can encourage private investment which will cause economic growth. Government expenditure provides the investment of public goods that will improve the investment environment.

The traditional Keynesian model indicates that the expansion of government size may resist a recession. However, there is an ongoing debate on the effects of government size on economic growth. Landau (1983), Engen and Skinner (1991), Folster and Henrekson (2001), and Dar and AmirKhalkhali (2002) find a negative relationship between government size and economic growth. They believe that expanding government size has the effect of a decreasing return of government expenditure and over-expanding government size will cause a crowded effect to private investment. In addition, government expenditure often turns into inefficient expenditure which will cause a distorted allocation to the resource. When expanding government expenditure, a government needs more taxes to support the expenditure, but expanding taxes will damage the economy.

Lin (1994), Vedder and Gallaway (1998), and Gwartney, Lawson, and Holcombe (1998) use different government size indicators to discuss the relationship between government size and economic growth. Vedder and Gallaway (1998) provide five classifications of government size to test and find that the Armey curve exists only while the government size variable is “total government expenditure/GDP” and “net investment expenditure/GDP”.

Gwartney et al. (1998) indicate that different government size indicators all have negative impacts to economic growth. Lin (1994) uses “government consumption expenditure/GDP” and “government nonproduction expenditure/GDP” as government size indicators and finds that the two indicators of government size both have a positive impact to economic growth in the short run. However, Lin (1994) indicates that the contribution of government consumption expenditure will be less than the contribution of government investment expenditure, because government investment expenditure has the encouraging effect to private investment. Sameti (1993) has analyzed the relationship between government size and economic growth in Iran and concluded that government size isn't appropriate.
3. Model and methodology

Ram (1986) indicates that production \((Y)\) can be classified into two sectors: one is the government sector \((G)\) and the other is the non-government sector \((C)\). The production functions of both sectors are indicated as follows:

\[
Y = C + G \tag{1}
\]

\[
C = C(L_C, K_C, G) \tag{2}
\]

\[
G = G(L_G, K_G) \tag{3}
\]

\[
L = L_C + L_G \tag{4}
\]

\[
K = K_C + K_G \tag{5}
\]

\[
\frac{G_L}{C_L} = \frac{G_K}{C_K} + 1 + \delta \tag{6}
\]

Equation (2) indicates the production function of the non-government sector and equation (3) is the production function of the government sector. Equation (1) provides that total output \((Y)\) is the sum of \(C\) and \(G\), and equation (4) shows that the total labor force \((L)\) is the sum of the non-government labour input \((L_C)\) and government labour input \((L_G)\). In addition, equation (5) indicates that the total capital stock \((K)\) is the sum of non-government sector capital input \((K_C)\) and government sector capital input \((K_G)\). Moreover, equation (2) says that the government sector output \((G)\) will create an externality effect to non-government sector output \((C)\). In order to understand the difference of the marginal production between the factors’ input in the two sectors, in equation (6), \(G_L = \frac{\partial G}{\partial L}\) indicates the marginal production of labor input in the government sector; \(C_L = \frac{\partial C}{\partial L}\) indicates the marginal production of labor input to the non-government sector; \(G_K = \frac{\partial G}{\partial K}\) is the marginal productivity of capital input in the government sector; and \(C_K = \frac{\partial C}{\partial K}\) is the marginal productivity of capital input in the non-government sector. Here, \(\delta\) indicates the difference of marginal production between the factors’ input in the two sectors, while \(\delta > 0\) indicates that marginal productivity of the government sector is higher than the non-government sector, and \(\delta < 0\) indicates the opposite result.

We totally differentiate equations (2) and (3) and put the result into equations (1) and (4), which are total differentials. From equation (6), we can then conclude that:

\[
dY = C_L dL + C_K dK + C_G dG + \frac{\delta}{1+\delta} dG \tag{7}
\]

We next divide equation (7) by \(Y\) and find the equation as follows:

\[
\frac{dY}{Y} = (\frac{C_L}{Y} dL_Y + \frac{C_K}{Y} dK_Y) + \frac{\delta}{1+\delta} + C_G (\frac{dG}{G_Y}) (G/Y) \tag{8}
\]

Or

\[
g_T = B_1 g_L + B_2 (SI) + B_3 (GG) (SG) \tag{9}
\]

In the equation (8), \(C_G\) indicates the marginal externality effect which comes from the production of the government sector imposed on the production of the non-government sector and \(\frac{\delta}{1+\delta}\) indicates the direct effect of government sector on economic growth. Equation (9) shows that the variables which effect economic growth \((g_T)\) include the investment rate \((SI)\),
labour force growth \( (g_L) \), and the multiple effects of the growth of government expenditure \((GG)\) and government size \((SG)\). In addition, we identify the multiple effects through the sign of \(B_3\). This indicates that the government sector has a reciprocal effect on economic growth through two ways: one is the direct contribution of the government sector and the other is the indirect effect of government sector through the non-government sector (externality effect).

Equation (9) is a traditional linear economic growth model and in the empirical analysis of Vedder and Gallaway (1998) they find that economic growth and government size have a non-linear relation. Based on this idea, we alter the linear model of Equation (9) into the two regime TAR model of Hansen (1996, 2000). The model can be shown as follows:

\[
g_Y = B_{10} + B_{11}(SI) + B_{12}g_L + B_{13}(GG)(SG) + \varepsilon_{1T} \quad \text{if } q_t \leq \gamma
\]  
(10)

\[
g_Y = B_{20} + B_{21}(SI) + B_{22}g_L + B_{23}(GG)(SG) + \varepsilon_{2T} \quad \text{if } q_t > \gamma
\]  
(11)

The term \(q_t\) is the threshold variable which divides all the observations into two groups, \(\varepsilon_{1T}\) is the error term, and \(\gamma\) is the threshold value. The above model indicates that while the threshold variable is smaller than the threshold value, the regression equation is shown as equation (10). When the threshold variable is greater than the threshold value, the regression equation is shown as equation (11). Assume that the dummy variable \(I_q(\gamma) = \{q_t \leq \gamma\}\) and that \{·\} is an indicator function: As \(q < \gamma\), then \(I = 1\), or otherwise \(I = 0\). Then, equations (10) and (11) can be rewritten as follows:

\[
g_Y = \begin{cases} 
B_{10} + B_{11}(SI) + B_{12}g_L + B_{13}(GG)(SG) & \text{if } q_t \leq \gamma \\
B_{20} + B_{21}(SI) + B_{22}g_L + B_{23}(GG)(SG) & \text{if } q_t > \gamma
\end{cases}
\]  
(12)

The subject of this paper is Iran, and the annually data used are from 1967 to 2007. The data come from the database of the statistical abstract of the national income in Iran and the annually bulletin of the central bank of Iran. In order to test if the Armey curve exists in Iran or not, we apply "government expenditure divided by GDP" as the threshold variable. In order to analyze that different government expenditure variables will cause different results, we classify government expenditure into three categories: investment expenditure, consumption expenditure, and total expenditure. In this study, liner and non-liner models (equation 9&12) are estimated for total government expenditure growth \((GG_1)\), government investment expenditure growth \((GG_2)\) and government consumption expenditure growth \((GG_3)\) respectively. Also in tables 1to8, \(SG_i\) denotes "total government expenditure/GDP", \(SG_2\) is "government investment expenditure/GDP", and \(SG_3\) is "government consumption expenditure/GDP".

4. The Empirical Results

This paper uses Hansen (1996, 2000) and Enders (2004) threshold regression model to study whether a non-linear Armey curve exists in Iran. As table 1&2 shows, we adopt Enders & Hansen advice to use the bootstrapping model to test linearity hypothesis (table 1) and to find threshold values for \(SG_1, SG_2\) and \(SG_3\).
Table 1. Bootstrap results for linearity test

<table>
<thead>
<tr>
<th>Threshold variables</th>
<th>F-value</th>
<th>The critical values at 1%</th>
<th>The critical values at 5%</th>
<th>The critical values at 10%</th>
<th>results</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG₁</td>
<td>9.233</td>
<td>1.211</td>
<td>1.152</td>
<td>1.088</td>
<td>Reject null hypothesis(linearity)</td>
</tr>
<tr>
<td>SG₂</td>
<td>10.452</td>
<td>1.136</td>
<td>1.062</td>
<td>1.025</td>
<td>Reject null hypothesis(linearity)</td>
</tr>
<tr>
<td>SG₃</td>
<td>3.564</td>
<td>1.652</td>
<td>1.216</td>
<td>1.091</td>
<td>Reject null hypothesis(linearity)</td>
</tr>
</tbody>
</table>

Table 2. Confidence interval for threshold variables

<table>
<thead>
<tr>
<th>Threshold variables</th>
<th>Lower confidence interval</th>
<th>Upper confidence interval</th>
<th>Threshold values</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG₁</td>
<td>0.18</td>
<td>0.30</td>
<td>0.228</td>
</tr>
<tr>
<td>SG₂</td>
<td>0.75</td>
<td>0.11</td>
<td>0.098</td>
</tr>
<tr>
<td>SG₃</td>
<td>0.07</td>
<td>0.15</td>
<td>0.129</td>
</tr>
</tbody>
</table>

As table 1 show, null hypothesis of linearity is rejected in all significant levels (90%, 95% and 99%). We also conclude that specification 12 (equation 12) has threshold value for all three threshold variables: $SG₁$ (total government expenditure/GDP), $SG₂$ (government investment expenditure/GDP) and $SG₃$ (government consumption expenditure/GDP). After making sure that the three classifications of government size all have threshold effects and achieve the threshold regimes, we analyze the linear and non-linear government expenditure effects in different government sizes and discuss how the government expenditure effects influence the economic growth in different threshold regimes.

4.1 The estimation of linear model (equation 9)

In this section, we estimate linear equation 9 for three different government sizes. Results are shown in tables 3 to 5, respectively.

As table 3 shows, total government expenditure has a significantly positive relationship with economic growth (the coefficient of this variable is 0.316). Moreover, the investment ratio has a significantly negative (the coefficient of this variable is -0.342) impact to economic growth and the labor force growth hasn’t any significant impact on economic growth (the coefficient of this variable is -1.104). The result of evaluation criteria and diagnostic test show that the estimation of liner model isn’t satisfactory and non-liner specification probability is enhanced.

As table 4, 5 shows, the estimation of linear model 9 isn't satisfactory for government investment expenditure and government consumption expenditure. The impact of most variables on economic growth isn’t satisfactory. These results show that liner model can't analysis the impact of government expenditures (government size) on economic growth.
The result of the estimation linear model (equation 9) for total expenditure

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\alpha_0$</th>
<th>SI</th>
<th>GL</th>
<th>GG1* SG1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>0.125</td>
<td>-0.342</td>
<td>-1.104</td>
<td>0.316</td>
</tr>
<tr>
<td>$t$</td>
<td>3.142***</td>
<td>-2.207**</td>
<td>-1.07</td>
<td>3.16***</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.04</td>
<td>0.155</td>
<td>1.03</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Evaluation criteria: $r^2 = 0.218$, RSS = 0.175, AIC = -2.55, SBC = 2.39, DW = 1.255

Diagnostics test: $AR, \chi^2 = 2.125$, Reset = 10.82***, HET = 1.89*, NORM = 7.615*

Notes: ***, ** and * denote significance at 1%, 5% and 10% levels, respectively, $AR, \chi^2$ is used for serial correlation test, reset test (Ramsey's reset test) is used for specification test, norm test is used for residual normality test and white het test is used for heteroscedasticity test.

The result of the estimation linear model (equation 9) for investment expenditure

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\alpha_0$</th>
<th>SI</th>
<th>GL</th>
<th>GG2* SG2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>0.12</td>
<td>-0.26</td>
<td>-1.07</td>
<td>1.38</td>
</tr>
<tr>
<td>$t$</td>
<td>2.68**</td>
<td>-1.52</td>
<td>-0.94</td>
<td>0.79</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.04</td>
<td>0.17</td>
<td>1.14</td>
<td>1.75</td>
</tr>
</tbody>
</table>

Evaluation criteria: $r^2 = 0.07$, RSS = 0.175, AIC = -2.34, SBC = -2.18, DW = 1.14

Diagnostics test: $AR, \chi^2 = 3.42$, Reset = 14.82***, HET = 2.62*, NORM = 9.1*

The result of the estimation linear model (equation 9) for consumption expenditure

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\alpha_0$</th>
<th>SI</th>
<th>GL</th>
<th>GG3. SG3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>0.114</td>
<td>-0.23</td>
<td>-1.028</td>
<td>7.64</td>
</tr>
<tr>
<td>$t$</td>
<td>2.56**</td>
<td>-1.362</td>
<td>-0.9</td>
<td>2.70***</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.044</td>
<td>0.167</td>
<td>1.144</td>
<td>0.076</td>
</tr>
</tbody>
</table>

Evaluation criteria: $r^2 = 0.07$, RSS = 0.08, AIC = -2.34, SBC = -2.18, DW = 1.19

Diagnostics test: $AR, \chi^2 = 2.42$, Reset = 12.82***, HET = 3.62*, NORM = 6.1*

Notes: ***, ** and * denote significance at 1%, 5% and 10% levels, respectively, $AR, \chi^2$ is used for serial correlation test, reset test (Ramsey's reset test) is used for specification test, norm test is used for residual normality test and white het test is used for heteroscedasticity test.
4.2 The estimation of non-liner model (equation 12)
In this section, non-liner model (equation 12) is estimated for three different government sizes (three threshold variables: $SG_1$, $SG_2$ and $SG_3$). According to equation 12, if the size of government is less than threshold ($\gamma$) then $SI$, $gL$ and $GGSG$ affect economic growth with the $B_{11}$, $B_{12}$ and $B_{13}$ coefficients, respectively. But if the government size is higher than threshold ($\gamma$) then the coefficients are $B_{21}$, $B_{22}$ and $B_{23}$, respectively.

As table 6 shows, if the threshold variable is $SG_1$ (total government expenditure/GDP) then threshold value for government size is %22.83. When government size is less than threshold value (less than %22.83), total government expenditure has a positive relationship with economic growth (0.066) and when government size is higher than threshold value (higher than %22.83), this relationship become negative (-0.049). This result is consistent with army curve theory and could be due to the crowding out effect of government expenditure increasing. Labor force growth has a significantly positive effect on economic growth in both regimes. Investment ratio has a significantly positive effect on economic growth when government size is small than threshold value (0.041) and it hasn’t any significant effect on economic growth when government size is higher than threshold value.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Government size is small</th>
<th>Government size is large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold value</td>
<td>$SG_1 \leq 22.83$</td>
<td>$SG_1 &gt; 22.83$</td>
</tr>
<tr>
<td>Interception</td>
<td>0.028(0.255)</td>
<td>0.027(0.078)</td>
</tr>
<tr>
<td>$SI$</td>
<td>0.05(1.086)</td>
<td>0.066(4.44)**</td>
</tr>
<tr>
<td>$GL$</td>
<td>0.67(10.39)**</td>
<td>0.623(3.77)**</td>
</tr>
<tr>
<td>$GGSG$</td>
<td>-0.049(-2.15)**</td>
<td>0.066(4.44)**</td>
</tr>
</tbody>
</table>

Table 6. The result of the estimation non-liner model (equation 12) for total government expenditure

Threshold variables is total government expenditure/GDP, values given in parenthesis denoted t-values, ***, ** and * denote significance at 1%, 5% and 10% levels, respectively and this table shows the regression results of government size (total government expenditure/GDP) and economic growth.

As table 7 shows, if the threshold variable is $SG_2$ (government investment expenditure/GDP) then threshold value for government size is %9.87. When government size is less than threshold value (less than %9.87), government investment expenditure has a positive relationship with economic growth (1.037) and when government size is higher than threshold value (higher than %22.83), this relationship became negative (-0.459). Then as previous case, we accept army curve theory for government investment expenditure.

Table 7. The result of the estimation non-liner model (equation 12) for government investment expenditure
As table 8 shows, if the threshold variable is $SG_3$ (government consumption expenditure/GDP) then threshold value for government size is 12.95. Increase government consumption expenditure has a significantly positive impact on economic growth (0.816) when this expenditure is less than threshold value (government size is less than 12.95). But when the government consumption expenditure is higher than threshold value, the relationship between economic growth and government size became negative (-0.061). As before, labor force growth has a significantly positive impact on economic growth in both regimes. Investment ratio has a significantly positive effect on economic growth when government size is small than threshold value (0.816) and it hasn’t any significant effect on economic growth when government size is higher than threshold value.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Government size is large</th>
<th>Government size is small</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold value</td>
<td>$SG_2 &gt; 9.87$</td>
<td>$SG_2 \leq 9.87$</td>
</tr>
<tr>
<td>Interception</td>
<td>4.724(5.441)***</td>
<td>1.702(3.55)***</td>
</tr>
<tr>
<td>SI</td>
<td>0.036(0.206)</td>
<td>0.384(1.984)**</td>
</tr>
<tr>
<td>GL</td>
<td>1.487(4.112)***</td>
<td>1.911(6.186)***</td>
</tr>
<tr>
<td>GG2, SG2</td>
<td>-0.459(-1.065)</td>
<td>1.039(3.254)***</td>
</tr>
</tbody>
</table>

Threshold variables is government investment expenditure/GDP, values given in parenthesis denote t-values, *** and ** denote significance at 1%, 5% and 10% levels, respectively and this table shows the regression results of government size (government investment expenditure /GDP) and economic growth.

Table8. The Result of the estimation of non-linear model (equation 12) for government consumption expenditure

<table>
<thead>
<tr>
<th>Variables</th>
<th>Government size is large</th>
<th>Government size is small</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold value</td>
<td>$SG_3 &gt; 12.95$</td>
<td>$SG_3 \leq 12.95$</td>
</tr>
<tr>
<td>Interception</td>
<td>3.101(5.92)***</td>
<td>1.614(1.44)</td>
</tr>
<tr>
<td>SI</td>
<td>0.21(0.59)</td>
<td>0.816(2.436)***</td>
</tr>
<tr>
<td>GL</td>
<td>1.297(3.182)***</td>
<td>2.33(6.829)***</td>
</tr>
<tr>
<td>GG3, SG3</td>
<td>-0.061(-1.92)**</td>
<td>0.816(2.95)***</td>
</tr>
</tbody>
</table>

Threshold variables is government consumption expenditure/GDP, values given in parenthesis denote t-values, *** and ** denote significance at 1%, 5% and 10% levels, respectively and this table shows the regression results of government size (government consumption expenditure /GDP) and economic growth.

5. Conclusion

This paper tests non-linear Armey curve in Iran inspired by Armey (1995) and Vedder and Gallaway (1998). We modify two sector production model suggested by Ram (1986) into a threshold regression model and apply Hansen (1996, 2000) method to test the threshold effect. The empirical results indicate that threshold effects exist between government size and economic growth for Iran in which government sizes is determined as the threshold variable. First, if “total government expenditure divided by...
GDP” is the threshold variable, the threshold is estimated 22.8%, implying that there is a non-linear relationship as the Armey curve. When the government size is smaller than the threshold, economic growth is promoted by expanding government expenditure, but if the government size is larger than the threshold, then the economic growth decreases with more government expenditure. Secondly, when “government investment expenditure divided by GDP” is selected as the threshold variable, the threshold is estimated 9.8%. Finally, when “government consumption expenditure to GDP” is the threshold variable, it is estimated 12.9%.

The negative impact of government size enlarging could be due to two reasons: 1. crowding out effect that means increase in government expenditure crowds out private investment expenditure, 2. diminishing returns of excess government activities causes non-optimal allocation of resources in economy and it’s detrimental to economic growth. Thus, it should be investigated whether government is over-sized or not when designing its public fiscal policy. If the government is over-size it should shrink its government size to increase the efficiency of government expenditures and promote economic growth.

References