

The Asymmetric Effects of Labor Force Growth on Economic Growth in Iran; New Evidence with Non Linear Approach

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Abstract: This paper surveys the asymmetric effects of labor force growth on economic growth in Iran. To this end, using two sectors Ram (1986) model and using threshold regression, we result that the labor force growth until the unemployment rate is less than 12% has a positive effect on economic growth, but labor force growth when the unemployment rate is larger than 12% has a negative effect on the growth.

Key words: labor force growth, economic growth, threshold regression JEL Classification: E62, O40, C221.

INTRODUCTION

This paper has discussed the idea that the effect of labor force growth on economic growth is asymmetrical, which means that the effect of labor force growth on economic growth has a positive effect in low unemployment's regime and has a negative effect in high unemployment's regime.

The assumptions in this paper are:

1. There is a non-linear relationship between labor force growth and economic growth in Iran.
2. The unemployment rate has a threshold value that increasing in labor force growth before this threshold value has a positive effect on economic growth but increasing in labor force growth after this threshold value has a negative effect on economic growth in Iran.

2. Model specification:

We have used the Ram (1986) model as following:

$$\dot{Y}_t = \beta_0 + \beta_1 \left(\frac{I_t}{Y_t}\right) + \beta_2 g_{L_t} + \beta_3 g_{G_t} \left(\frac{G_t}{Y_t}\right) + e_t \quad (1)$$

Regression (1) shows that the variables which affect economic growth (\dot{Y}) include the investment rate ($\frac{I}{Y}$), growth of labor force (g_L), and the multiplication effects of government expenditure growth (g_G) times government size (G/Y). In addition, we identify the multiplication effects through the sign of β_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 through the non-government sector (externality effect).

Regression (1) is a traditional linear economic growth model, but we alter the linear model into the two regime TAR model of Hansen (1996, 2000). The model can be shown as follows:

$$\begin{cases} \dot{Y}_t = \delta_{10} + \delta_{11} \left(\frac{I_t}{Y_t}\right) + \delta_{12} g_{L_t} + \delta_{13} g_{G_t} \left(\frac{G_t}{Y_t}\right) + e_t & \text{if } q_t \leq \gamma \\ \dot{Y}_t = \delta_{20} + \delta_{21} \left(\frac{I_t}{Y_t}\right) + \delta_{22} g_{L_t} + \delta_{23} g_{G_t} \left(\frac{G_t}{Y_t}\right) + e_t & \text{if } q_t > \gamma \end{cases} \quad (2)$$

Or as one nonlinear regression such as:

$$\dot{Y}_t = \left(\delta_{10} + \delta_{11} \left(\frac{I_t}{Y_t} \right) + \delta_{12} g_{L_t} + \delta_{13} g_{G_t} \left(\frac{G_t}{Y_t} \right) \right) I[q_t \leq \gamma] + \left(\delta_{20} + \delta_{21} \left(\frac{I_t}{Y_t} \right) + \delta_{22} g_{L_t} + \delta_{23} g_{G_t} \left(\frac{G_t}{Y_t} \right) \right) I[q_t > \gamma] + e_t \tag{3}$$

The threshold value γ can be found by estimating the regression (3) through finding the minimum Error Sum of Squared in a re-order threshold variable. The threshold variable can be set by the exogenous variables out of the theoretical model. For example, in this paper we set unemployment rate as the threshold variable. We can also apply the statistic coming from the threshold variable. For instance, we adopt the heteroskedasticity-consistent Lagrange multiplier (LM) of Hansen (1996) to test the null hypothesis of the linear assumption.

Once the estimator can be found, we then start with the statistical test, but the test procedure of Regression (3) is different from the traditional test. Under the null hypothesis of no threshold effect, the threshold parameters will be unidentified. This will cause the traditional test statistic in a large sample distribution to not belong to the χ^2 distribution, but rather to a non-standard and non-similar distribution which is affected by nuisance parameters. This will cause the critical value of the distribution to not be estimated through simulation. In order to overcome the difficulty, Hansen (1996) uses a statistic of his own large sample distribution function to transfer and calculate the asymptotic p-value of a large sample. Under the null hypothesis, the distribution of the p-value statistic is uniform, and this kind of transformation can be calculated through bootstrap. The null hypothesis to test Reg. (3) is as follows:

$$H_0 : \delta_{1i} = \delta_{2i}; \quad i = 1, 2, 3. \tag{4}$$

If H_0 is not rejected then the relationships between economic growth and the government size would be the linear regression as the regression (1). This means there exist no threshold effect. Otherwise, if H_0 hypothesis is rejected, it means that there exist different effects between the two regimes of δ_{1i} and δ_{2i} . The F-test statistics is as follows:

$$F_1 = \frac{RSS_0 - RSS_1(\hat{Y})}{\hat{\sigma}^2} \tag{5}$$

In which RSS_0 and RSS_1 are the residual sum of squares under the null hypothesis and the alternative, respectively.

Data Description:

The resent socio-economic history of Iran has been subject to the past and political-strategic volatility of the region. Iran has not experienced a relatively free market economy due to the share of oil revenue at large. We have intended to use the annual data from 1959 to 2005 available on the Website database of the Central Bank of Iran (CBI).

Empirical Results:

This paper uses Hansen (1996, 2000) threshold regression model to study whether a non-linear relationship between labor force growth and economic growth exists in Iran. As Table 1 shows, we adopt Hansen (1996, 2000) advice to use the bootstrapping model. While the threshold variable is “unemployment rate”, we find that F-statistic is (9.46), which is significant at 1% level. The threshold value is 12%, and this means that one threshold exists. After making sure that the unemployment rate has threshold effects and achieve the threshold regimes, we analyze the linear and non-linear labor force growth effects in different unemployment rate regimes and discuss how the labor force growth affects the economic growth in different threshold regimes.

Table 1: Threshold Tests

<i>Threshold Variables</i>	<i>Unemployment rate</i>	<i>P-value</i>
F value of threshold test	9.46	0.00
Threshold regime (%)	12%	

Table 2: Economic Growth and Labor Force Growth

Variables	Linear Model		Unemployment rate			
	Coefficient	prob	≤0.12	prob	>0.12	prob
Threshold value (%)						
Interception	-0.04	0.51	-0.04	0.51	-0.09	0.33
I/ Y	0.1288	0.25	-0.15	0.43	0.69	0.00
g_L	-0.5942	0.46	3.28	0.00	-4.23	0.02
$(g_G)(GS)$	0.4539	0.01	0.72	0.00	-0.28	0.95
R^2	0.1792				0.7162	
Ramsey reset (p-value)	0.00				0.72	
Jarque-Bera (p-value)	0.31				0.33	

As table 2 shows, while “unemployment rate” is the threshold variable, labor force growth has not a significant effect on economic growth in the linear model. Since the unemployment rate is small (the threshold value is less than 0.12) in two-regime model, labor force growth and economic growth have a significantly positive relationship, but when the unemployment rate is large (the threshold value is larger than 0.12), labor force growth and economic growth have a significantly negative relationship. Thus, we can make sure that the non-linear situation exists in Iran when “unemployment rate” is the threshold variable. The investment ratio also has a significantly positive impact on economic growth concerning both of the two unemployment regimes. The investment ratio also has a significantly positive impact on economic growth in high unemployment regime and this variable has not a significantly effect on economic growth in linear model and the multiplication effects of government expenditure growth (g_G) times government size (G/Y) has a positive effect on economic growth in linear model but this variable has a positive effect on economic growth in low unemployment regime and it has not a significantly effect on economic growth in high unemployment regime.

Conclusion:

We have tested the presence of a non-linear relationship between labor force growth and economic growth in Iran. Doing so, we have modified the Ram (1986) two-sector production model into a threshold regression model and apply Hansen (1996, 2000) method to test the threshold effect. The empirical results indicate that threshold effect exist in unemployment rate in Iran. Concerning the “unemployment rate” as the threshold variable, the threshold regime is 12%. This indicates that when the unemployment rate is smaller than the regime, economic growth is promoted under expanding labor force growth, but if the unemployment rate is larger than the regime, then the economic growth decreases.

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