Threshold Unemployment Rate, Labor Force Growth and Economic Growth; New Evidence from Iran and Pakistan Economies

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Abstract: The aim of this paper is considering the threshold effects of labor force growth on economic growth in Iran and Pakistan economies at 1959-2007 periods. We have used the two sectors Ram growth model and threshold regression approach. Results for Iran and Pakistan economies indicate that the labor force growth until the unemployment rate is less than the threshold value has a positive effect on economic growth, but labor force growth when the unemployment rate is larger than the threshold value has a negative effect on the economic growth in these countries.

Key words: Threshold Unemployment Rate, Labor Force Growth, Economic Growth, Threshold Regression, Iran, Pakistan

INTRODUCTION

Economic growth is an increase (or decrease) in the value of goods and services that a geographic area produces and sells compared to an earlier time. If the value of an area's goods and services is higher in one year than the year before, it experiences positive growth, usually simply called "economic growth." In a year when less value than the year before is produced and sold, it experiences "negative economic growth," also called "recession" or "depression."

The modern conception of economic growth began with the critique of Mercantilism, especially by the physiocrats and with the Scottish Enlightenment thinkers such as David Hume and Adam Smith, and the foundation of the discipline of modern political economy. The theory of the physiocrats was that productive capacity, itself, allowed for growth and the improving and increasing capital to allow that capacity was "the wealth of nations". Whereas they stressed the importance of agriculture and saw urban industry as "sterile", Smith extended the notion that manufacturing was central to the entire economy.

David Ricardo argued that trade was a benefit to a country, because if one could buy a good more cheaply from abroad, it meant that there was more profitable work to be done here. This theory of "comparative advantage" would be the central basis for arguments in favor of free trade as an essential component of growth.

The notion of growth as increased stocks of capital goods (means of production) was codified as the Solow-Swan Growth Model, which involved a series of equations which showed the relationship between labor-time, capital goods, output, and investment. According to this view, the role of technological change became crucial, even more important than the accumulation of capital. This model, developed by Robert Solow (1956) and Trevor Swan (1956), was the first attempt to model long-run growth analytically. This model assumes that countries use their resources efficiently and that there are diminishing returns to capital and labor increases. From these two premises, the neoclassical model makes three important predictions. First, increasing capital relative to labor creates economic growth, since people can be more productive given more capital. Second, poor countries with less capital per person will grow faster because each investment in capital will produce a higher return than rich countries with ample capital. Third, because of diminishing returns to capital, economies will eventually reach a point at which any increase in capital will no longer create economic growth. This point is called a "steady state".

The model also notes that countries can overcome this steady state and continue growing by inventing new technology. In the long run, output per capital depends on the rate of saving, but the rate of output growth should be equal for any saving rate. In this model, the process by which countries continue growing despite the diminishing returns is "exogenous" and represents the creation of new technology that allows production with fewer resources. Technology improves, the steady state level of capital increases, and the country invests and grows. The data does not support some of this model's predictions, in particular, that all countries grow at the same rate in the long run or that poorer countries should grow faster until they reach their steady state. Also, the data suggests the world has slowly increased its rate of growth.

This paper has discussed that the effect of labor force growth on economic growth is asymmetric, 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 and Pakistan.
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 these countries.

**Model Specification:**

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

$$\hat{Y}_t = \beta_0 + \beta_1 \left( \frac{L}{Y_t} \right) + \beta_2 g_L + \beta_3 g_G + e.$$  \hspace{1cm} (1)

Regression (1) shows that the variables which affect economic growth ($\hat{Y}_t$) include the investment rate ($\frac{L}{Y_t}$), 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 $\beta_3$. 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 (2000). The model can be shown as follows:

$$\begin{align*}
\hat{Y}_t &= \alpha_0 + \delta_1 \left( \frac{L}{Y_t} \right) + \delta_2 g_L + \delta_3 g_G + e, & \text{if } q_t \leq \gamma \\
\hat{Y}_t &= \alpha_0 + \delta_4 \left( \frac{L}{Y_t} \right) + \delta_5 g_L + \delta_6 g_G + e, & \text{if } q_t > \gamma
\end{align*}$$ \hspace{1cm} (2)

Or as one nonlinear regression such as:

$$\hat{Y}_t = \left\{ \begin{array}{ll}
\alpha_0 + \delta_1 \left( \frac{L}{Y_t} \right) + \delta_2 g_L + \delta_3 g_G + e, & \text{if } q_t \leq \gamma \\
\alpha_0 + \delta_4 \left( \frac{L}{Y_t} \right) + \delta_5 g_L + \delta_6 g_G + e, & \text{if } q_t > \gamma
\end{array} \right\}$$ \hspace{1cm} (3)

The threshold value $\gamma$ 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 (2000) 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 $\chi^2$ 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 (2000) 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:

$$H_0: \delta_{1l} = \delta_{2l}, \quad l = 1, 2, 3.$$ \hspace{1cm} (4)

If $H_0$ is not rejected then the relationships between economic growth and the labor force growth 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 $\delta_{1l}$ and $\delta_{2l}$. The F-test statistics is as follows:

$$F_1 = \frac{RSS_0 - RSS_1(\gamma)}{\delta^2}$$ \hspace{1cm} (5)

In which RSS$_0$ and RSS$_1$ are the residual sum of squares under the null hypothesis and the alternative, respectively.
Data Description:
We have used the annual data from 1959 to 2007 available on the WDI 2008 data source for Iran and Pakistan.

Empirical Results:
This paper uses Hansen (2000) threshold regression model to study whether a non-linear relationship between labor force growth and economic growth exists in Iran and Pakistan. As Table 1 shows, we adopt Hansen (2000) advice to use the bootstrapping method. While the threshold variable is “unemployment rate”, we find that F-statistic is 9.46, 11.35 and 8.43 for Iran and Pakistan respectively which are significant at 1% level. 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

<table>
<thead>
<tr>
<th>Countries</th>
<th>F value of threshold test</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iran</td>
<td>9.46</td>
<td>0.00</td>
</tr>
<tr>
<td>Pakistan</td>
<td>8.43</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 2: Economic Growth and Labor Force Growth in Iran

<table>
<thead>
<tr>
<th>Variables</th>
<th>Linear Model</th>
<th>Unemployment rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>prob ≤0.12</td>
</tr>
<tr>
<td>Interception</td>
<td>-0.04</td>
<td>0.51</td>
</tr>
<tr>
<td>I/Y</td>
<td>0.1288</td>
<td>0.25</td>
</tr>
<tr>
<td>gL</td>
<td>-0.5942</td>
<td>0.46</td>
</tr>
<tr>
<td>(gL)(GS)</td>
<td>0.4539</td>
<td>0.01</td>
</tr>
<tr>
<td>R²</td>
<td>0.1792</td>
<td>0.7162</td>
</tr>
</tbody>
</table>

Table 3: Economic Growth and Labor Force Growth in Pakistan

<table>
<thead>
<tr>
<th>Variables</th>
<th>Linear Model</th>
<th>Unemployment rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>prob ≤0.04</td>
</tr>
<tr>
<td>Interception</td>
<td>4.57</td>
<td>0.0</td>
</tr>
<tr>
<td>I/Y</td>
<td>3190</td>
<td>0.10</td>
</tr>
<tr>
<td>gL</td>
<td>-5.64</td>
<td>0.88</td>
</tr>
<tr>
<td>(gL)(GS)</td>
<td>34.13</td>
<td>0.03</td>
</tr>
<tr>
<td>R²</td>
<td>0.29</td>
<td>0.56</td>
</tr>
</tbody>
</table>

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. As table 3 shows for Pakistan, 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 0.04) 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 0.04), labor force growth and economic growth have a significantly negative relationship. Thus, we can make sure that the non-linear situation exists in Pakistan when “unemployment rate” is the threshold variable.

Conclusion:
We have tested the presence of a non-linear relationship between labor force growth and economic growth in Iran and Pakistan. Doing so, we have modified the Ram (1986) two-sector production model into a threshold regression model and apply Hansen (2000) method to test the threshold effect. The empirical results indicate that threshold effect exist in unemployment rate in Iran and Pakistan. Concerning the “unemployment rate” as the threshold variable, the threshold regimes are 12% and 4% for Iran and Pakistan respectively. This indicates for Iran and Pakistan 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.
REFERENCE