Threshold Effects of Capital Stock on the Public Capital Productivity in the Iranian Economy Using a Smooth Transition Regression Model

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Abstract

Improving capital efficiency is one of the most effective methods for increasing the rate of economic growth and one of the factors affecting capital productivity is the rate of capital utilization. In this study, using the annual data of Iran's economy during the period of 1979-1959, and using the nonlinear model of soft transfer regression (STR), we investigated the effect of government capital stock on capital productivity in Iran. Initial tests confirmed a nonlinear relationship between the stock of government capital and the production and acceptance of the state capital stock as the transfer variable. In the first regime, when the stock of government capital is less than the threshold, the effect of this variable on production was negative, and in the second regime, when the capital of the state is more than the threshold, the accumulation of state capital has a significantly more negative effect on production. These results mean that the accumulation of government capital in Iran during the reviewed period the coefficient of effectiveness of the stock of government capital on production (as an indicator of the productivity of government capital) has had a negative effect.

Keywords: public capital stock, government capital productivity, economic growth, smooth transition regression model (STR).

JEL Classification: C32, O40, R42, 04, D24, E22.

1. Introduction

Improvement of productivity can be considered as one of the effective and important factors in economic growth. Productivity means an efficient and effective use of productive inputs. In fact, productivity is a comprehensive and general concept, whose increase as a necessity for the promotion of human life and for building a more prosperous society has always been of interest to policymakers and economists (Jorgenson, 1997: 1)

In Iran, the volume of government capital is high and capital productivity is low. The capital productivity index is low for unclear and unknown reasons. In the comparison between the OECD and Iran (1996-1996), it was shown that the average growth of capital productivity in these countries was about 1.2%, but in Iran was reported to be minus 0.6%. It shows that Iran has a disproportionate use

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of capital in comparison with the developed countries, and that the country's fixed capital has not been used efficiently, especially in the public sector. The values related to the capital productivity indicator better show this shortcoming. In this study, the issue to be considered is whether government investments and the addition of state-owned capital are productive.

2. Background

In macroeconomic management, it is important to pay attention to the optimal size of the state because, due to the uneven growth of the size of the state, the presence of the private sector in the economy becomes weaker, and this situation, over time, leads to a narrowing of the capacity and the tax base. On the other hand, the government's current spending increases with an unprofitable growth of government size, and these costs allow less flexibility for reduction. As a result of these conditions, the burden of the large and unprofitable size of the government will overcome the current government revenues, and the government faces an operational deficit. In addition, the large size of the government will reduce competitiveness and economic growth due to low efficiency of these activities and the expansion of rentier activities (Recall and Chemistry, 2006, 9).

One of the most classic macroeconomic questions is concerned with the effect of government investment on economic growth. In fact, one can ask whether a permanent increase in state-owned investment will lead to a permanent increase in economic growth, or will it only have a temporary effect?

The traditional model of the neoclassical growth of Solo (1956) predicted that any positive effect of the increase in the national rebound and the rate of investment on economic growth would be temporary. The steady state growth rate is fully determined by population growth and exogenous technology advances. According to this model, the increase in government's productive capital costs would increase temporary investment in a period, but the rate of capital accumulation and economic growth will decrease over time, and in the long run, the production level will be higher. The growth rate of production reaches the same level before the start of government expenditures.

3. Methodology

In this study, to investigate the effect of capital reservoir threshold on government capital investment in Iran, a soft transfer regression model (STR) was used, in which the variables are as follows. Y: Private Capital Storage Capacity Generation, G / K: Private Equity State Capacity, K: Private Equity Storage, EMP: Employment.

4. Model estimation results

All of the maneuver variables of the model are tested by the generalized Dickey-Fuller method. As shown in Table (1), according to the generalized Dickey-Fuller test,. Template variables are non-invariant and accumulated from the unit degree.

Table 1: Results from Maneuverability Test (ADF) Model Variables

G/K				EMP				Test	Generalized Dickey Fuller Maneuvered Test (ADF)
		ADF statistics	P-rob	McCainon Critical Values		ADF statistics	P-rob		
10%	5%			10%	5%				
-2.6	-2.94	-1.94	0.31	-2.6	2.94	-1.33	0.602	Level	Width from source
-2.61	-2.94	-6.19	0.00	2.61	-2.94	-4.75	0.00	First degree difference	
	K				Y				
-2.6	-2.94	1.64	0.45	-2.6	-2.94	-1.05	0.72	Level	Width from source
-2.61	-2.94	-5.36	0.00	-2.61	-2.94	-5.55	0.00	First degree difference	

Source: Research calculation

The results of the linearity test clearly indicate that the null hypothesis that the model is linear is rejected (according to the critical value of the table at the 5% confidence level). The results of estimation are presented in Table 2:

Table 2: Testing the absence of a linear model relationship

Zero hypothesis	The value of the t	Degree of freedom	The probability value of the t statistic
H04: b1=b2=b3=b4=0	2.31	(14,19)	0.04
H03: b1=b2=b3=0	2.08	(11,22)	0.06
H02: b1=b2=0	2.82	(8,25)	0.02
H01: b1=0	5.15	(4,29)	0.00

Source: Research calculation

The result of estimation is as follows:

LGDPK = (1.54*LGK - 7.04*LEMP(-1) + 119.09+ 0.22*@TREND - 0.27*LK(-1)) + (-1.64*LGK - 6.41*LEMP(-1) + 102.08 + 0.11*@TREND)*(1. - @EXP(-3.01*(LGK(-1)+0.55)^2))

So for the first regime:

$$LY_t = 119.09 + 0.22 \text{ trend} + 1.54\, L(\tfrac{G}{K})_t - 7.04\ LEMP_{t-1} - 0.27\, LK_{t-1}$$

And for the second regime we will have:

$$LY_t = 102.08 + 0.11 \, \text{trend} - 1.64 \, L\left(\frac{G}{K}\right)_t - 6.41 \, LEMP_{t-1}$$

Based on estimated regression equations and considering the fact that the logarithmic coefficients of the stock of government capital on the stock of private capital in the first and second regimes are 1.54 and 1.64 respectively, it can be concluded that the increase in the stock of government capital during the studied period has had a positive and significant effect on output to the threshold level, but in the second regime (when the stock of government capital has been overestimated) this effect is negative. It means that the coefficient of capital impact on production varies in the two regimes, and it is observed that the effect has become negative with regime change. Figure (4) shows the coefficient of effect of the stock of government capital on production over the specified period of time.
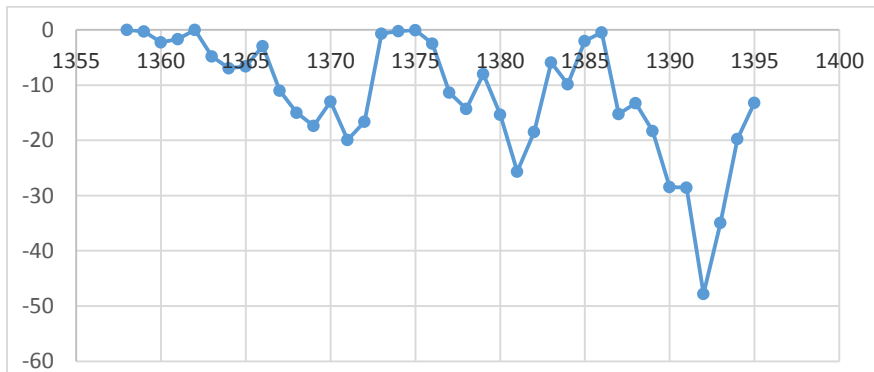
Chart 4: Changes in the coefficient of influence of the stock of government capital on production during the studied period Source: Research calculations

5. Conclusion

This paper was an attempt to investigate the nonlinear effects of state capital stock on the productivity of Iranian state capital using the Mild Transition Regression (STR) and temporal data of 1395-1355. The results of model estimation showed that the accumulation of state capital in a non-linear way and in the form of a two-regime structure has affected Iran's production. In the first regime, when the stock of government capital was less than the threshold, the effect of this variable on the output was negative, and in the second regime, when the amount of capital accumulation was more than the threshold, the accumulation of state capital had a more negative and significant effect on production.

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