The Impact of Government Size on Economic Growth

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ABSTRACT

Driven by the observed growing government expenditure in Egypt, this study sets to test the non-linear relationship between government expenditure and economic growth and it tries to examine the existence of Armey curve in Egypt. We employ the smooth transition regression models (STR). The results show a non-linear relationship of the Armey curve in Egypt, in which the threshold effect corresponding to government final consumption expenditure share in GDP of about 13%.

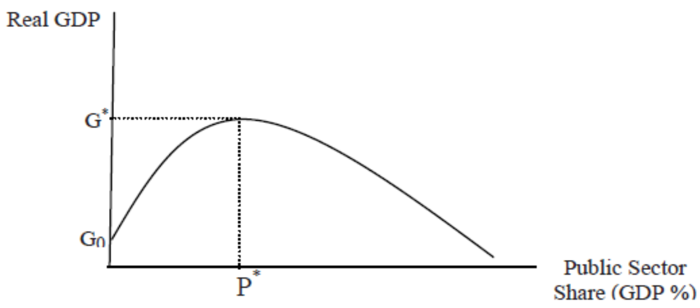
JEL Classification: E62, O40, C22
Keywords: Government size, Economic growth, Smooth threshold regression model

1- INTRODUCTION

Economic growth has always been at the heart of the literary works in development economics, and it is one of the most attractive subjects in macroeconomics. Among many factors that determine economic growth, government size is our particular interest in this study. The Solow growth approach was used in many empirical studies, although it dealt with all economic growth sources as exogenous factors. As a result, government policy has no effect on long run economic growth. In contrary to the exogenous growth models, the endogenous growth models [Romer (1986) and Barro (1990)] indicate that the determinants of growth are endogenous to the model. The determination of long run growth within the model, rather than by some exogenous variables (e.g. technological progress). (Barro and Sala-i-Martin, 1995, 38)

Theoretically, the relationship between government spending and economic growth has been studied within via the Armey curve (Armey et al., 1995), the Rahn Curve (Rahn and Fox, 1996), and the “BARS” curve (Barro [1989], Armey et al. [1995], Rahn [1996], and Scully [1994]). Armey curve, which explain the rule of government spending on economic growth, shows that there is a positive relationship between government expenditure and economic growth before certain point. And after this point the relation will become negative.

Fig 1. Armey Curve



There are two points of view to interpret the impact of government sector on economic growth. The first point maintains that over expanding government sector tends to crowd out private sector investment, leading in the end to hinder economic growth. Generally, the negative relationship between government size and economic growth may be because of many reasons: costly financing methods (print new money, borrowings...), crowding out of production private investment, (government spending displaces private sector activities), transfer payments (welfare programs, grants, unemployment insurance) may discourages economic decisions. In addition, transfer payments may provide an incentive to lower savings rate, hindering resource allocation and inhibiting innovations Landau (1983), Engen and Skinner (1991), Folster and Henrekson (2001), and Dar and AmirKhalkhali (2002). The second point attributes to the government a non-negligible rule to play in mobilizing necessary physical and human capital that are important to boost economic growth.

The aim of this paper is to examine the growth–government size relationship in Egypt for the 1983 – 2012 period. The remainder of this paper is organized as follows: section 2 devotes to literature review about government expenditure and economic growth. Section 3 presents model specification and data description. Section 4 focus on empirical results, and finally a brief conclusion will be presented in section 5.

2- LITERATURE REVIEW

As brief indicated in Table 1, many empirical studies, depending on cross-section data, such as Landau (1983), Ram (1986), Grier and Tullock (1989), Romer (1990), Barro (1990, 1991), Levine and Renelt (1992), Devarajan *et al.* (1996), and Sala-i- Martin (1997) studied the effect of government spending on economic growth, and they found varied evidence. 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. This negative relationship is result of crowd-out effect to private investment. In addition, government expenditure may distort the allocation of resources.

On the contrary, Ram (1986), Kormendi and Meguire (1986) and Wu et al (2010) examined the causal relationship between government expenditure and economic growth using either OLS method or Granger causality test, and they found that there is a positive effect of government spending on economic growth. They believe that government expenditure can support private investment through improving the investment environment. In addition, depending on Keynesian view, expanding on government expenditure has positive effect on investors' expectations.

Easterly and Rebela (1993) found a mix results, while government expenditure on specific sectors (e.g. transport, education, and communication) is positively related with economic growth, total public investment is negatively related with growth.

These inconsistent results of government expenditure (size) on economic growth may be due to non-linear relationship Chen and Lee (2005). Whereas, Henrekson (1993) argues that earlier findings from time series studies are likely to be spurious because they did not test the stationarity hypothesis of the data. Vezirl et al (2011) have carried out a study that utilized Hansen's threshold regression (1996). They found a non-linear relationship between economic growth and government size.

Vedder and Gallaway (1998) investigate that the relationship between government size and economic growth has an inverse U-shape curve. They found that if government expenditure is greater than 15%, then the relationship between them is negative. However, the relationship turns to positive when government expenditure get smaller than 15%. This asymmetric relationship is known as Armey curve (Figure 1).

Table 1. Literature review of the relationship between government size and economic growth

Author (s)	**government size variable**	**Subject**	**Relationship**
Landau (1983)	government consumption	96 developed Countries. 1960 -1977	Negative relationship
Dar, Amirkhakhla (2002)	Total government outlays /GDP	19 OECD countries, 1971-1999	Negatively relationship between TFP and government size
Abo Bader and Abo Qarn 2003	government consumption	Egypt, Israel, and Syria	Negative relationship
Chandra 2004	Investment and total expenditure	India 1950-1996	Negative relation in short run. And no relation in long run
Loizides & Vamvoukas 2005	Total expenditure/ GDP	Greece, UK, and Ireland (1950-1995)	Government size causes economic growth in all countries except Greece in short and long run as well.
Ahmed & Ahmed 2005	Government final consumption/ GDP	D-8 countries 1973- 2003	No correlation in short run.
Wu et al. (2010)	Real government expenditures	182 countries. 1950 -2004	Positive bidirectional relationship

Safdari et al. (2011)	The ratio of government expenditure to GDP	Iran. 1975-2008	Negative effect on GDP
Christie 2014	Total government spending (excluding interest payments)	136 countries. 1971 - 2005	Negative effect
Varoudakis et al. 2007		25 countries – 1992-2004	Negative relationship
Herath. 2012	total government expenditure.	Sri Lanka. 1959 – 2009	Positive relationship
Mehrara & Keikha. 2012	total government expenditure.	Iran. 1967-2007	Positive relationship
Rajabi & Muhammed. 2014	Government consumption	ASEAN-5. 1980-2006	Negative effect

3- DATA AND MODEL

The data set in this study relates to Egypt and consists of 120 quarterly time series observations covering the time period 1983:Q1 to 2012:Q4. We use gross domestic product growth (GROWTH), and as a measure of government size (GOVSIZE), general government final consumption expenditure to gross domestic product. Government consumption includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation. All data are transformed to logarithmic form.

Transition dynamics based on continuous transition that allows for smooth changes during the transition. Most of economic variables take time to change from one regime to another, and not in sudden abrupt changes.

The smooth transition regression models (STR) have been arisen since seminal study of Bacon and Watt (1971) and followed by further studies such as Granger and Teräsvirta (1993), Franses and van Dijk (2000), and van Dijk et al (2002).

Following Teräsvirta (2004), the standard STR model can be written as

$$y_t = \varphi' X_t + \theta' X_t \, G(\gamma, c, s_t) + u_t, \qquad t = 1, \ldots\ldots, T$$

Where X_t is a vector of predictor variables equals $(1, y_{t-1}, \ldots, y_{t-p}, x_t, \ldots\ldots, x_{qt})$. $\varphi' = (\varphi_{11}, \ldots, \varphi_{1m})$ and $\theta' = (\theta_{21}, \ldots\ldots, \theta_{2m})$ are m X 1 parameters vectors. u_t is an error with mean equal zero and a constant variance. And $G(\gamma, c, s_t)$ is a transition function bounded between 0 and 1, and it depends on the slope parameter; the vector of location parameters which equals $(c_1 \ldots\ldots c_k)'$ where $c_1 \leq \cdots \leq c_k$; and transition variable s_t that can be part of X_t or another variable. The shape of transition function is assumed to be a logistic function.

$$, \gamma > 0$$

The most common choices for K are K = 1 (LSTR1) and K = 2 (LSTR2).

STR modelling cycle consists of three basic steps:

The first step is identifying the model. This step starting by using VAR framework to test the stationarity, testing the nonlinear relationship between variables, choosing the transition variable (st), and deciding whether LSTR1 or LSTR2 model should be used.

At this stage, and in order to study the nonlinear relationship models LSTRi, the following regression model is used:

$$y_t = \beta_0' z_t + \sum_{j=1}^{3} \beta_j' \tilde{z}_t s_t^j + u_t^* \qquad t = 1, \ldots\ldots, T$$

Where $z_t = (1, \tilde{z}_t)$, β_j', j = 1, 2, 3, is of the form $\tilde{\beta}_j$, where, $\tilde{\beta}_j \neq 0$ is a function of θ and c. The null hypothesis of linearity is:

$$H_0: \beta_1 = \beta_2 = \beta_3$$

The F test is used to test the hypothesis. After rejecting the linearity hypothesis, the following tests should be performed for selecting between LSTR1and LSTR2 models:

Test H_{04}: $\beta_3 = 0$

Test H_{03}: $(\beta_2 = 0|\beta_3 = 0)$

Test H_{02}: $(\beta_1 = 0|\beta_2 = \beta_3 = 0)$

In case of rejecting H_{03} , one choses the LSTR2 model. Otherwise, selects LSTR1 model. The second step is estimating the parameters of STR model using conditional maximum likelihood. In this paper we use BFGS (Broyden, Fletcher, Goldfarb and Shanno (1970)) algorithm that is very robust and efficient algorithm (Skajaa, 2010).

The final step is evaluating of the estimated STR model. This step usually involves besides graphical analysis various diagnostic tests such as no error autocorrelation, no additive nonlinearity, and test of parameter constancy.

4- RESULTS

We start our analysis by testing the data for stationarity using augmented dickey-fuller test (ADF) and ADF type test of Saikkonen and Lütkepohl (2002) which take into account of structural break.

Table 2 Unit root tests

	ADF: Without time trend	ADF:With time trend	ADF: with constant	Saikkonen & Lütkepohl (S&L) (2002)
GOVSIZE	7.0376***	3.6849**	6.0998***	
Growth	1.2538	-1.5493	1.0417	-8.1953***

** and *** represents significance at the 5% and 1%, respectively. The estimated break point for the Growth is 2007:4.

The results reported in table (2) show that the null hypothesis of unit root is rejected for the two variables using both tests (ADF and S & L). Thus, all level variables are stationary or I(0).

In order to estimate STR model, we start with specifying an adequate linear model and determining the number of lagged variables in the model. Based on AIC and SBC criteria; the optimal lag length between economic growth and government size is 2 lags. Next, linearity null hypothesis tests against the alternative one of the STR model. The results reported in table (3) show that, based on F statistics; we can reject the null hypothesis of linearity at 1% level of significance. In addition, based on results reported in table (3), we consider GOVSIZE (government expenditure) as the transition variable. Figure 2 shows the estimated logistic transition function against this transition variable .

Table 3 The results of the linearity tests against the STR model

Variable	F	F4	F3	F2	Suggested model
GROWTH $_{(t-1)}$	3.028^{-18}	5.144^{-1}	3.019^{-7}	6.169^{-16}	LSTR1
GROWTH $_{(t-2)}$	3.079^{-18}	5.070^{-1}	3.577^{-7}	5.372^{-16}	LSTR1
$GOVSIZE_{(t)}{}^{*}$	3.041^{-22}	9.729^{-5}	3.493^{-2}	2.405^{-21}	LSTR1
$GOVSIZE_{(t-1)}$	1.439^{-18}	1.525^{-3}	3.098^{-1}	6.320^{-20}	LSTR1
$GOVSIZE_{(t-2)}$	1.598^{-18}	1.748^{-3}	2.941^{-1}	6.543^{-20}	LSTR1
Trend	3.699^{-19}	3.932^{-3}	2.940^{-1}	8.706^{-9}	LSTR2

The next step is estimating STR model. Due to the nonlinear nature of these types of models, we have to obtain appropriate starting values for the slope parameter "γ " and the transition variable "*c*". using grid search within ranges [0.43,8.02] and [5.50,20], the selected initial values for the γ and *c* are 7.1334 and 13.5931 respectively. Considering these initial points, the results of the first (G =0) and second regime (G=1) are presented in table (4).

Table 4 The estimation results of the STR model

	Linear part	Nonlinear part
constant	3.06122*	3.21236*
	(3.9349)	(2.8010)
$GROWTH_{t-1}$	0.86609*	-0.12433*
	(22.9962)	(-2.2917)
$GOVSIZE_{t}$	19.93581*	-19.93582*
	(3.6781)	(-3.6381)
$GOVSIZE_{t-1}$	-21.33156*	26.60931*
	(-4.0885)	(4.0563)

Gamma	7.3352
C1	13.1379
Adjusted R2	0.9338
ARCH-LM	17.1736
Jarque-Bera	2.3545
Breusch–Godfrey	1.2434

As shown in table (4), the slope parameter which represent the speed to switch from one regime to another, equals to 7.3352 which denotes to the rapid transition of regimes. According to the transition value (13.14), if the size of government is higher than this value, then we entered the second regime.

Thus, the transition function $G(\gamma, c, s_t)$ is specified as below for the two extreme states, G=0 and G=1:

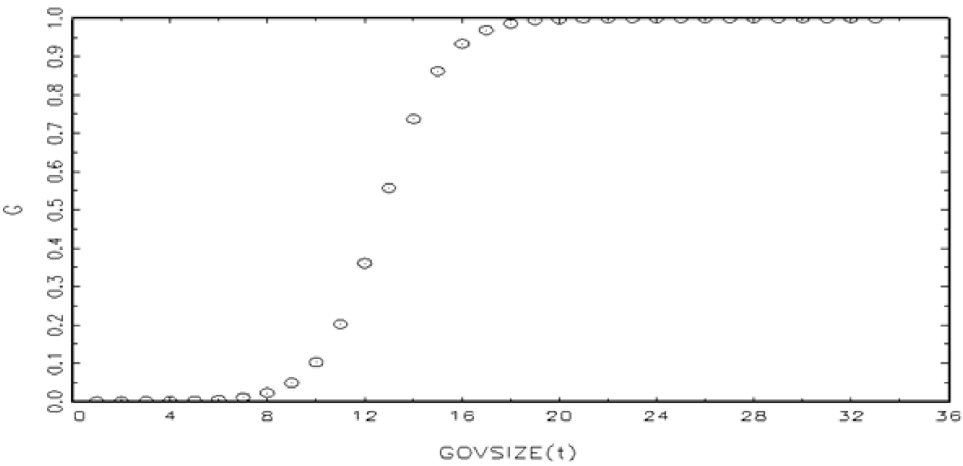
The first regime (G=0):

$$GROWTH_t = 3.061+0.866\ GROWTH_{t-1}+0.199\ GOVSIZE_t+0.213\ GOVSIZE_{t-1}$$

The second regime (G=1)

$$GROWTH_t = -2.152+0.073\ GROWTH_{t-1}-0.098\ GOVSIZE_t-0.794\ GOVSIZE_{t-1}$$

Fig. 2 logistic transition function related to regime changes



The results of both extreme regimes show that the size of government has a positive impact on economic growth in Egypt in the first extreme regime, while this effect becomes negative effect in the second regime. In other words, when government expenditure is small, the threshold is less than 13.14%, the relationship between government expenditure and economic growth is significantly positive (since the sum of the estimated coefficients of government consumption is equal 0.412). However, when total government expenditure is large, the threshold is higher than 13.14%, the relationship between government expenditure and economic growth becomes negative (the sum of government size coefficient equals -0.892).

To check the goodness of STR model diagnostic tests are carried out which include ARCH-LM test for heteroskedasticity, Jarque-Bera test for normality, and Breusch–Godfrey Lagrange multiplier test for serial correlation. The results of diagnostic rests reported in table (4). The ARCH-LM test are implying the rejection of null hypothesis; absence of heteroscdasticity. Also Jarque-Bera test is significant, confirming the normality of errors. The last diagnostic test is Breusch–Godfrey Lagrange multiplier that shows the absence of serial correlation.

5- CONCLUSIONS

Given the importance of the impact of government size on economic growth, and the controversial empirical and theoretical literatures on this relationship, this study further to test the nonlinear relationship between these variables in Egypt over 1983-2012 under notion of" Armey curve". For testing the existence of a threshold effect between government total consumption and economic growth, this study has used smooth threshold regression (STR) model.

The results show that the magnitude of government size on economic growth varies according to regimes. When the government size is smaller than the threshold limit value, economic growth is nourished by expanding government expenditure. but if the government size is larger than the threshold value, then the economic growth decreases. Thus, policy makers should make control about government size, because economic growth is sensitive to government size.

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