JOURNAL OF ECONOMIC DEVELOPMENT
Volume 22, Number 2, December 1997

Government Spending and Economic Growth in Saudi Arabia*

Khalifa H. Ghali**

This paper builds on Barro's (1990) endogenous growth model to untangle the nature of the relationship between government expenditure and economic growth in Saudi Arabia by examining the intertemporal interactions among the growth rate in per capita real GDP and the share of government spending in GDP. Using vector autoregressive (VAR) analysis, particular attention is given to testing for the existence and direction of Granger-causality among the variables. The empirical analysis found no consistent evidence that government spending can increase Saudi Arabia's per capita output growth. Therefore, a fiscal policy aiming the control of the budget deficit in Saudi Arabia has to consider shrinking the size of the government and limiting its role in the economy.

I. Introduction

Saudi Arabia has the largest budget deficit among the gulf countries. In 1991 the government deficit reached 27% of GDP. In recent years, the Saudi government has made sizable efforts towards reducing its budget deficit by adopting important cuts in government spending. However, despite these efforts the deficit remains substantially high and accounts for about 10% of GDP over the last four years.

The success in implementing an effective fiscal policy targeting the control of the budget deficit in Saudi Arabia and, at the mean time, the promotion of the private sector so that it can compete efficiently in the global economy, rests on the nature of the relationship that exists between government spending and economic growth. It is the aim of this paper to investigate the intertemporal interactions among the growth rate of per capita real GDP and the share of government spending in GDP in Saudi Arabia. Empirical evidence on this issue would clarify the nature of the causal relationship between government spending and growth and provide useful recommendations for the Saudi government concerning its size and its role in the economy. If changes in the share of government spending does not affect the output growth rate, then shrinking the size of the government can be a potentially important factor for solving the budget deficit.

The possibility of linkage between the size of government and economic growth is a major contribution of endogenous growth models which treat public services as input to production. In contrast to traditional growth models, as those developed by Cass (1965) and Solow (1956), the attractiveness of endogenous growth models is that they do not depend on exogenous technological changes or labor growth (e.g., Becker et al. (1990), Lucas (1988), Rebelo (1991), and Romer (1986, 1990)).

* I wish to thank an anonymous referee for his valuable comments on an earlier version of this paper.
** Department of Economics, College of Business and Economics, P.O.BOX 17555, United Arab Emirates University, AL Ain, United Arab Emirates.

Barro (1990) examined an endogenous growth model that suggests a possible relationship between the share of government spending in GDP and the growth rate of per capita real GDP. The key feature of Barro's model is the presence of constant returns to capital that broadly includes private capital and public services. To the extent that public services are considered an input to production, a possible linkage arises between the size of government and economic growth.

Previous empirical studies of the relationship between government spending and economic growth were primarily based on cross-sectional analysis. Based on Barro's (1990) endogenous growth model, this paper uses time series techniques to investigate the nature of the relationship between government expenditure and economic growth by examining the intertemporal interactions among the growth rate in per capita real GDP and the share of government spending in GDP. In particular a time series analysis is conducted with particular attention paid to the causal relationship between the variables in the context of vector autoregressions. The empirical analysis found no consistent evidence that changes in the share of government spending have an impact on changes in the real per capita output growth in Saudi Arabia. However, as Barro (1990) suggested, since the impact of government spending may vary depending on the component of government expenditures that we consider, in the next step of the analysis we have decomposed total government spending into its major components, consumption and investment. In this case too, the analysis found no evidence that changes in government consumption or changes in government investment can contribute to economic growth. Hence, we are led to the conclusion that changes in government spending in Saudi Arabia have no effect on changes in per capita output growth and, therefore, shrinking the size of the government seems to be the appropriate measure towards reducing the budget deficit.

The remaining of the paper is organized as follows. Section II presents a model of endogenous growth and discusses the relationship between government spending and economic growth. Section III describes the econometric methodology. Section IV contains the empirical results and section V concludes.

II. A Model of Government Spending and Economic Growth

Following Barro (1990), the representative individual is assumed to choose a consumption path $\{ c_t \}$ so as to maximize an intertemporal utility function with a constant elasticity of substitution (σ):

$$\begin{aligned} U &= \int_0^x e^{-\rho t} u(c_t) dt \\ &= \int_0^\infty e^{-\rho t} (c_t - 1)(1-\sigma)^{-1} dt \end{aligned} \tag{1}$$

subject to a capital accumulation constraint $k = y - g - c$, a government budget constraint, $g = \tau y$ and a production function $y = k\phi(g/k)$, where $\rho > 0$ is the time discount rate, y is the per capita output, g is the per capita government purchases, k is capital per worker, and τ is the average tax rate. The production function is supposed to satisfy the usual conditions

for positive and diminishing marginal products.[1] Hence the model allows government services such as education, training, and public infrastructures to enter as a separate input to private production.

Given the model above, the steady-state growth rate (γ) is

$$\gamma = \dot{c}/c = [(1 - g/y)(1 - \eta)\phi(g/k) - \rho]/\sigma \tag{2}$$

where η is the elasticity of y with respect to g such that $(1-\eta)\pi(g/k) = \partial y/\partial k$ which is the marginal product of capital. A change in g/y can therefore affect γ in two counteracting ways. An increase in g/y reduces $(1-g/y)$, crowds out private investment and hence lowers the growth rate. On the other hand, a higher g/y makes private capital more productive, raises $\partial y/\partial k$ and thereby leads to a higher γ. The net effect is given by the following derivative

$$\partial\gamma/\partial(g/y) = \phi(g/k)(\phi' - 1)/\sigma \tag{3}$$

the sign of which depends on the level of government spending. If government spending is too large then $\phi' < 1$, and consequently $\partial\gamma/\partial(g/y) < 0$, implying that a further expansion of government spending will depress the growth rate. If government spending is too low such that $\phi' > 1$, then $\partial\gamma/\partial(g/y) > 0$ suggesting that an increase in government spending can increase the growth rate. If government spending is at the optimal level then $\phi' = 1$, however $\partial\gamma/\partial(g/y) = 0$ and a growth maximizing share of government spending can be determined. At the optimum, and further marginal change in spending will not affect the growth rate, implying little correlation between g/y and γ.

When government consumption services (h) are taken into account, then the model in (1) becomes

$$U = \int_0^\infty e^{-\rho t}((c^{1-\beta}h^{\beta})^{1-\sigma} - 1)/(1-\sigma)dt \qquad 0 < \beta < 1 \tag{4}$$

and the steady-state growth rate becomes

$$\gamma = \dot{c}/c = [(1 - g/y - h/y)(1 - \eta)\phi(g/k) - \rho]/\sigma \tag{5}$$

The diagnoses for the effects for productive government spending on growth are the same as before. Since $\partial\gamma/\partial(h/y) = -(1 - \eta)\phi(g/k)/\sigma$, however, an expansion of government spending if applied largely to consumption services will unambiguously lower the growth rate.

Table 1 summarizes the sign implications of the model when both g and h are included. Increasing government spending in nonproductive services will lower the growth rate, independent of the size of the government. Whereas, an increase in government spending on productive services can either raise or lower the growth rate, depending on the size of government. Despite the

1. The analysis abstracts from externalities associated with the use of public services.

fact that the model has to be tested using separate data on productive and nonproductive services, the results of table 1 suggest that working with data on total expenditures can still be informative. For example, since expenditure on consumption services always have a negative impact on the growth rate, findings of a non-negative relationship between total government expenditures and growth can be viewed as evidence of underspending in productive services. However, a negative relationship does not lead to any inference concerning the size of productive services. This is because such result may be due to excessive spending in consumption services, regardless of the level of expenditure on productive services. Moreover, even in the case of underspending in productive services, the positive effect on growth out of these services can be veiled by the negative effect from government consumption services, resulting in a net negative relationship.

Table 1 The Sign Implications of the Model

	Underspending in productive services	Optimal Spending in productive services	Overspending in productive service
Expenditures on productive services	$\partial\gamma/\partial(g/y) > 0$	$\partial\gamma/\partial(g/y) = 0$	$\partial\gamma/\partial(g/y) > 0$
Expenditures on consumption services	$\partial\gamma/\partial(g/y) < 0$	$\partial\gamma/\partial(g/y) < 0$	$\partial\gamma/\partial(g/y) < 0$
Sign of the combined effects	+ or -	-	-

III. The Econometric Methodology

Most empirical studies of the relationship between government spending and economic growth have been conducted using cross-country data in attempts to explain the observed differences in growth rates across countries. For example, Landau (1983), in a cross-sectional study of over 100 countries reported evidence of a negative relationship between the growth rate of real per capita GDP and the share of government expenditure in GDP. Using data on 47 countries, Kormendi and Meguire (1985) found no significant cross-sectional relationship between the growth rate of real GDP and the growth rate or the level of the share of government consumption spending. Barro (1991) examined 98 countries and reported a negative relationship between the output growth rate and the share of government consumption expenditures. When the share of public investment was considered, however, Barro (1991) found a positive but statistically insignificant relationship between public investment and the output growth rate.

However, cross-section analysis cannot capture the country specific nature of the government spending and growth relationship. For this reason, this study uses time series data to investigate the particular relationship that exists between government spending and economic growth in Saudi Arabia. Moreover, time series analysis allows to reveal the causal relationship between variables, while cross-section analysis can identify correlation but not causation between variables. Thus, our aim is not to estimate the correlation and the sign of the effects of government spending on growth but to test for the existence and direction of causality between these variables. According to Barro (1990), the share of government spending in GDP may have a significant effect on the growth rate of real per capita GDP. On the other hand, one can also argue that economic growth may influence the demand for government services such as economic infrastructure and public education. The relationship between public expenditures and output

growth can therefore go in either direction. It follows that significant correlation between the two variables may exist, regardless of whether Barro's (1990) causal argument holds or not. To provide appropriate information about such causality, the time series relationship between the economic variables has to be exploited carefully.

The dynamic relationship between the growth rate of real per capita GDP and the share of government in GDP is examined using vector autoregressive (VAR) analysis (e.g., Sims (1980)). The model can be described by

$$\begin{bmatrix} a_{11}(L) & a_{12}(L) \\ a_{21}(L) & a_{22}(L) \end{bmatrix} \begin{bmatrix} x_{1t} \\ x_{2t} \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \tag{6}$$

where x_{1t} is the growth rate of real per capita GDP and x_{2t} is the share of government spending in GDP. The elements $a_{ij}(L)$ are the p-th order polynomials in the lag operator L, $(c_1, c_2)'$ is a vector of constants, $(e_{1t}, e_{2t})'$ is a serially independent random vector with mean zero and covariance matrix $\sum$.

Given that each equation in the VAR system contains the same regressors, the system can be efficiently estimated by least squares. Because of the presence of cross-equation feedbacks and the tendency for the estimated coefficients of successive lags to oscillate, the VAR parameter estimates are generally hard to interpret. We consequently follow the usual practice and focus on testing for the existence and direction of causality between the variables.

The temporal linkages between x_{1t} and x_{2t} can be examined using Granger's (1969) test for causality, which tests for the exclusion of all lags of the exogenous variable in an equation. To test whether the share of government spending Granger causes the growth rate of real per capita GDP, we test the null hypothesis $H_0: a_{12}(L) = 0$, and to test whether the growth rate of per capita GDP Granger causes the share of government spending in GDP we test the null hypothesis $H_0: a_{21}(L) = 0$.

IV. Empirical Result

In this section we apply the methodology described above to annual data from Saudi Arabia over the period 1960 - 1996. We first test for the existence and direction of Granger causality between the share of total government spending in GDP and the growth rate of real per capita GDP. Then we redo the econometric tests after decomposing government spending into consumption and investment. The variables used and their definitions are as follows:

D(y) = the growth rate of real per capita GDP,
GSHARE = the share of total government spending in GDP,
ISHARE = the share of government investment in GDP,
CSHARE = the share of government consumption in GDP,

where the output growth rate is constructed as the first difference in the natural logarithm of the real per capita GDP series.

As a preliminary data analysis, all series are first checked for stationarity. If the series are nonstationary, standard econometric techniques can lead to misleading results. Both the augmented Dickey-Fuller, ADF(p), and the Phillips-Perron, $Z_t(q)$, tests for a unit root are performed on each individual series. Table 2 reports the results of the unit-root tests that allow for a time trend and use different values of the lag parameters: p, q = 1, 3 and 5. The results in table 2 indicate that all the series are trend stationary.

Table 2 Testing for Stationarity

Series	The Dickey-Fuller ADF(p) test			The Phillips-Perron $Z_t(q)$ test		
	p = 1	p = 3	p = 5	q = 1	q = 3	q = 5
$D(y_t)$	-4.451*	-4.482*	-4.441*	-4.398*	-4.390*	-4.365*
$GSHARE_t$	-5.075*	-5.114*	-5.315*	-5.101*	-5.220*	-5.112*
$ISHARE_t$	-5.226*	-5.301*	-5.101*	-5.333*	-5.200*	-5.201*
$CSHARE_t$	-5.001*	-5.012*	-5.101*	-4.902*	-4.995*	-5.005*

The variables are as defined in the text. The null hypothesis tested is that the relevant series contain a unit root against the alternative that it does not. Both tests allow for a time trend. The parameter p is the lag length employed in the Dickey-Fuller test. The parameter q is the lag length employed in the Phillips-Perron test. Critical values for the tests are tabulated in Fuller (1976). Statistical significance at the 5% is indicated by *.

Table 3 reports the results of the causality tests between the share of total government spending in GDP and the growth rate of per capita real GDP based on (6). The lag order p of the vector autoregression is selected using both the Akaike information criterion (AIC) and the Schwarz information criterion (SIC). Once the lag order was determined, the corresponding estimated residuals were further tested for the presence of autocorrelation. The estimated lag length for which the residuals pass the autocorrelation test is p = 4, which also allows sufficient dynamics in the model. The exclusion tests are based on the computed values of the standard F-statistics.

Table 3 Granger-Causality Test Results (D(y), GSHARE)

Null hypothesis	F-value	Degrees of Freedom
D(y) Granger-causes GSHARE	4.011*	(4, 28)
GSHARE Granger-causes D(y)	0.092	(4, 28)

The estimated VAR includes the share of government spending in GDP and the growth rate of per capita real GDP. The lag length is equal to 4. Statistical significance is indicated by *.

According to the results of table 3, a change in the share of government spending has a statistically insignificant impact on changes in the growth rate of real per capita GDP. Changes in the output growth rate, on the other hand, seem to be a factor explaining part of the movements in the share of government spending in GDP. Hence the flow of causality is running from output growth to the share of government spending not the other way around.

However, as Barro (1990) suggested, the impact of government spending on economic growth may vary depending on the component of government expenditures that we consider.

Therefore, it is interesting to decompose total government spending into government consumption and government investment and investigate whether their effects on economic growth could be different.

Table 4 reports the results on causality after decomposing government spending into the share of government investment in GDP and the share of government consumption in GDP. Hence, we estimated a three-variable VAR system containing the growth rate of real per capita GDP, D(y), the share of government investment in GDP, ISHARE, and the share of government consumption in GDP, CSHARE. The lag length p is also selected according to AIC and SIC and was set equal to 4. The results of table 4 indicate that neither government investment nor government consumption has a significant impact on real per capita output growth. The flow of causality is rather going from output growth to investment and consumption spending.

Table 4 Granger-Causality Test Results (D(Y), ISHARE, CSHARE)

Null hypothesis	F-value	Degress of Freedom
D(y) Granger-causes ISHARE	3.895*	(4, 24)
D(y) Granger-causes CSHARE	4.012*	(4, 24)
ISHARE Granger-causes D(y)	0.453	(4, 24)
CSHARE Granger-causes D(y)	0.706	(4, 24)

The estimated VAR includes D(y), ISHARE and CSHARE. The lag length is equal to 4. Statistical significance is indicated by *.

Therefore, the empirical results suggest that neither changes in government consumption nor changes in government investment, nor both, would have an impact on changes in per capita real output growth. Thus, since in Saudi Arabia the government is facing large budget deficits, a potentially important measure that can be considered by public authorities to solve this problem without causing any harm to economic growth, is to shrink the size of the government.

V. Conclusion

This paper attempts to investigate the intertemporal interactions between the share of government spending in GDP and the growth rate of per capita real GDP. A time series analysis is conducted with particular attention given to the causal pattern in the context of vector autoregressions. The analysis applied to data from Saudi Arabia, which has the largest budget deficit in the gulf, found no consistent evidence that changes in government spending have an impact on per capita real output growth. The flow of causality seems to be running in the other direction from output growth to government spending. Therefore, an important implication of the analysis for the conduct of public policy in Saudi Arabia is that the government can face its deficit by shrinking its size and limiting its role in the economy.

Reference

Barro, R.J., "Output Effects of Government Purchases," *Journal of Political Economy*, Vol. 89, 1981, 1086-1121.

_____, "Government Spending in a Simple Model of Endogenous Growth," *Journal of Political Economy*, Vol. 98, 1990, S103-S125.

_____, "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics*, Vol. 106, 1991, 407-444.

Barro, R.J., and X. Sala-i-Martin, *Economic Growth*, New York, McGraw-Hill, 1995.

Becker, G.S., K.M. Murphy, and R. Tamura, "Human Capital Fertility, and Economic Growth," *Journal of Political Economy*, Vol. 98, 1990, 12-37.

Cass, D., "Optimum Growth in an Aggregative Model of Capital Accumulation," *Review of Economic Studies*, Vol. 32, 1965, 233-40.

Dickey, D.A., and W.A. Fuller, "Distribution of the Estimators for Autoregressive Time Series With a Unit Root," *Journal of the American Statistical Association*, Vol. 74, 1979, 427-31.

Fuller, W.A., *Introduction to Statistical Time Series*, Wiley, New York, 1976.

Granger, C.W.J., "Investigating Causal Relations by Econometric Models," *Econometrica,* Vol. 37, 1976, 424-38.

Grier, K.B., and G. Tullock, "An Empirical Analysis of Cross National Economic Growth 1950-1980," Working Paper, California State Institute of Technology, 1987.

Kormendi, R.C., and P.G. Meguire, "Macroeconomic Determinants of Growth: Cross-Country Evidence," *Journal of Monetary Economics*, 1985, Vol. 16, 141-63.

Landau, D., "Government Expenditure and Economic Growth: A Cross-Country Study," *Southern Economic Journal*, Vol. 49, 1983, 783-97.

Levine, R., and D. Renelt, "A Sensitivity Analysis of Cross-Country Regressions," *American Economic Review*, Vol. 82:4, 1992, 942-963.

Lucas, R.E., Jr., "On the Mechanics of Economic Development," *Journal of Monetary Economics*, Vol. 22, 1988, 3-42.

Phillips, P.C.B., and P. Perron, "Testing for a Unit Root in Time Series Regression," *Biometrica*, Vol. 75, 335-46.

Rebelo, S., "Long-run Policy Analysis and Long-run Growth," *Journal of Political Economy*, Vol. 99, 1991, 500-21.

Romer, P.M., "Increasing Returns and Long-run Growth," *Journal of Political Economy*, Vol. 94, 1986, 1002-38.

_____, "Endogenous Technological Change," *Journal of Political Economy*, Vol. 98, 1990, S71-S102.

Solow, R.M., "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, Vol. 70, 1956, 65-94.