Fiscal policy and growth in Saudi Arabia

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Abstract

Whether government spending can boost the pace of economic growth is widely debated. In the neoclassical growth model, it is supplies of productive resources and productivity that determine growth in the long-run. In endogenous growth models, an increase in government spending may raise the steady-state rate of growth due to positive spillover effects on investment in physical and/or human capital. This paper examines the relationship between government spending and non-oil GDP in the case of Saudi Arabia. Using time-series methods and data for 1969-2005, we find that increases in government spending have a positive and significant long-run effect on the rate of growth. Estimated effects of current expenditure on growth turn out to exceed those of capital expenditure -- suggesting that government investment in infrastructure and productive capacity has been less growth-enhancing in Saudi Arabia than programs to improve administration and operation of government entities and support purchasing power. We discuss possible reasons for this finding in the Saudi case and draw some policy implications. [176 words]

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1. Introduction

Economic growth is one of the most important determinants of economic welfare. Yet, the role of fiscal policy in stimulating growth is poorly understood. In the standard neoclassical growth model, the pace of growth in output over the long-run is determined by growth in labor supply, accumulation of physical and human capital, and technological change. If fiscal policy increases the incentive to save or to invest, the equilibrium capital-output ratio will be altered; thus, the growth rate will rise as the economy transitions to a new higher level of output per capita, but in the long-run it will return to its previous level. Turnovsky (2004) developed a neoclassical-type model in which changes in tax rates have long-lasting effects on growth. In contrast, in endogenous growth models, an increase in government spending may raise the steady-state rate of growth due to positive spillover effects on investment in physical and/or human capital. Within the endogenous growth framework, Dalgaard and Kreiner (2003), Howitt (2000), and Eicher and Turnovsky (1999) have predicted that the growth effect of fiscal policy can be temporary and the speed of convergence may be fast or slow. Thus, with a wide range of models suggesting that fiscal policy could have long-lasting effects on growth, it becomes important to establish empirically whether or not it does, and if so, what the strength and duration of the effects are.

This paper examines the relationship between government spending and non-oil GDP in the case of Saudi Arabia. The issue of whether fiscal policy can affect growth is particularly important in the Saudi case, given the central role of oil revenues in the country's efforts to promote development of the non-oil economy. Using time-series methods, we examine how changes in government spending have affected non-oil gross domestic product over the 1969-2005 period. This period saw both expansions and contractions in government spending, along with shifts in its composition, which enables us to trace through how changes in fiscal variables affect output in both the short- and long-runs. Our findings show that increases in government spending have a positive and significant long-run effect on the rate of growth. Unexpectedly, estimated effects of current expenditure on growth turn out to exceed those of capital expenditure -- suggesting that government investment in infrastructure and productive capacity has been less growth-enhancing in Saudi Arabia than programs to improve administration and operation of government entities and support purchasing power.

The next section of this paper discusses previous research on fiscal policy and growth. The third section lays out the present study's methodology, specification, and data. The fourth section presents results, while the final section concludes.

2. Previous research on fiscal policy and growth

There has been a considerable amount of empirical research on the relationship between fiscal policy and economic growth, covering different fiscal measures, different sets of countries and using cross-sectional, panel, and time-series regression methods. In a meta-analysis of 41 studies exploring the impact of fiscal policies on long-run growth, Nijkamp and Poot (2004) found that 17 percent of studies showed positive relationships between different measures of fiscal policy and economic growth; 29 percent showed negative relationships; and 54 percent were inconclusive. While they found indications of strong effects of education and infrastructure spending on growth, there was no similar impact of fiscal variables in general. This is not surprising considering mixed effects of different fiscal aggregates, as well as the composition of spending and financing methods used.

Thus, several studies have explored how different categories of public spending influence economic growth.[1] These studies predict that each type of government expenditure can influence growth through different channels. For instance, public investment in infrastructure may affect growth by increasing the quantity of factors of production, while public spending on education and health services have an impact on growth by improving the marginal productivity of human capital. At the same time, some types of public spending -- such as subsidies and military expenditure -- may not be productivity-enhancing.[2]

The traditional approach of categorizing public expenditure into consumption or current spending, versus investment or capital spending, assumes that the latter generally promotes growth more than the former. Thus, for example, Gupta et al.

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[1] See Bose et al. (2003) and Eken et al. (1997) for discussion.

[2] See for example Barro (1990), Barro and Sala-i-Martin (1992), and Al-Jarrah (2005).

(2005) analyze data on 39 low-income countries during the 1990s, demonstrating that higher wages tend to lower growth, while higher capital and non-wage expenditure tend to increase it. However, the assumption that capital expenditures are more growth-promoting than current expenditures requires caution since some types of current expenditures are beneficial for growth (e.g. education and training, R&D), while some public investment projects may be "*white-elephants*" that do not increase the country's productive capacity. Consistent with this cautionary note, Devarajan et al. (1996) studied the relationship between expenditure composition and growth for 43 developing countries for the period 1970-1990 and found no significant effect of total public spending on economic growth. But contrary to the commonly-held view, they found that public consumption had a significant positive effect on economic growth, while public investment had a significant negative effect. This negative effect also held for each of the components of government investment, including transportation and communication. The authors interpreted these results as a matter of over-investment in public projects with negative marginal returns.[3]

However, a number of studies contradict the results of Devarajan et al. (1996), at least with respect to some types of investment spending. Fedderke et al. (2006) and Albala-Bertrand and Mamatzakis (2001) examine effects of infrastructure investment on long-run growth in South Africa and Chile respectively, using a vector error-correction model (VECM); both studies find a positive growth effect of 'productive' public expenditure in infrastructure. Using a similar methodology, M'Amanja and Morrissey (2005) examined the Kenyan case for 1964-2002, also finding a positive growth effect of public investment. Haque and Kim (2003) used fixed- and random-effects models to analyze panel data for 15 developing countries for 1970-1987, finding that investment in transportation and communication has a positive impact on economic growth. Likewise, Easterly and Rebelo (1993) used cross-section and panel data of different samples for more than 100 countries and concluded that investment in transportation and communication has a positive and strong effect on growth. Using panel data for 28 developing countries for 1981-1991, Dessus and Herrera (2000) found that public capital accumulation has a positive long run growth effect.

[3] Using panel data for 15 developing countries, Ghosh and Gregoriou (2006) find results similar to those of Devarajan et al. (1996). Tanzi and Schuknecht (1995) suggest that the relationship between government expenditure and growth is not monotonic, and an expenditure share beyond 30 percent of GDP tends to adversely affect growth.

Findings with respect to growth effects of other categories of government expenditure are varied. Using panel data on 120 developing countries, Baldacci et al. (2004) found that spending on human capital (i.e. education and health) is associated with higher economic growth. Baffes and Shah (1998) investigated the relationship between the sectoral allocation of public spending and economic growth, using a sample of 21 low- and medium-income countries from 1965 to 1984. They concluded that 'human development' capital investment has the highest output elasticity; investment in infrastructure capital had a positive but much smaller output elasticity, while military capital showed a negative output elasticity in half the countries in the study.

In research specifically on Saudi Arabia, Al-Jarrah (2005) examined the causal relationship between defense spending and economic growth for 1970-2003 using time-series methodologies. He found evidence of bi-directional causalities, wherein higher defense spending lowered economic growth in the long run. This is consistent with many empirical studies for developing countries.[4] Using annual data for 1970-2001, Al-Obaid (2004) investigated the long-run relationship between total government expenditure and real gross domestic product in order to assess the validity of "Wagner's law" – the hypothesis that public spending tends to rise with economic growth. The cointegration test showed a positive long-run relationship between the share of public spending in GDP and GDP per capita, consistent with Wagner's prediction. Using OLS regressions, Al-Yousif (2000) showed that how the size of the government is measured can influence estimates of its relationship with economic growth: if size is measured as the percentage change in government expenditure, then size is positively related to growth, but if it is measured as a ratio of government expenditure to GDP, the relationship is negative.[5]

Kireyev (1998) tested the relationship between growth in non-oil GDP and public spending using annual data for 1969-1997. His results suggested a significant and positive relationship between public spending and growth in non-oil GDP, wherein a one percent increase in public expenditure causes about half a percent increase in non-oil GDP. In contrast, Ghali (1997) used vector autoregression (VAR)

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[4] See Al-Jarrah (2005) for a review of the literature.
[5] The first definition of size is due to Ram (1986), while the second is due to Landau (1983).

and Granger causality analysis to analyze data for 1960-1996. He found no evidence that public expenditure increased output growth, whether the analysis included total expenditure or expenditures on consumption and investment.

There are two shortcomings of existing research on the relationship between economic growth and different types of government spending in Saudi Arabia. First, most previous studies aim to characterize either the short-run effects of fiscal variables on growth (using VAR analysis) or the long run relationships (using cointegration framework). This runs risks that causalities between government spending and economic growth may be attributed exclusively to short-run interactions or long-run relationships. Second, is the issue of the long-run budget constraints. Because government expenditures must be balanced against revenues in the long-run, analyses that overlook this long-run relationship may overstate the effects of higher spending on growth. Thus, for example, Bose et al. (2003) simultaneously examined public expenditure by sector (education and health) and type (investment and consumption) for 30 developing countries. They found evidence that human capital investments in health and education as well as overall capital spending have a positive impact on growth. However, when they incorporated a government budget constraint, only total capital spending and investment spending on education have positive growth effects. Thus, the authors include financing variables (e.g., tax revenue) to avoid biasing coefficients as a result of this omission.

To examine effects of fiscal policy on growth in Saudi Arabia, we use the co-integration approach adopted in other studies (e.g., M'Amanja and Morrissey, 2005; Fasano and Wang, 2001), which is helpful for characterizing short-run dynamics and long-run relationships between non-oil output, total government revenues, and various measures of government expenditure. We examine two questions left unresolved in current literature: first, whether government expenditure positively affects non-oil GDP growth rate in the long run, and second, whether government capital expenditure has a larger long-run effect on non-oil GDP growth than current expenditure. The following section describes the methodology, specification and data used.

3. Methodology, specification, and data

According to the Johansen (1992, 1988) cointegration methodology, variables of interest can be understood as reflecting long-run cointegrating relations and associated short term dynamics from a vector error-correction mechanism of the form:

$$\Delta Y_t = \sum_{i=1}^{p} \Gamma_i \Delta Y_{t-i} + DZ_t + \Pi Y_{t-1} + \varepsilon_t$$

where Y_t is a column vector of n endogenous variables, Z_t is a column vector of m exogenous variables, Δ is the difference operator, and ε_t is a column vector of white noise processes with mean zero and covariance given by the n x n matrix Σ, corresponding to covariance of residuals within and across equations. The matrix Γ_i contains parameters for a p-order lag process, while the Π matrix contains information about the long run relationships between the variables. When the Π matrix has a reduced rank ($r \leq (n\text{-}1)$), it can be decomposed into $\alpha\beta'$, where the α matrix includes the speed of adjustment to equilibrium coefficients and β' is the long-run matrix of coefficients.

In the present case, our interest is in estimating how non-oil GDP (Y) is affected by changes in government expenditures, which can be measured either as total expenditure (EX) or in terms of its two components, current expenditure (CU) and capital expenditure (CA).[6] Detailed variable definitions and data sources are shown in Table 1.[7] These variables are treated as endogenous, along with total government revenue (R), which is included in the analysis to represent the government budget constraint. In Saudi Arabia, total government revenue is largely determined by oil revenue, which typically represents more than 80 percent of the total. As exogenous variables, we include the world price of oil (OP) and the terms of trade (TOT); the former is included for the current period, while the latter is lagged one year, on the

[6] Capital expenditure is related to government investment activities and primarily used for constructions and purchases of capital and intermediate goods. Current expenditure includes spending on recurrent expenses such as wages and salaries, administration, subsidies and transfers, and operation and maintenance services.

[7] Note that Saudi Arabia's fiscal accounts currently cover the central government's budget, but not institutions such as the Public investment Fund (PIF), the Public Pension Agency (PPA), or the General Organization for Social Insurance (GOSI). Lack of comprehensive information on these institutions does not allow the presentation of consolidated general government accounts.

grounds that higher oil prices are likely to have a concurrent effect on the endogenous variables (especially the fiscal measures), whereas effects of shifts in the terms of trade would take time to materialize. In the econometric analysis, all variables are expressed in logs. The data are annual and cover the period from 1969 to 2005.

Economic theory predicts that, in the long run, the growth of expenditure and revenue should be related to aggregate economic conditions, which are represented in the models by non-oil GDP. The existence of cointegrating vector(s) indicates long-run relationship(s) among these variables, while short-term deviations from the long-run time path of these series will be captured in the error correction terms. For instance, if the intertemporal budget constraint is binding in the long run, expenditure and revenue are expected to share a common trend; whenever the gap between these two variables is large relative to their long-run relationship, one variable or both will adjust to reduce the gap and restore long-run equilibrium.

To determine orders of integration of the variables in the model, we conducted traditional Augmented Dickey-Fuller and Phillips-Perron unit-root tests, along with those of Kwiatkowski, Phillips, Schmidt and Shin (KPSS), which has stationarity as its null hypothesis, and of Ng and Perron, which is designed to address problems of low power and size distortions in the traditional tests.[8] As shown in appendix Table 2, in virtually all cases, the tests fail to reject unit roots in the levels of the variables (or, in the KPSS case, they reject stationarity) while they can reject unit roots in their first differences (or, in the KPSS case, do not reject stationarity).[9] Thus, with variables having a similar order of integration, we can proceed with the cointegration model.

For both the total expenditure model and the model differentiating between capital and current expenditure, the Schwartz Information Criterion indicated that the optimal lag length was one.[10] To test the hypothesis regarding the number of

[8] Maddala and Kim (1998) discuss unit root tests.

[9] There are two exceptions. The first concerns non-oil GDP, where the ADF test suggested stationary in the log level and the KPSS test showed non-stationarity in the log first difference; given the mixed evidence here, we follow the finding in other studies (e.g., Fasano and Wang, 2001) and treat non-oil GDP as non-stationary in level and stationary in first difference. The second is the log level of the oil price, for which stationarity cannot be rejected in the KPSS test. Again, given the advantages of the Ng-Perron test with respect to size and power properties in data series with limited span, we opt to place more weight on the Ng-Perron result.

[10] A maximum lag length of three was considered given the annual frequency of the data and the need to conserve degrees of freedom.

cointegrating vectors, the Trace statistic and the Maximum Eigenvalue statistic are used.[11] In both cases, the Johansen cointegration test suggested the existence of at least one cointegrating relationship under most assumptions about deterministic components in the data or the cointegration equations. In both models, intercept terms are included in both the cointegration equation and the VAR. Also a trend is included in the cointegration equation on the grounds that growth may be affected by exogenous factors such as technological progress, which is a reasonable assumption in the Saudi context. Details of the Trace and Eigenvalue statistics based on the Johansen cointegration test can be found in Appendix Tables 3 and 4.

Finally, we use the cointegrated variables to estimate the VECM (in log differences). This step allows for investigating the long run relationship and the short run dynamics among the relevant variables. In addition, it provides evidence about the direction of causation. For example, if two variables are cointegrated, an error correction model can be formulated according to Engle and Granger (1987) as follows:

$$\Delta y_{1t} = a_1 + \sum_{i=0}^{m} b_{1i} \Delta y_{2t-i} + \sum_{i=1}^{n} c_{1i} \Delta y_{1t-i} + \lambda_1 ecm_{t-1} + \mu_{1t}$$

$$\Delta y_{2t} = a_2 + \sum_{i=0}^{m} b_{2i} \Delta y_{1t-i} + \sum_{i=1}^{n} c_{2i} \Delta y_{2t-i} + \lambda_2 ecm_{t-1} + \mu_{2t}$$

where: y_{1t} and y_{2t} are variables that are cointegrated, Δ is the difference operator, m and n are the lag lengths of the variables, ecm_t denotes the residual from the cointegration equation (the error correction term), and μ_{1t} and μ_{2t} are uncorrelated white noise residuals.

In presenting impulse response functions based on the model results, identification of the common component in the error terms is carried out using Cholesky decomposition, which attributes all of the effect of any common component to the variable ordered first in the VECM system. In the baseline case, expenditure variables are ordered first, followed by non-oil GDP and then total revenue, based on

[11] These statistics are compared with the critical values in Osterwald-Lenum (1992). MacKinnon et al. (1999) also provide similar P-values.

the assumption that expenditure variables respond to a change in the state of the economy with a lag, while non-oil GDP responds to contemporaneous changes in expenditure variables; revenue is ordered last on the grounds that it is a passive variable that responds contemporaneously to changes in the state of the economy. We also estimate alternative specifications that order non-oil GDP before the expenditure variables, and/or order revenue first; results are qualitatively robust to these changes in specification.[12] Diagnostic tests show no evidence of non-normality, first-order serial correlation, or heteroskedasticity in the errors, allowing us to draw inferences from the VECM results.

4. Results

Total expenditure model

Results for the VECM model based on total expenditure are presented in Table 5. If we normalize the coefficient on non-oil GDP in the cointegrating relationship to one, the estimated relationship can be represented as follows [t-statistics in parentheses]:

$$LY_t = 5.235 + \underset{[6.25]}{0.66}\,LEX_t - \underset{[1.37]}{0.15}\,LR_t + \underset{[14.43]}{0.041}\,t$$

The estimated coefficient of 0.66 on government expenditure suggests that a 1 percent increase in government expenditure would boost non-oil GDP by 0.66 percent, where the estimated effect is statistically significant. The coefficient on the time trend is also positive and significant, suggesting growth in non-oil GDP due to technological progress and/or other exogenous factors. While the long-run effect of an increase in total government revenue on non-oil GDP is estimated to negative, the effect is not statistically significant.

According to the coefficients on the *ecm* terms in Table 5, non-oil GDP and total government revenue adjust relatively quickly to departures from their

[12] This true despite some scatter changes in the significance and direction of relationships among variables in the short run. Note that sensitivity to ordering assumptions depends on the extent to which innovations are correlated across variables; the weaker the correlation between the innovations, the less the ordering matters.

equilibrium in the previous period at a speed of 32 and 40 percent, respectively; total expenditure also adjusts but at a much slower rate. However, of the coefficients on *ecm*, only that in the equation for non-oil GDP is significant at a 5 percent level, suggesting that short run adjustment takes place primarily through non-oil GDP, rather than expenditure and revenue growth. This may reflect one of the main objectives of the Saudi development plans, which promote the private sector as a leading force to diversify the economy away from oil, while creating jobs for the increasing number of Saudis entering the labor market.

To understand the dynamics of adjustment to shocks in the various endogenous variables, Figure 1 presents impulse-response functions, which show how the various endogenous variables respond to a one standard-deviation permanent shock to each of the variables; also shown are 95 percent confidence intervals based on 2000 replications of the Hall bootstrap method. The results show that a shock to total government expenditure is associated with further increases in government expenditure over the next few years, until it gradually converges to a higher level; this likely reflects the inertia of traditional line-item budgeting, wherein spending levels in each new budget are 'grown out' from what they were in the previous budget. While a shock to government spending does not affect non-oil GDP concurrently, after a year the effect becomes positive and significant and continues to increase over the next several years before eventually leveling off. However, shocks to non-oil GDP do not systematically affect government expenditure, contrary to what would be expected from countercyclical fiscal policy. Note that variance decompositions (not shown) also indicate that shocks to government expenditure play a relatively important role in explaining fluctuations in non-oil GDP in the medium- to long-run: while shocks to government expenditure account for only 3.7 percent of the forecast error in non-oil GDP at a one-year forecast horizon, they account for 71.3 percent of the forecast error at a 5-year horizon and 81.8 percent 10 years out. This supports the hypothesis that government spending has a positive and relatively important effect on growth in non-oil GDP.

Current and capital expenditure model

The results for the model disaggregating total government expenditure into current and capital spending are presented in Table 6. If we again normalize the cointegrating relation by restricting the coefficient on non-oil GDP to be one, the results can be represented as follows [t-statistics are given in parentheses]:

$$LY_t = 5.071 + \underset{[5.017]}{0.507\, LCU_t} + \underset{[2.275]}{0.182\, LCA_t} - \underset{[1.396]}{0.127\, LR_t} + \underset{[5.334]}{0.041\, t}$$

Both current and capital expenditure are significantly and positively related to non-oil GDP in the long-run. The estimated coefficient on the time trend is again significant and positive, suggesting a role of technological progress and/or other exogenous changes. Again, the long run relationship between revenue and non-oil GDP is estimated to be negative, but not statistically significant. As estimated coefficients on the *ecm* terms shown in the table indicate, the endogenous variables all adjust to departures from equilibrium in the previous period at a relatively quick rate, although these coefficients are estimated to be statistically significant in the equations for non-oil GDP and current expenditure only.

Figure 2 presents the impulse response functions from the model, again with 95 percent confidence intervals obtained using the Hall bootstrap. While a shock to current expenditure does not concurrently affect non-oil GDP, it has a positive, significant and permanent effect that phases in primarily in the first 1 to 5 years after the shock. In contrast, a shock to capital expenditure does not significantly affect non-oil GDP until about two years after the shock, and although there is a significant positive effect in years two to four, thereafter the effect is only of borderline statistical significance. Variance decompositions (not shown) also suggest that current expenditure plays a more important role in explaining fluctuations in non-oil GDP than capital expenditure: At a 5-year time horizon, for example, shocks to current expenditure explain 54 percent of forecast variance in non-oil GDP, while those of capital expenditure account for 16 percent. This result could be attributed to the fact that current expenditure includes spending categories such as training, scholarships, R&D, and salaries of workers in the large public sector, which feed immediately into the demand for domestically-produced goods and services. On the other hand, the limited contribution of capital expenditure in explaining the variation of non-oil GDP could reflect capital spending on *white-elephant* projects or imports of military equipments, which may negligibly or negatively impact growth (Al-Jarrah, 2005). This suggests it may be useful to extend this analysis by disaggregating government expenditure into 'productive' and 'non-productive' elements, as will be done in future research.

5. Conclusion

To summarize, our analysis provides evidence that increases in government spending significantly increase non-oil GDP in Saudi Arabia, whether spending is measured in the aggregate or in terms of capital and current expenditure. These results are consistent with studies by Al-Yousif (2000) and Kireyev (1998), who also find positive effects of government spending on non-oil GDP in Saudi Arabia. They contrast with those of Al-Jarrah (2005), who finds a negative effect of military spending, and those of Ghali (1997), whose results are inconclusive. Interestingly, the findings show effects of current expenditure on growth to exceed those of capital expenditure, contrary to commonly held views. Conceivably, this may reflect public investment patterns that are not optimally growth-promoting -- for example, due to non-economic criteria used in the selection of investment projects and/or problems with managerial incentives that undermine returns to public investment.[13] This suggests that, from a growth perspective, it may be preferable to allocate public spending to maintaining and improving existing infrastructure, rather than starting new projects with uncertain returns. Unfortunately, because procedures for classifying capital expenditures do not differentiate between types of spending (but rather are just broken out by project and government agency), it is not possible to identify components of public investment that drag down its contribution to growth. This suggests that reforming the budget classification system could be valuable for ensuring that public investment enhances the country's non-oil productive capacity.

Finally, it is also worth noting that the Saudi government is attempting to contain the impact of sudden shifts in government spending on non-oil activities by expanding the role of the private sector in the economy and maintaining prudent fiscal

[13] Thus, for example, one study found that countries with high levels of corruption had high levels of public capital expenditures, but low operations and maintenance expenditures (Tanzi and Davoodi 1997). See Ghosh and Gregoriou (2006) and Devarajan et al (1996) for more discussion.

policies. Besides the role played by government expenditure in the development of the non-oil sectors, broadening the role of the private sector needs to consider policies that would involve transfer of responsibility between the public and private sectors. To encourage higher private sector growth, the government would need to continue its structural adjustment efforts to encourage diversification of the economy, broaden and deepen the financial market, open the domestic market for foreign participation, remove domestic price distortions, and improve the efficiency of the public sector. Stimulating these adjustment policies would facilitate private sector growth, and give the government an opportunity to focus on providing public goods that are not sufficiently provided by the private sector.

Appendix

Table 1: Detailed variable definitions and data sources			
Abbr.	Variable	Units	Data source
Y	Non-oil GDP	Billions of constant Saudi Riyals (converted to 1999 terms using the consumer price index)	Annual reports, Saudi Arabian Monetary Agency; and reports on Achievement of the Development Plans, Ministry of Economy and Planning
R	Total government revenue	(same)	(same)
EX	Total government expenditure	(same)	(same)
CU	Current government expenditure	(same)	(same)
CA	Capital government expenditure	(same)	(same)
OP	World oil price (per barrel)	US$ deflated by the CPI for industrial countries	IMF, International Financial Statistics Book
TOT	Terms of trade	Ratio of indices of exports and imports prices	Annual reports, Saudi Arabian Monetary Agency and authors' calculations

Table 2: Results of unit root tests for the log levels and the log first differences

Variable		**ADF**	**PP**	**KPSS**	**Ng-P**
LY	Level	*d*, I(0)	*d*, I(1)	*d*, I(2)	*d*, I(1)
	Difference	-	*d*, I(0)	*d*, I(1)	*d*, I(0)
LR	Level	*d*, I(1)	*d*, I(1)	*d*, I(1)	*d*, I(1)
	Difference	I(0)	I(0)	*d*, I(0)	*d*, I(0)
LEX	Level	*d*, I(1)	*d*, I(1)	*d*, I(1)	*d*, I(1)
	Difference	I(0)	I(0)	*d*, I(0)	*d*, I(0)
LCU	Level	*d*, I(1)	*d*, I(1)	*d*, I(1)	*d*, I(1)
	Difference	*d*, I(0)	*d*, I(0)	*d*, I(0)	*d*, I(0)
LCA	Level	*d*, I(0)	*d*, I(1)	*d*, I(0)	*d*, I(1)
	Difference	-	I(0)	-	*d*, I(0)
LOP	Level	*d*, I(1)	*d*, I(1)	*d*, I(0)	*d*, I(1)
	Difference	I(0)	I(0)	-	*d*, I(0)
LTOT	Level	I(1)	I(1)	*d*, I(1)	*d*, I(1)
	Difference	I(0)	I(0)	*d*, I(0)	*d*, I(0)

Notes: d = drift term was included in unit root test. I(0), I(1) = test showed the series to be integrated of order zero or one, respectively

Table 3: Unrestricted cointegration rank test for total expenditure model

		Trace Test			Maximum Eigenvalue Test		
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.497	43.492*	42.915	0.044*	24.037	25.823	0.085
At most 1	0.278	19.455	25.872	0.255	11.377	19.387	0.475

Trace test indicates one cointegrating equation at the 0.05 level. Max-Eigenvalue test indicates no cointegration at the 0.05 level. *Denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) P-values.

Table 4: Unrestricted cointegration rank test for Current and Capital Expenditure Model

		Trace Test			Maximum Eigenvalue Test		
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.627	66.614*	63.876	0.029*	34.475*	32.118	0.025*
At most 1	0.365	32.138	42.915	0.381	15.899	25.823	0.554

Trace test indicates one cointegrating equation at the 0.05 level. Max-Eigenvalue test indicates one cointegrating equation at the 0.05 level. *Denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) P-values.

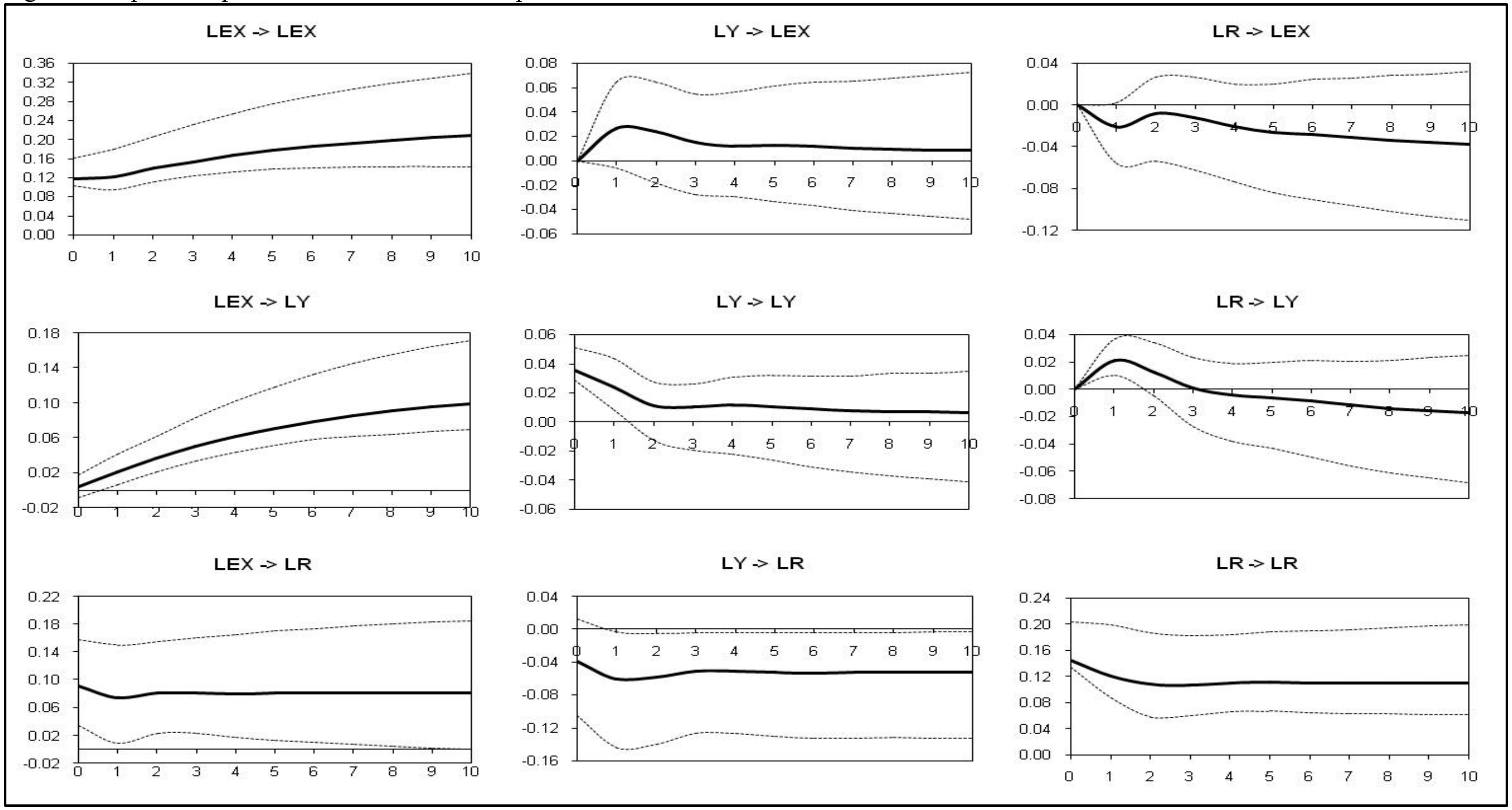
Table 5: VECM estimates for the total expenditure model

Cointegrating Eq:	CointEq1		
LY(-1)	1.0000		
LEX(-1)	-0.6605		
	[-6.2511]		
LR(-1)	0.1504		
	[1.3666]		
Trend	-0.0414		
	[-14.433]		
C	-5.2346		
Error Correction:	ΔLY_t	ΔLEX_t	ΔLR_t
Ecm $_{t-1}$	-0.3206	0.0167	-0.4010
	[-3.9260]	[0.0678]	[-1.0908]
ΔLY_{t-1}	0.3501	0.7013	-0.3298
	[3.3442]	[2.2173]	[-0.6999]
ΔLEX_{t-1}	-0.1341	0.1362	-0.1826
	[-1.8198]	[0.61201]	[-0.5507]
ΔLR_{t-1}	0.1811	-0.1374	-0.1218
	[3.5938]	[-0.9027]	[-0.5369]
C	0.0495	-0.0058	0.0835
	[4.8091]	[-0.1855]	[1.8008]
$\Delta LTOT_t$	-0.0538	0.2402	0.1790
	[-1.6534]	[2.4439]	[1.2226]
ΔLOP_t	0.0659	0.4340	0.9030
	[2.3796]	[5.1876]	[7.2448]
Adj. R-squared	0.7590	0.6005	0.6457
F-statistic	18.8418	9.5167	11.3255
Log likelihood	65.0157	26.3181	12.3651
Akaike AIC	-3.3152	-1.1039	-0.3066
Schwarz SC	-3.0041	-0.7928	0.0045
Log likelihood		112.18	
Akaike information criterion		-4.9822	
Schwarz criterion		-3.8713	

Diagnostic tests for the VECM residual	P value
Jarque-Bera test for normality	0.4032
Serial correlation LM test	0.7435
White heteroskedasticity test	0.3127

Notes: t-statistics are given in parentheses. The null hypotheses for the diagnostic tests are that the errors are normal, not serially correlated, and homoskedastic, respectively.

Figure 1: Impulse response functions for Total Expenditure Model



Notes: Solid lines show the estimated effect of a one standard-deviation shock in one variable on the other, where the vertical axis is the estimated effect and the horizontal axis shows the number of years. Dotted lines are 95 percent confidence intervals based on 2000 replications of the Hall bootstrap.

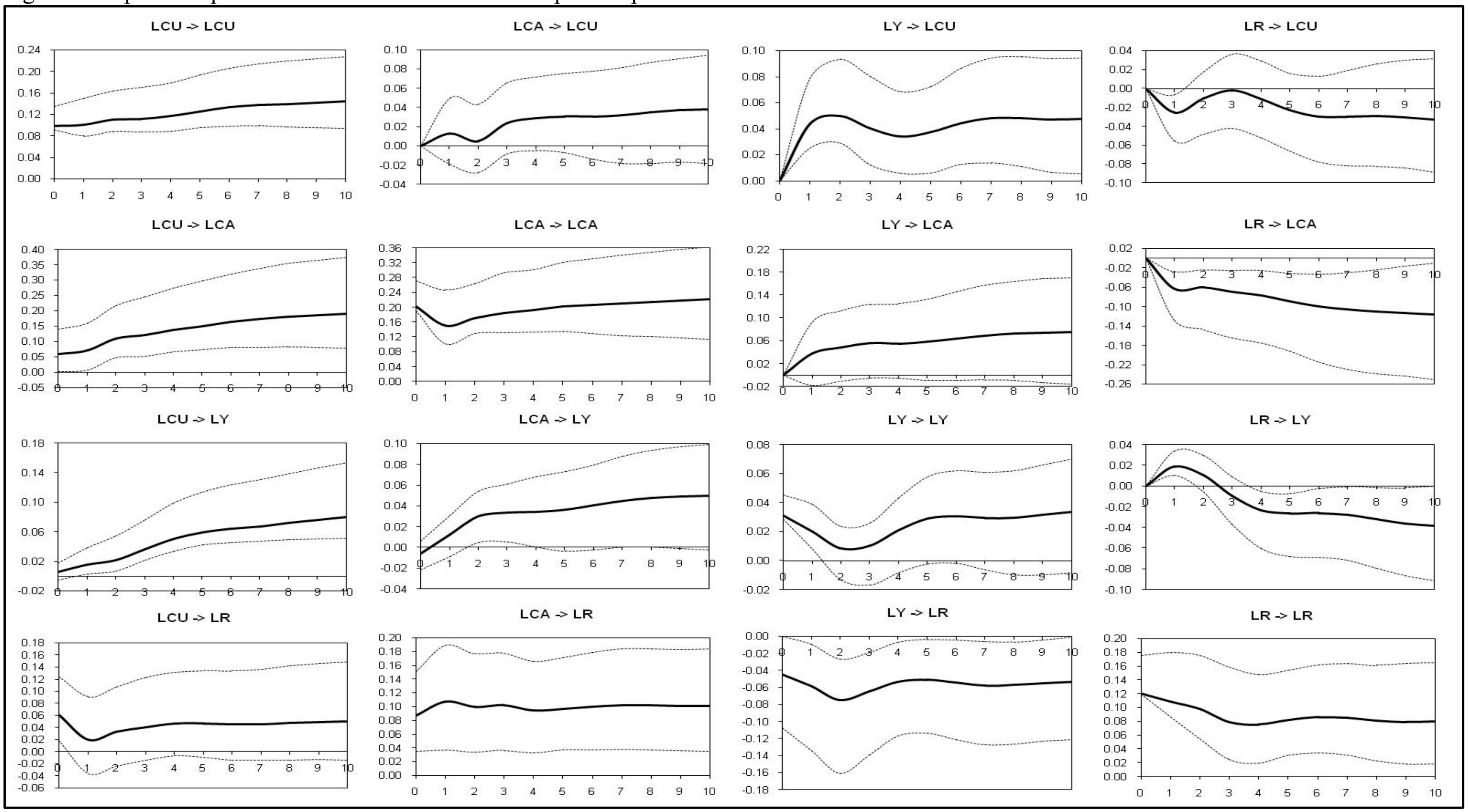
Table 6: VECM estimates for current and capital expenditure model

Cointegrating Eq:	CointEq1			
LY(-1)	1.0000			
LCU(-1)	-0.5074			
	[-5.0173]			
LCA(-1)	-0.1817			
	[-2.2752]			
LR(-1)	0.1272			
	[1.3964]			
Trend	-0.0413			
	[-5.3338]			
C	-5.0710			
Error Correction:	**DLY**	**DLCU**	**DLCA**	**DLR**
CointEq1	-0.4020	0.4851	-0.2547	-0.2748
	[-4.7433]	[2.1411]	[-0.5000]	[-0.6761]
DLY(-1)	0.4181	0.6062	0.9660	-0.0523
	[4.3619]	[2.3655]	[1.6768]	[-0.1138]
DLCU(-1)	-0.1375	0.1215	0.3327	-0.5000
	[-2.1279]	[0.7037]	[0.8570]	[-1.6140]
DLCA(-1)	-0.0460	0.2797	-0.0609	0.0725
	[-1.2075]	[2.7458]	[-0.2659]	[0.3968]
DLR(-1)	0.1973	-0.2683	-0.4797	-0.0518
	[3.7744]	[-1.9203]	[-1.5272]	[-0.2068]
C	0.0458	0.0115	-0.0553	0.0816
	[4.8505]	[0.4550]	[-0.9751]	[1.8040]
DLTOT(-1)	-0.0500	0.1511	0.5585	0.1550
	[-1.5578]	[1.7592]	[2.8933]	[1.0067]
DLOP	0.0684	0.3986	0.7255	0.8559
	[2.5013]	[5.4562]	[4.4175]	[6.5313]
Adj. R-squared	0.7923	0.6425	0.4718	0.6535
F-statistic	19.5297	9.7285	5.3385	10.1587
Log likelihood	68.2590	33.8384	5.4877	13.3906
Akaike AIC	-3.4434	-1.4765	0.1436	-0.3080
Schwarz SC	-3.0879	-1.1210	0.4991	0.0475
Log likelihood		134.8327		
Akaike information criterion		-5.5904		
Schwarz criterion		-3.9462		

Diagnostic tests for the VECM residual	P value
Jarque-Bera test for normality	0.1476
Serial correlation LM test	0.7758
White heteroskedasticity test	0.4357

Notes: t-statistics are given in parentheses. The null hypotheses for the diagnostic tests are that the errors are normal, not serially correlated, and homoskedastic, respectively.

Figure 2: Impulse response functions for Current and Capital Expenditure Model



Notes: Solid lines show the estimated effect of a one standard-deviation shock in one variable on the other, where the vertical axis is the estimated effect and the horizontal axis shows the number of years. Dotted lines are 95 percent confidence intervals based on 2000 replications of the Hall bootstrap.

References

Albala-Bertrand, J., and E. Mamatzakis, 2001, "Is Public Infrastructure Productive? Evidence from Chile," *Applied Economics Letters,* Vol. 8, pp. 195-198.

Al-Jarrah, M., 2005, "Defense Spending and Economic Growth in an Oil-Rich Country: The Case of Saudi Arabia," *Pakistan Economic and Social Review,* Vol. 43, pp. 151-166.

Al-Obaid, H., 2004, "Rapidly Changing Economic Environments and the Wagner's Law: The Case of Saudi Arabia," *Ph.D. Dissertation,* (Fort Collins, Colorado: Colorado State University).

Al-Yousif, Y., 2000, "Do Government Expenditures Inhibit or Promote Economic Growth: Some Empirical Evidence from Saudi Arabia," *The Indian Economic Journal,* Vol. 48, pp. 92-96.

Baffes, J., and A. Shah, 1998, "Productivity of Public Spending, Sectoral Allocation Choices, and Economic Growth," *Economic Development and Cultural Change,* Vol. 46, pp.291-303.

Baldacci, E., B. Clements, S. Gupta, and Q. Cui, 2004, "Social Spending, Human Capital, and Growth in Developing Countries: Implications for Achieving The MDGs," *IMF Working Paper* No. 04/217 (Washington, DC: International Monetary Fund).

Barro, R., 1990, "Government Spending in a Simple Model of Endogeneous Growth," *Journal of Political Economy,* Vol. 98, pp. 103-125.

Barro, R., and X. Sala-i-Martin, 1992, "Public Finance in Models of Economic Growth," *Review of Economic Studies,* Vol. 59, pp. 645-661.

Bose, N., M. Haque, and D. Osborn, 2003, "Public Expenditure and Economic Growth: A Disaggregated Analysis for Developing Countries," *Centre for Growth and Business Cycle Research Discussion Paper Series,* (Manchester, United Kingdom: University of Manchester).

Dalgaard, C., and C. Kreiner, 2003, "Endogenous Growth: A Knife Edge or the Razor's Edge?" *Scandinavian Journal of Economics,* Vol. 105, pp. 73-85.

Dessus, S., and R. Herrera, 2000, "Public Capital and Growth Revisited: A Panel Data Assessment," *Economic Development and Cultural Change,* Vol. 48, pp. 407-418.

Devarajan, S., V. Swaroop, and H. Zou, 1996, "The Composition of Public Expenditure and Economic Growth," *Journal of Monetary Economics,* Vol. 37, pp. 313-344.

Dickey, D., and W. Fuller, 1981, "Likelihood Ratio Statistics for Autoregressive Time Series with Unit Root," *Econometrica,* Vol. 49, pp.1057-1072.

Easterly, W., and S. Rebelo, 1993, "Fiscal Policy and Economic Growth: An Empirical Investigation," *Journal of Monetary Economics,* Vol. 32, pp. 417-458.

Eicher, T., and S. Turnovsky, 1999, "Convergence in a Two-Sector Nonscale Growth Model," *Journal of Economic Growth,* Vol. 4, pp. 413-428.

Eken, S., T. Helbling, and A. Mazarei, 1997, "Fiscal Policy and Growth in the Middle East and North Africa Region," *IMF Working Paper* No. 97/101 (Washington, DC: International Monetary Fund).

Engle, R. and C. Granger, 1987, "Co-integration and Error Correction: Representation, Estimation, and Testing," *Econometrica,* Vol. 55, pp. 251-276.

Fasano, U., and Q. Wang, 2001, "Fiscal Expenditure Policy and Non-Oil Economic Growth: Evidence from GCC Countries," *IMF Working Paper* No. 01/195 (Washington, DC: International Monetary Fund).

Fedderke, J., P. Perkins, and J. Luiz, 2006, "Infrastructure Investment in Long-run Economic Growth: South Africa 1875-2001," *World Development,* Vol. 34, pp. 1037-1059.

Ghali, K., 1997, "Government Spending and Economic Growth in Saudi Arabia," *Journal of Economic Development,* Vol. 22, pp. 165-172.

Ghosh, S., and A. Gregoriou, 2006, "On the Composition of Government Spending, Optimal Fiscal Policy, and Endogenous Growth: Theory and Evidence," *Brunel University Discussion Paper* No. 06-19 (Middlesex, United Kingdom).

Gupta, S., B. Clements, E. Baldacci, and C. Mulas-Granados, 2005, "Fiscal Policy, Expenditure Composition, and Growth in Low-Income Countries," *Journal of International Money and Finance,* Vol. 24, pp. 441-463.

Haque, M., and D. Kim, 2003, "Public Investment in Transportation and Communication and Growth: A Dynamic Panel Approach," *Centre for Growth and Business Cycle Research Discussion Paper Series,* (Manchester, United Kingdom: University of Manchester).

Howitt, P., 2000, "Endogenous Growth and Cross-Country Income Differences," *American Economic Review,* Vol. 90, pp. 829-846.

Johansen, S., 1992, "Determination of Cointegration Rank in the Presence of a Linear Trend," *Oxford Bulletin of Economics and Statistics,* Vol. 54, pp. 383-397.

______, 1988, "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control,* Vol. 12, pp. 231-254.

Kireyev, A., 1998, "Key Issues Concerning Non-Oil Sector," In *Saudi Arabia Recent Economic Development Issue,* Vol. 48, pp. 29-33 (Washington, DC: International Monetary Fund).

Kwiatkowski, D., P. Phillips, P. Schmidt and Y. Shin, 1992, "Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root," *Journal of Econometrics,* Vol. 54, pp. 159-178.

Landau, D., 1983, "Government Expenditure and Economic Growth: A Cross-Country Study," *Southern Economic Journal,* Vol. 49, pp. 783-792.

Mackinnon, J., A. Haug, and L. Michelis, 1999, "Numerical Distribution Functions of Likelihood Ratio Tests for Cointegration," *Journal of Applied Econometrics,* Vol. 14, pp. 563-577.

Maddala, G., and I. Kim, 1998, *Unit Roots, Cointegration, and Structural Change,* Cambridge University Press (New York and Cambridge, United Kingdom).

M'Amanja, D. and O. Morrissey, 2005, "Fiscal Policy and Economic Growth in Kenya," *CREDIT Research Paper* No. 05/06 (Nottingham, United Kingdom: University of Nottingham).

Ministry of Economy and Planning, 2006, *Achievements of the Development Plans: Facts and Figures,* No. 23—and other previous issues (Riyadh, Saudi Arabia).

Ng, S., and P. Perron, 2001, "Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power," *Econometrica,* Vol. 69, pp. 1519-1554.

Nijkamp, P., and J. Poot, 2004, "Meta-Analysis of the Effect of Fiscal Policies on Long-Run Growth," *European Journal of Political Economy,* Vol. 20, pp. 91-124.

Osterwald-Lenum, M., 1992, "A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistic," *Oxford Bulletin of Economics and Statistics*, Vol. 54, pp. 461-472.

Perron, P., 1989, "The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis," *Econometrica,* Vol. 57, pp.1361-1401.

Ram, R., 1986, "Government Size and Economic Growth: A New Framework and Some Evidence from Cross Sectional and Time Series Data," *American economic Review,* Vol. 76, pp. 191-203.

Saudi Arabian Monetary Agency (SAMA), 2006, *Annual Report*, No. 42—and other previous issues (Riyadh, Saudi Arabia).

Tanzi, V., and H. Davoodi, 1997, "Corruption, Public Investment, and Growth", *IMF Working Paper* No. 97/139 (Washington, DC: International Monetary Fund).

_____, and H. Schuknecht, 1995, "The Growth of Government and the Reform of the State in Industrial Countries," *IMF Working Paper* No. 95/130 (Washington, DC: International Monetary Fund).

Turnovsky, S., 2004, "The Transitional Dynamics of Fiscal Policy: Long-Run Capital Accumulation and Growth," *Journal of Money Credit and Banking,* Vol. 36, pp. 883-910.