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Economic Growth and Government Spending in Saudi Arabia: an Empirical Investigation

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Economic Growth and Government Spending in Saudi Arabia: An Empirical Investigation

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Abstract

This paper empirically examines the effects of different types of government expenditures, on economic growth in Saudi Arabia. We use different econometric techniques to estimate the short- and long-run effects of these expenditures on growth and employ annual data over the period 1969-2010. Our findings indicate that while private domestic and public investments, as well as healthcare expenditure, stimulate growth in the long-run, openness to trade and spending in the housing sector can also boost short-run production. These findings draw some policy implications for Saudi policymakers on maximizing the returns of the government spending on economic growth.

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I. INTRODUCTION

A fundamental question in growth theory asks whether increasing government expenditure promotes economic growth. Yet the empirical evidence is inconclusive. On the one hand, government expenditure on education and health care would raise labor productivity. Further, government expenditure on such infrastructure as roads and communications would also boost the rate of private domestic investment, which in turn fosters economic growth. Barro (1991, p. 430), for instance, argues that "expenditures on education and defense are more like public investment than public consumption; in particular, these expenditures are likely to affect private sector productivity or property rights, which matters for private investment." On the other hand, higher government spending may hinder overall economic performance if the spending comes at a cost of increased taxes and/or borrowing to finance the government expenditures.

Fiscal policy is a key element of Saudi Arabia's macroeconomic policy given the importance of public expenditures in financing investment and consumption activities and their role in meeting the growing need for public social services. Available statistics show that total government expenditures increased from US$1.6 billion in 1970 to US$158.9 billion in 2010 (a 9,800 percent increase in nominal and 1,700 percent increase in real terms) in order to meet continuing increase in demand due to population growth and higher standards of living. Despite this fact, unemployment has remained high in recent years. This underlines the importance of the composition of government spending and how it could be altered to encourage private-sector-led growth and reduce unemployment.

Although several empirical studies have examined the relationship between government expenditure and economic growth in Saudi Arabia, none of these studies has explored the relationship between different categories of government expenditures and economic growth. Therefore, the main objective of this paper is to empirically re-examine the impacts of different components of government expenditure on economic growth in Saudi Arabia. To this end, we use Vector Auto Regression (VAR), Cointegration, and Vector Error Correction Model (VECM) techniques to estimate the short- and long-run effects of these expenditures on growth and employ annual data over the period 1969-2010. The empirical findings indicate that while private domestic and public investments, as well as healthcare expenditures, stimulate growth in the long-run, openness to trade and spending in the housing sector can also boost the short-run production.

The rest of the paper is organized as follows. Section II gives a brief background on the structure of Saudi Arabia's government expenditures. Section III provides a review of related literature. Section IV discusses our theoretical model, empirical methodology, and data. Section V presents the empirical results, and Section VI concludes with some policy implications.

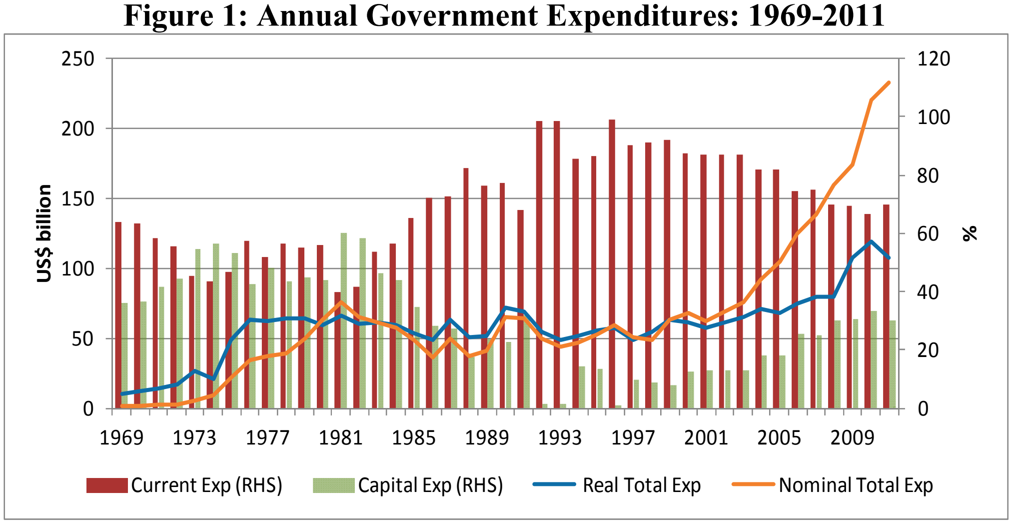
II. BACKGROUND

Although Saudi Arabia is one of the fastest growing economies in the Middle East and North Africa,[2] its economy still depends heavily on the oil sector. Oil revenue accounts for roughly 90.0 percent of total government revenues, oil exports account for about 88.0 percent of total export earnings, and the oil sector contributes about 35.0 percent to GDP.

Given the importance of public expenditures in financing investment and consumption activities, Saudi Arabia's fiscal policy plays a vital role in the economy. Saudi government activities may be divided into public investment, which is carried out by state-owned firms, and through government expenditures. The government expenditures consist of two types, current and capital. While the former includes wages, salaries, subsidies, transfers, and other expenses (i.e. consumption), the latter encompasses government spending on reinforcing human resources, providing social services and healthcare, developing economic resources, transportation and telecommunications, and increasing the availability of municipal and housing services.[3]

Figure 1 shows the historical path of government expenditures in Saudi Arabia. As can be seen from the graph, the Saudi government allocated a large portion of its budget in the 1980s to capital spending, but with the decline in oil prices in late 1980s, capital expenditure shrank significantly.

Figure 1: Annual Government Expenditures: 1969-2011



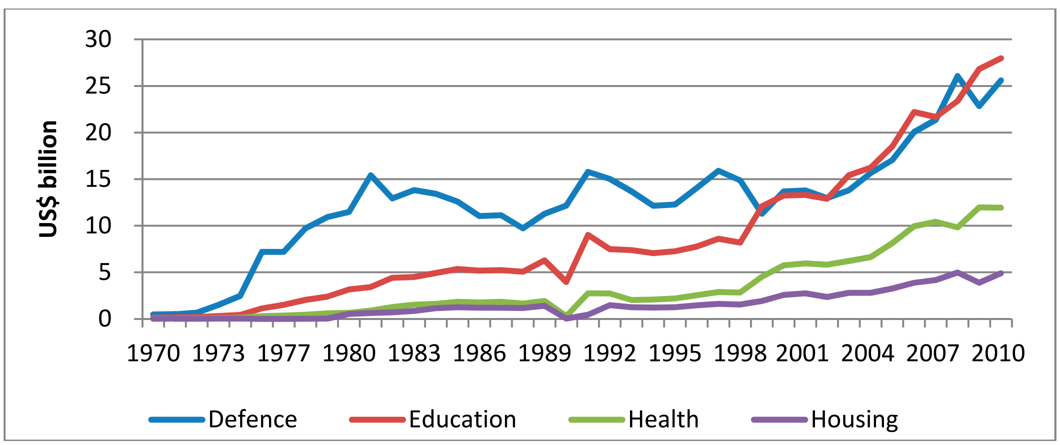
Source: *SAMA Annual report*, 2011

[2]In the last decade, the average annual growth rate was 8.8 percent.
[3]Chapter (4) of the budget encompasses programs and projects of development sector.

In order to achieve better economic performance, Saudi Arabia adopted deliberate planning and careful implementation of a development program with clear goals by introducing the First Development Plan in 1970. With this first attempt, Saudi government has started a series of five-year plans that continues today. As can be seen from Figure 1, in the first three Development Plans (1970-1984) the government focused on financing the projects needed for improvement of education, health, housing, transportation, and telecommunication services. Thus, capital expenditure was as large as current expenditure. During the Fourth and the Fifth Development Plans (1985-1994), oil revenues significantly declined as the global prices for oil slumped. This drop was followed by a decline in real government spending. Furthermore, most infrastructure projects were completed, thus further eroding the share of capital expenditure.

Over the Sixth Development Plan (1995-99) the government's strategic plans focused on development of human resources. Actual expenditure on development sectors amounted to US$112.1 billion of which US$57.7 billion was spent on human capital development.

Figure 2: Government Expenditures (current prices): 1970-2010



Source: *SAMA Annual report*, 2011

The Seventh Development Plan (2000-04) further prioritized human capacity development. Total government expenditure amounted to US$129.4 billion of which 57.1 percent was allocated to human capital development, 19.1 percent for social and healthcare development, and 12.6 percent for infrastructure. During the Eighth Plan (2005-2009), total government expenditure reached US$230.4 billion of which 55.6 percent was allocated to human resources development, 18.0 percent for social and health development, 12.2 percent for economic resources, and 14.2 percent for infrastructure (see Figure 2). This pattern reflects the natural progress in the country's socio-economic development.

III. LITERATURE REVIEW

The empirical literature on the impact of government spending on economic growth may be grouped into two strands. While the first focuses on the effects of total government expenditures on economic progress, the second recognizes that different types of government expenditures may have different effects on economic growth.

Regarding the first stand of the literature, several studies investigate the relationship between government spending and economic growth using different empirical methodologies, and yet the results are inconclusive. Landau (1983) found that an increase in government expenditure's share in real GDP reduces the growth rate of per capita real GDP. Barro (1989) found a significant negative relationship between government consumption share and the growth of real per capita GDP and discerned insignificant positive effects of government investment. Josaphat *et al.* (2000) investigated the impact of government spending on economic growth in Tanzania using time series data over 1965-96 and found that increased productive expenditure (physical investment) has a negative effect on growth while consumption expenditure stimulates growth. Niloy *et al*. (2003) examined growth effects of government expenditure for a panel of thirty developing countries over 1970-80. They found that the share of government capital expenditure in GDP is positively and significantly correlated with economic growth, but current expenditure is insignificant. Other studies (such as Romer, 1990; Alexander, 1990; Folster and Henrekson, 1999) concluded that total government expenditures seem to have a negative effect on economic growth.

Regarding the second strand of literature, which differentiates the impact of various categories of public expenditure, Landau (1983), using data for developing countries over 1960-80, examined the relationship between the growth rate of real per capita GDP and the share of government expenditure in GDP. He found that government consumption expenditure has negative effects on the growth of per capita output, while the other types of government expenditure have little effect on output growth. Baum and Lin (1993) also examined the impact of three different types of government expenditures, i.e., defense, welfare, and education, on the growth rate of per capita GDP using cross-section data from developed and developing countries over 1975-85. They found that the growth rate of education and defense expenditures has positive effects on growth rate, while the growth of welfare expenditures has an insignificant negative effect on economic growth. Deverajan *et al.* (1993), using a sample of 14 OECD countries, found that government expenditure on health care, transportation, and communication has positive effects on economic growth, while expenditure on education and defense fail to produce such a positive impact. Albala, Bertrand, and Mamatzakis (2001) tested the impacts of infrastructure investment on long-run economic growth rates in South Africa and Chile and found positive growth impacts of "productive" government expenditure on infrastructure. Using a similar methodology, M'Amanja and Morrissey (2005) examined the Kenyan case for 1964-2002, reaching the same conclusion.

With respect to the effects of government expenditures and economic growth in Saudi Arabia, the empirical evidence is also mixed. Ghali (1997), using Vector Autoregression (VAR) and Granger causality analysis as well as annual data for 1960-96, found no evidence that government expenditure increased output growth, even after disaggregating the total expenditure into expenditures on consumption and investment. Kireyev (1998) investigated the relationship between growth in non-oil GDP and government spending using annual data for 1969-97. His empirical evidence suggests a significant and positive relationship between government spending and growth in the non-oil sector GDP. Using two different measures of government size, Al-Yousif (2000) showed that the effect of government spending depends on the way government size is measured. That is, if the size is measured as a percentage change in the government expenditure, then the government size is positively related to growth, but if it is measured as a ratio of the government expenditure to GDP, then the relationship is negative. Albatel (2000) tested the effects of changes in government expenditures using data over 1964-95. He found that the government plays an important role in promoting growth and development. Al-Obaid (2004) examined the long-run relationship between total government expenditure and real GDP, and his empirical findings show a positive long-run relationship between the share of government spending in GDP and GDP per capita. 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. Joharji and Starr (2010), using time-series methods and data for 1969-2005, examined the relationship between government capital and current expenditures and non-oil sector GDP in the case of Saudi Arabia. They found that increases in government spending have significant positive long-run effects on the growth rate for both current and capital expenditures, although the current expenditure has larger impacts on economic growth in the non-oil sector than the capital expenditure. This finding was also reached by Espinoza and Senhadji (2011), although they found that capital expenditures have the largest impacts.

This study distinguishes itself from the existing literature in the following aspects. First, we examine the effects on economic growth of seven different types of government expenditures, namely, housing, education, defense, health care, current and capital expenditures, and public investment, as well as the effects of total expenditures and private domestic investment. Second, we simultaneously estimate the long-run equilibrium relationship and short-run dynamics between different types of government expenditures and economic growth by using VECM. Finally, we use non-oil GDP for Saudi Arabia, which is a better indicator of economic activity. Although the oil sector makes a significant contribution to overall GDP, it is largely affected by fluctuations in the world oil price and is a very misleading measure of growth for oil exporters such as Saudi Arabia.

IV. METHODOLOGY

A. Theoretical Model

In order to empirically test the impact of government expenditure on the economic growth rate in Saudi Arabia, we will use a modified version of Ram's (1986) framework which is based on a two-sector production function; the private sector, *P* and the government sector, *G*. Output in the government sector depends on the inputs of labor, *L* and capital, *K*, while output in the private sector depends, in addition to those factors, depends on externality effects stemming from the size of the government sector. Thus, the production function for these two sectors may be written as follows:

$$P = P(L_P, K_P, G), \qquad (1)$$

$$G = G(L_G, K_G), \qquad (2)$$

where subscripts indicate sectors, and the total inputs in the two sectors are given by:

$$Lp + Lg = L, \qquad (3)$$

$$Kp + Kg = K, \qquad (4)$$

and the total output, *Y* is given by the sum of outputs in the two sectors

$$Y = P + G \qquad (5)$$

The model assumes constant factor productivities in both sectors with respect to labor and capital. That is,

$$G_L/P_L = G_K/P_K = (1 + \delta) \qquad (6)$$

where a positive δ indicates higher input productivity in the government sector.
Thus, totally differentiating (5), and using (3) and (4) we get

$$dY = P_K\, dK_P + G_K\, dK_G + P_L dL_P + G_L dL_G + P_G dG \qquad (7)$$

where P_x and G_x are the marginal products of factor x in the private and government sector, respectively. Using (6) and (7), and assuming that the growth rate of total labor is equal to the sum of labor growth rates in both sectors,[4] we can derive the following aggregate growth equation:

$$dY/Y = (I/Y) + (dL/L) + dG/G \qquad (8)$$

[4] See Ram (1986) for details, and complete set of assumptions.

which will be the basis of our empirical methodology.

B. Empirical Methodology

In our estimation we will slightly diverge from Ram's (1986) framework in the following aspects. First, most empirical studies examining the relationship between domestic investment and economic growth suggest that the impacts of private investment differ significantly from those of government investment (Khan and Reinhart, 1990; De Gregorio, 1992; and Levine and Renelt, 1992; Khan and Kumar, 1997). Therefore, we will distinguish between private investment, $I_{P,}$ and government investment, I_G. Second, Equation (8) estimates the effects of total government expenditure on economic growth. However, as we have discussed, different types of government spending may have different real effects. Thus, to incorporate this hypothesis in our model, we will disaggregate total government expenditure into six components. We will use different subsets of these components, both individually and simultaneously to better understand the effect of each subset on growth. Finally, to eliminate the effects of changes in trade policies we will include trade openness as a control variable in our regressions. Therefore, we will estimate the following growth equation.

$$\dot{y}_t = \beta_0 + \beta_1 \left(\frac{I_p}{Y}\right)_t + \beta_2 \left(\frac{I_G}{Y}\right)_t + \beta_3 \mathrm{Open}_t + \sum_{i\in\xi} \beta_i \Delta \mathrm{Exp}_t^i + \varepsilon_t \qquad (9)$$

where $\dot{y}$ is the growth rate of the real non-oil per capita GDP in period t, I_p is real private domestic investment, I_g is real government investment, Y is real non-oil GDP, *(Open)* is openness to trade calculated as the sum of real exports and imports over real non-oil GDP, (Exp^i) represents various components of government expenditure in the subset ξ (described in the results section), βs are unknown parameters to be estimated, and ε is the usual random disturbance term.

Since we are interested in estimating the impact of government expenditures on economic growth in the short- and long-run simultaneously, our preferred econometric method is VECM. Nevertheless, as a robustness test, we will also utilize OLS and VAR methods to gauge the effect of government expenditures on economic growth in the short-run. In order to undertake the empirical analysis using the VECM technique, the variables involved in the model must be non-stationary and integrated of the same order, or they should be stationary. To test for the order of integration of the variables, we use the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. Under both tests, the null hypothesis is that the variable contains a unit root and the alternative variable is stationary.

To test for cointegration, we use two separate methods. First, we test for the presence of unit roots in the residuals from the regressions of variables in levels. Then, we utilize the Johansen (1988) and Johansen and Juselius (1990) full information maximum likelihood of a Vector Error Correction Model.

C. Data

In this study we employ annual data covering 1969-2010. Following the literature, we use natural logarithm of real non-oil per capita GDP for the long-run analysis and the growth rate of non-oil total GDP for the short-run analysis. Openness to trade is measured as the ratio of sum of real exports and imports to the real non-oil GDP. Since data on total labor, ***L***, are not readily available over the time span we employ, we use the growth rate of total population instead. Private and government investments are expressed as a share of GDP for the long-run estimations, as dictated by our theoretical model, and we use the real growth of these variables for the short-run analysis, following the literature. Total, capital, and current government expenditures, as well as the government expenditures on education, health care, defense, and housing are expressed as growth rates of these variables. All variables are obtained from the Saudi Arabian Monetary Agency (SAMA) annual report (2011). Data are converted into real terms by the GDP deflator (1999 = 100) and scaled using natural logarithm.

V. EMPIRICAL RESULTS

A. Stationarity and Cointegration

As a first step, we test the stationarity of the variables by conducting the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. The results presented in Table 1 offer strong evidence that all our variables are integrated of order one (i.e., $I(1)$). For each variable, the null hypothesis of the unit root is not rejected by at least one of the tests for the series in levels suggesting that the variables are non-stationary.[5] However, all the variables are found to be stationary in the first difference. Since all variables in our model are integrated of order one, according to at least one of the tests employed, the next step is to test for the presence of long-run relation between our variables of interest. Table 2 reports the results for cointegration tests implying that there is at least one cointegration equation at the 5.0 percent confidence level in each model.

[5] We prefer to err on the rejection side; thus, we take conflicting results as a sign of a unit root.

Table 1: Unit Roots Tests

	Augmented Dickey-Fuller Test				Phillips-Perron test			
	Level		First Difference		Level		First Difference	
	Stat	p-val	Stat	p-val	Stat	p-val	Stat	p-val
Non-Oil per capita GDP Growth	-2.425	0.135	-6.453	0.000	-2.815	0.056	-6.196	0.000
Private Domestic Investment/NOGDP	-2.007	0.598	-9.554	0.000	-1.220	0.665	-4.437	0.000
Public Investment/NOGDP	-2.169	0.218	-2.919	0.043	-1.446	0.847	-4.118	0.006
Total Expenditures growth	-2.813	0.056	-7.925	0.000	-8.617	0.000	-11.093	0.000
Capital Expenditures growth	-1.829	0.366	-3.091	0.027	-6.614	0.000	-12.412	0.000
Current Expenditures growth	-1.973	0.299	-3.543	0.007	-12.913	0.000	-19.806	0.000
Education Expenditures growth	-2.623	0.088	-8.070	0.000	-9.661	0.000	-15.373	0.000
Health Expenditures growth	-2.766	0.063	-3.384	0.012	-11.380	0.000	-23.107	0.000
Defense Expenditures growth	-1.637	0.464	-2.955	0.039	-6.319	0.000	-14.641	0.000
Housing Expenditures growth	-2.775	0.062	-3.329	0.014	-9.162	0.000	-17.092	0.000

Notes: Augmented Dickey-Fuller and Phillips-Perron unit-root tests both contain a constant. Similar results are obtained but not presented here when a linear trend is included. The optimal lag length is determined by AIC, with maximum of five lags considered. Rejection of null hypothesis (p<confidence level) provides evidence of stationary process at level or first difference.

Following the Engel and Granger (1987) procedure, the results in panel A are obtained by testing the presence of unit roots in the residuals from the OLS on the long-run equation. The rejection of unit root implies a presence of cointegration, and the hypothesis is rejected for all of the models that will be described below.

Since in the presence of multiple independent variables there is a possibility of numerous cointegrating equations, we next employ the Johansen maximum eigenvalue test to identify the number of long-run relations among the model variables. We start by choosing the number of lags to be included in the estimations by analyzing various lag length selection criteria. Since we have annual data, the maximum number of lags that we can include in our model is limited, but using post-estimation tests we ensure that enough lags are included to avoid autocorrelation in the VECM residuals. To preserve space, Table 2 presents only test statistics for the hypotheses that fail to be rejected. For example, for model 1, the Johansen test fails to reject the presence of at most two, but rejects the presence of one or less cointegrating relations. This implies that model 1 has two cointegrating equations.

Table 2: Cointegration Tests

	A: Residual based tests				B: Johansen test				
	ADF Test		PP Test		Hypothesized	Log		Trace	5% crit
Model	Stat	p-val	Stat	p-val	No. of CE(s)	Likelihood	Eigenvalue	Stat.	Value
1	-3.073**	0.029	-6.445	0.000	2	161.07	0.435	0.096	3.76
2	-3.554**	0.007	-6.781	0.000	3	169.43	0.470	0.026	3.76
3	-4.253**	0.001	-6.523	0.000	4	162.19	0.510	0.011	3.76
4	-2.877**	0.048	-6.727	0.000	2	236.54	0.534	12.542	15.41
5	-2.650*	0.083	-10.983	0.000	4	303.16	0.611	26.966	29.68
6	-3.436**	0.010	-7.334	0.000	2	173.53	0.611	14.913	15.41
7	-3.415**	0.010	-6.533	0.000	2	147.05	0.675	14.499	15.41
8	-3.219**	0.019	-6.550	0.000	2	182.38	0.559	13.667	15.41
9	-3.477**	0.009	-6.631	0.000	3	139.34	0.497	0.099	3.76

Notes: For Johansen's test, trace statistics indicates at least one co-integrating equation at the 0.05 level for each model. Residual based tests. ** Indicates the rejection of no cointegration at 5% or lower, while * indicates the rejection at 10%.

B. Benchmark Analysis

As a benchmark, we start our analysis by estimating Equation (9) using a simple OLS regressions. To avoid spurious regression results, we use only the first difference of variables that are I(1). As explained in the methodology section, we estimate nine different versions of Equation (9) using various components of government expenditures in Saudi Arabia as explanatory variables. In our first model, ξ includes only the private domestic investment and openness to trade as independent variables. In the second model we include total government expenditures. The third model has total expenditures disaggregated to capital and current government expenditures to see the effect of different channels through which government expenditures can contribute to growth. In model 4, we look at public investment only. Model 5 includes spending on education, health care, defense, and housing at the same time, while models 6 to 9 investigate the effect of these variables in isolation. The results are provided in Table 3, where we distinguish between two classifications of expenditures. In the first classification, we separate the total spending into current and capital spending. We also look at a separate effect of public investment, which is mostly carried out by state-owned firms. In the second classification, we take an even deeper look into total spending, separating it into education, healthcare, defense, and housing expenditures.

The main results are in line with most of the literature on the effects of government expenditures on growth. We observe the same surprising result as Joharji and Starr (2010): while total expenditures have a positive short-run effect on production, this effect originates mainly from current expenditures. This may suggest that the capital government spending is not optimally allocated to finance projects that foster the rate of economic growth. We also find that changes in private domestic and government investment, as well openness to trade, will boost the short-run output. With regard to detailed components of expenditures, the only significant effect stems from defense spending. We will show in our subsequent analysis that this result may be an outcome of volume of defense spending and its high correlation with oil revenues.

Table 3: Short-run Effects of Government Expenditures

	Classification 1				Classification 2				
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Δ Openness	0.118***	0.065***	0.084***	0.110***	0.061**	0.108***	0.127***	0.132***	0.064***
	(0.026)	(0.023)	(0.024)	(0.025)	(0.023)	(0.028)	(0.027)	(0.025)	(0.023)
Δ Private Investment	0.078***	0.064***	0.064***	0.108***	0.083***	0.074***	0.075***	0.071***	0.079***
	(0.022)	(0.018)	(0.020)	(0.025)	(0.015)	(0.021)	(0.023)	(0.019)	(0.016)
Δ Total Expenditures		0.203***							
		(0.042)							
Δ Capital Expenditures			0.015						
			(0.011)						
Δ Current Expenditures			0.155***						
			(0.045)						
Δ Public Investment				0.108**					
				(0.047)					
Δ Education Expenditures					0.101	0.090			
					(0.078)	(0.055)			
Δ Health Expenditures					-0.047		0.003		
					(0.029)		(0.023)		
Δ Defense Expenditures					0.223***			0.237***	
					(0.046)			(0.045)	
Δ Housing Expenditures					-0.002				-0.015
					(0.013)				(0.017)
Observations	**39**	**39**	**39**	**39**	**36**	**38**	**38**	**36**	**38**
R-squared	0.51	0.71	0.65	0.57	0.80	0.57	0.54	0.61	0.74

Note: Robust *std. errors* are in parentheses. *, **, and *** indicate statistical significance at 1 percent, 5 percent and 10 percent levels, respectively.

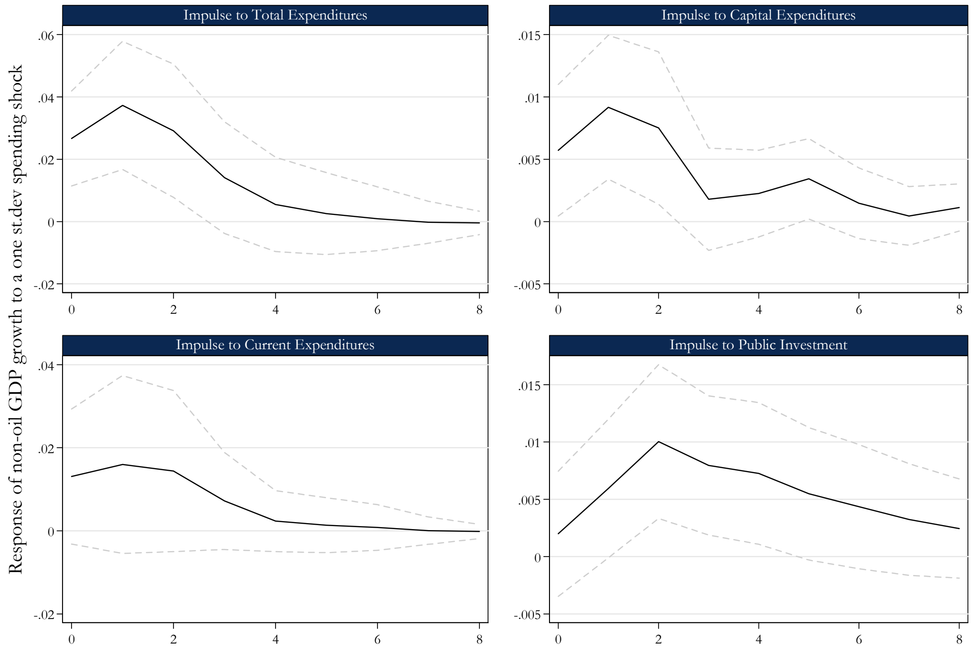
C. Short-term Stability

Since our previous technique is imposing strict exogeneity constraints on the variables, next we turn to a VAR analysis which is relatively free from modeling restrictions. In a VAR model, we do not need to assume which variables are strictly exogenous and which are strictly endogenous, but we still need to impose some assumptions on the ordering of variables in terms of exogeneity. In what follows, we always assume that non-oil GDP is the most endogenous variable (the last in the order).

All impulse-responses in our VAR analysis come from a typical estimation where we chose the lag order of two. We also estimate VARs with just one lag, and our principal results are unchanged. Figure 3 presents the contemporaneous response of the non-oil GDP growth to a one standard deviations shock from various spending categories. While all spending categories have a positive impact, the degree of relation varies significantly. For example, while one standard deviation increase in total expenditures (11.0 percent) increases non-oil GDP growth by more than 2.0 percent, the same amount of increase in capital expenditures will increase the non-oil GDP growth by only 5.0 percent. This variation exists also in the significance of the effects. While total and capital expenditures, as well as public spending have a positive and significant effect on the growth rate, the effect of current expenditures is less significant (although higher in magnitude).

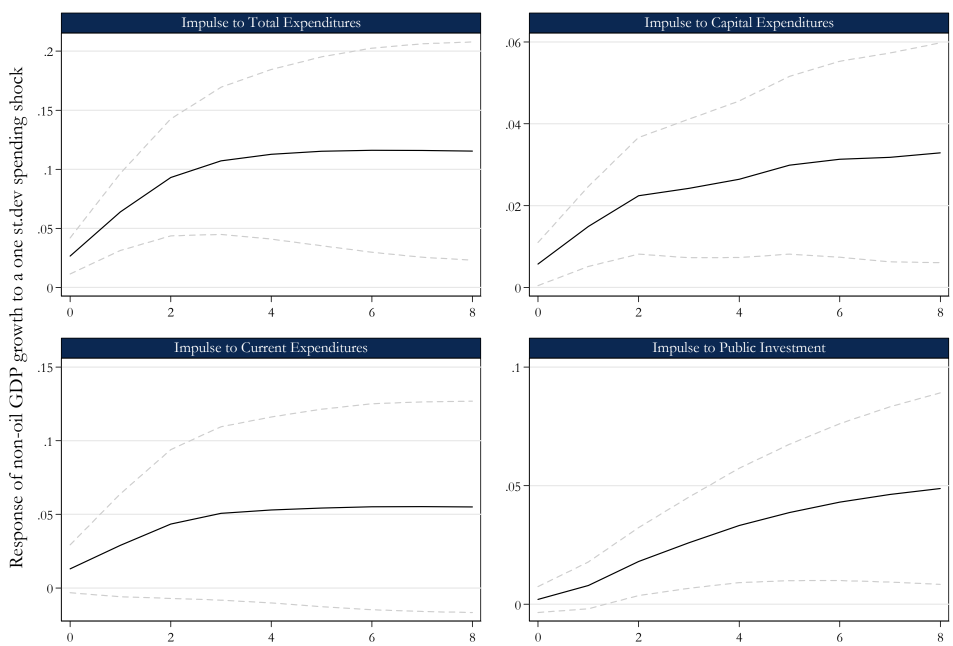
Figure 4 presents the cumulative response of the non-oil GDP growth to the shocks in expenditures, which mimics the results of orthogonalized impulse responses. Cumulative impulse-response functions for the first-difference specifications represent the sum of the responses of the variable in the system to an exogenous shock at each period. Although they can be interpreted as long-term results, we prefer to use VECM specifications for gauging the long-term results, since they are more flexible in imposing a long-run relation between the economic variables. We provide the cumulative IRFs only for the purpose of comparing them with the VECM results later.

Figure 3: Impulse-Responses for Models 1-4



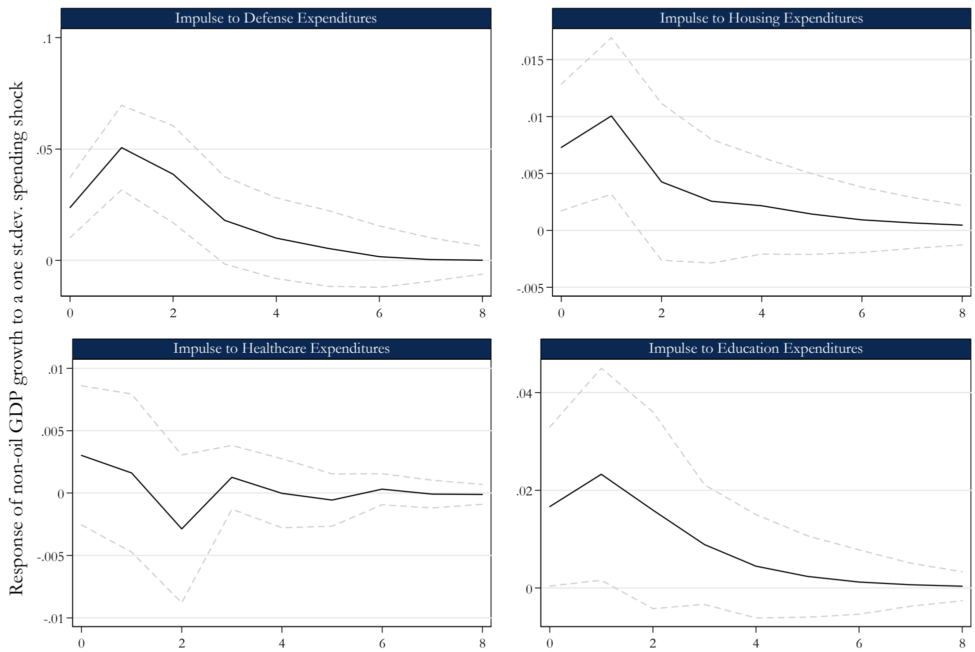
Solid line represents the orthogonalized impulse-response function, with 90% CI given by dashed line.

Figure 4: Cumulative Impulse-Responses for Models 1-4



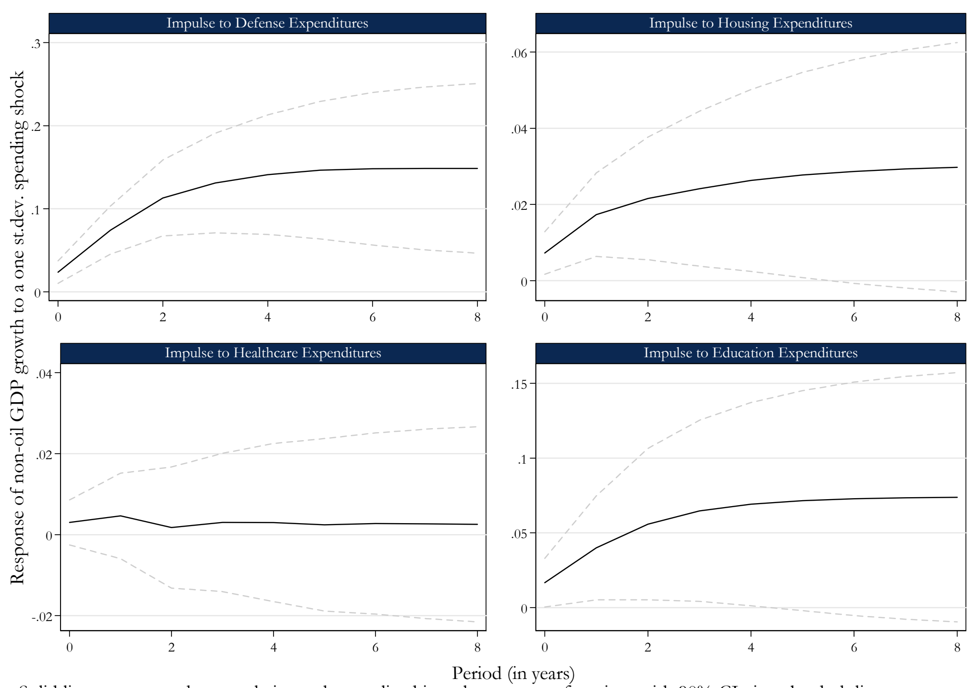
Solid line represents the cumulative orthogonalized impulse-response function, with 95% CI given by dashed line.

Figure 5: Impulse-Responses for Models 6-9



Solid line represents the orthogonalized impulse-response function, with 90% CI given by dashed line.

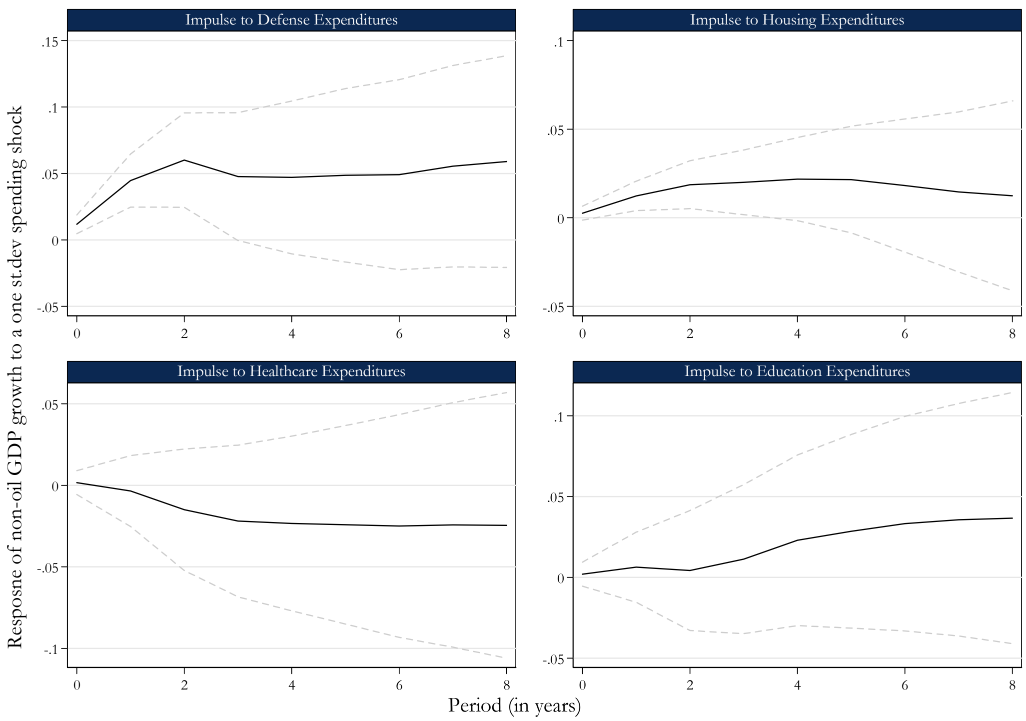
Figure 6: Cumulative Impulse-Responses for Models 7-9



Solid line represents the cumulative orthogonalized impulse-response function, with 90% CI given by dash line

Figures 5 and 6, present the response of the non-oil GDP growth to defense, education, healthcare, and housing expenditure shocks. While Figure 5 uses contemporaneous IRFs, Figure 6 illustrates cumulative responses. The results indicated that while all spending categories have significant first-period effects on non-oil GDP growth, this effect is not significant for healthcare spending. In fact, long-run effect correlation between healthcare expenditure and growth can be even negative. Finally, Figure 7 presents conditional IRFs from Figure 4, where the estimates are conditioned on other variables in Equation (8), as well as the openness to trade variable in Equation (9).

Figure 7: Conditional Cumulative Impulse-Responses for Models 7-9



Solid line represents the cumulative orthogonalized impulse-response function, with 90% CI given by dashed line.

D. Long-term growth: VECM Results

To investigate the determinants of short- and long-run economic growth in Saudi Arabia simultaneously, we estimate a series of VECM specifications for the growth rate of the real non-oil GDP together with several sets of other variables. The specification of each model is explained in detail in previous section IV.B.

Tables 4 and 5 present the estimated short- and long-run relations from the VECM. We report here only the results for our variables of interest, the growth rate of non-oil GDP. Results from Table 3 illustrate that in the short-run the main driving forces behind growth are public investment, private domestic investment, education spending, and openness. While health care spending has a positive short-run effect on growth when taken in isolation, the effect becomes insignificant when other spending categories are added to the regression. Capital, current, and total expenditures do not have a statistically significant effect on growth, which may be caused by certain categories of spending by the government included in those variables. Both defense and housing spending have only an insignificant effect on growth in the short-run. All statistically significant error correction adjustment coefficients are negative, implying the convergence to the long-run equilibrium in each specification.

In order to interpret the economic significance of the coefficients, one should take into account the overall variability in each variable. For example, the short-run coefficient of private domestic investment (st.dev. of 0.1) is 0.68 while the coefficient of education expenditures (st.dev of 0.2) is 0.04. This implies that one standard deviation shock to private domestic investment increases the non-oil GDP by 8 times more compared to a shock to education expenditures, instead of 17.

Table 4: Vector Error Correction Results

	Classification 1				Classification 2				
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Cointegrating Eq.1	0.011	-0.040	-0.038	-0.467**	-0.300*	-0.168	-0.055	0.123	-0.008
	(0.160)	(0.176)	(0.182)	(0.192)	(0.179)	(0.129)	(0.125)	(0.130)	(0.174)
Cointegrating Eq.2	-0.077***	-0.074***	-0.069***	-0.018	-0.068***	-0.069***	-0.071***	-0.075***	-0.082***
	(0.018)	(0.019)	(0.021)	(0.019)	(0.018)	(0.016)	(0.018)	(0.019)	(0.023)
Cointegrating Eq.3		-0.034	-0.033		0.17				-0.039
		(0.154)	(0.152)		(0.144)				(0.154)
Cointegrating Eq.4			0.003		-0.237***				
			(0.005)		(0.065)				
Δ Per capita non-oil GDP (lag)	-0.364**	-0.330*	-0.284	-0.129	-0.381**	-0.290**	-0.306*	-0.449***	-0.339*
	(0.174)	(0.183)	(0.198)	(0.160)	(0.193)	(0.144)	(0.165)	(0.167)	(0.197)
Δ Openness	0.079***	0.076***	0.073***	0.035**	0.078***	0.072***	0.073***	0.074***	0.083***
	(0.016)	(0.017)	(0.018)	(0.016)	(0.019)	(0.015)	(0.017)	(0.018)	(0.020)
Δ Private Investment	0.685***	0.687***	0.678***	0.643***	0.599***	0.760***	0.763***	0.770***	0.682***
	(0.191)	(0.206)	(0.228)	(0.155)	(0.213)	(0.180)	(0.201)	(0.210)	(0.235)
Δ Total Expenditures		-0.011							
		(0.013)							
Δ Capital Expenditures			0.001						
			(0.004)						
Δ Current Expenditures			-0.012						
			(0.013)						
Δ Public Investment				0.415***					
				(0.122)					
Δ Education Expenditures					0.093*	0.042**			
					(0.051)	(0.017)			
Δ Health Expenditures					-0.026		0.010*		
					(0.034)		(0.006)		
Δ Defense Expenditures					-0.02			0.014	
					(0.032)			(0.028)	
Δ Housing Expenditures					-0.001				-0.002
Observations	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**

Notes: The dependent variable is per capita non-oil GDP growth. Other equations of the VECM are not presented to preserve space. In classification 1, we look at the total government spending and then separate it into capital and current expenditures. We also look at public investment, which is a part of total expenditures. In classification 2, we distinguish between various expenditure categories. NB: These two classifications are not mutually exclusive. Cointegrating equation coefficients represent the speed of adjustment parameter from the VECM model. The equations with variables that are co-integrated with the growth rate are presented in Table 4. *, **, and *** indicate statistical significance at 1 percent, 5 percent and 10 percent levels, respectively.

To investigate the long-run effects in our models, we present the estimated normalized cointegration vectors in Table 4. The results show that in the long-run both private domestic investment and total expenditures have positive and statistically significant effect on growth. The other factor that contributes significantly to GDP in Saudi Arabia is health care expenditures. It has a positive effect both in isolation and when it is included with other variables, as in model 5. When taken in isolation a negative log-run relation is observed between our dependent variable and education, defense, and housing expenditures. The significant negative long-run effect of education is especially puzzling. We attribute this result to the lack of emphasis on education in the earlier sample period, rather than a negative effect of education on growth in the long-run. The main reforms in education by the government were initiated in early 2005. Although it is expected that long-run impact on growth will surface only after foreign educated talent returns to Saudi Arabia and is employed at full capacity; the short-run effects are already observed from VECM estimations.

Table 5: Maximum Likelihood Estimates of Cointegrating Vectors with Non-Oil GDP Growth (after normalization)

	Classification 1				Classification 2				
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Per capita non oil GDP growth	-1	-1	-1	-1	-1	-1	-1	-1	-1
Openness	0	0	0	0	0	0	0	0	0
Private Investment- PI/Y	0.858***			0.403***		0.728***	0.843***	0.532**	0.445***
	(0.190)			(0.145)		(0.121)	(0.146)	(0.225)	(0.107)
Capital expenditure growth									
Current expenditure growth			-1.250***						
			(0.161)						
Total expenditure growth		2.956***							
		(0.575)							
Public Investment- GI/Y				-0.095					
				(0.060)					
Education exp growth						-0.268***			
						(0.033)			
Health exp growth					0.414***		0.109***		
					(0.068)		(0.014)		
Defense exp growth					-0.366			-0.467***	
					(0.053)			(0.099)	
Housing exp growth					-0.199				-0.046***
					(0.022)				(0.017)
Observations	**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**
R-squared	0.515	0.530	0.516	0.520	0.586	0.558	0.531	0.520	0.497

Notes: Classifications 1 and 2 are the same as in Table 3. In this table, only the cointegrating equations that include the growth rate are presented. The coefficient of per capita non-oil GDP is normalized to unity. Other cointegrating equations from Table 4 are ignored to conserve space. *, **, and *** indicate statistical significance at 1 percent, 5 percent and 10 percent levels, respectively.

Post-estimation analysis

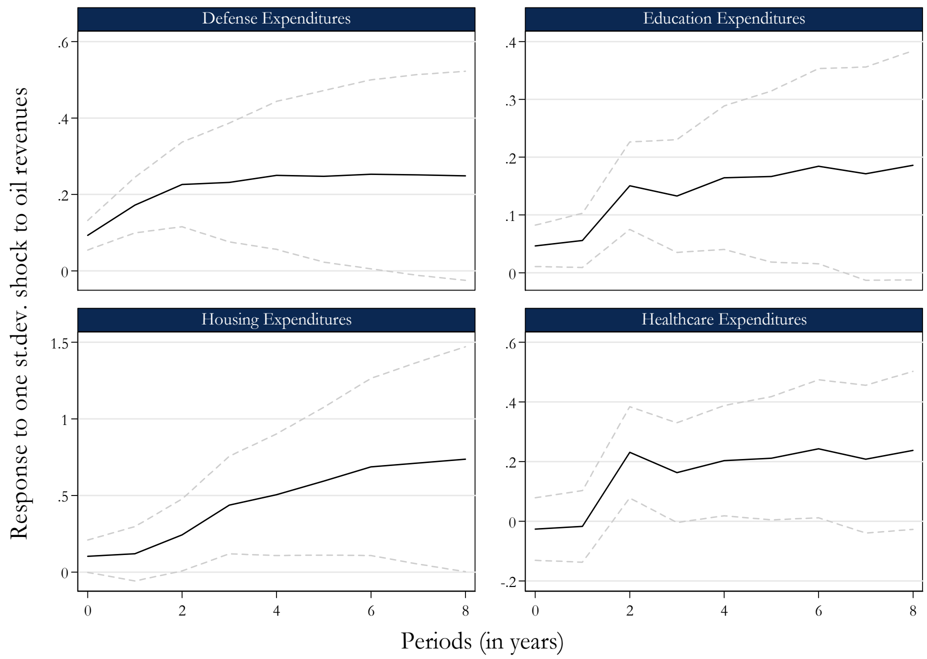
Table 5 presents results for various post-estimation diagnostic tests. First, to test the stability of the estimated vector process, we look at the modulus of maximum eigenvalue for all nine models. All values are within a unit circle, implying a stable vector autoregressive process. Next, we test for the presence of autocorrelation in the residuals from our estimations. It is well known that the absence of autocorrelation in residuals is a crucial assumption for the accuracy of VECM estimations. The Lagrange Multiplier test results imply that except for model nine, we fail to reject the null of no-autocorrelation of first and second order at 5.0 percent. For model 9, we fail to reject the hypothesis only at 1.0 percent. As a robustness check (not presented here), we also estimate model 9 with three lags and have similar results for the short- and long-run relations.

Table 6: Post Estimation Tests

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Max. Eigenvalue Modulus	0.749	0.742	0.773	0.711	0.846	0.673	0.725	0.656	0.720
LM test for AR 1	12.37	25.68	22.22	14.34	62.25	12.44	14.71	16.45	11.17
P-value for AR 1	0.193	0.058	0.623	0.573	0.096	0.713	0.546	0.422	0.799
LM test for AR 2	14.94	17.65	24.38	20.00	42.46	24.07	19.15	20.85	28.07
P-value for AR 2	0.092	0.345	0.498	0.220	0.734	0.088	0.261	0.184	0.031

E. Expenditures and Oil Revenues

Figure 8: Response of Expenditures to Oil Revenue Shocks



Solid line represents the cumulative orthogonalized impulse-response function, with 90% CI given by dashed line.

Before closing this section, we briefly investigate another aspect of a fiscal policy in an oil-rich economy. Namely, we estimate the response of government expenditure to oil revenue shocks. Given the heavy reliance of the Saudi's economy on oil revenues, this question deserves further analysis and can provide a topic for a separate study. From Figure 8, we observe that historically an increase in oil revenue was followed by an increase in all four expenditure categories. This response, however, varies in intensity and timing. The immediate, biggest, and statistically significant response is observed in defense expenditures. Given the standard deviation of oil revenue growth, the IRF in Figure 8 implies 2.0 percent increase in the growth rate of defense expenditures for every 10.0 percent increase in oil revenues. We also observe an immediate increase in education expenditures, but the largest increase is observed in the medium term. This is also the case for housing and healthcare expenditures.

VI. CONCLUSION AND POLICY PRIORITIES

The main objective of this paper has been to explore the relationship between government spending and economic growth in Saudi Arabia, which is measured as the growth rate of real non-oil per capita GDP. While, focusing on seven government spending categories; namely, housing, education, defense, health care, current and capital expenditures, and public investment, we analyze the relations between economic growth and total expenditures and private domestic investment. We employed VAR, cointegration, and VECM techniques in order to disentangle such effects into short- and long-runs. To this end, we used time series data for Saudi Arabia over 1969-2010. We found that in the short-run the main determinants of growth are private domestic investment, openness to trade, public investment, and expenditures on health care and education. The cointegration analysis, on the other hand, showed that the main driving forces behind long-run growth are private domestic investment, capital expenditures, and spending on health care which includes human capital.

One of the policy lessons from these results is the need to facilitate private domestic investment, put more emphasis on the productive part of government spending in the form of public investment, increase public health care spending, alleviate barriers to trade to facilitate higher growth rate, and increase the efficiency in the housing market by improving access to housing finance. It is generally advisable to allocate government spending to maintain existing infrastructure and social projects and to start new projects. These projects should be concentrated in areas that provide public services and facilitate Research and Development and human capital. It is preferable that the government involve the private sector in these projects, since the contribution of private to the growth rate is higher, by allocating some subsidies from oil revenues to ensure the efficiency and accountability of operations. This will also help achieve fiscal sustainability over the medium- and long-term by diversifying non-oil revenue sources, and enhance efficiency of spending through the development of a medium-term expenditure framework.

Finally, given the size of oil sector, fiscal policy will be a significant macroeconomic instrument to use for the economic stability of Saudi Arabia. Intensive fiscal spending programs should be employed as an investment in future generations by allocating them to the productive sectors, especially during periods of global financial crises. In addition, the development and growth funds of the aforementioned categories should be properly managed in order to enhance economic growth and sustainable development, and they should be implemented while simultaneously improving the overall business climate in the country.

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