

DEFENSE SPENDING AND ECONOMIC GROWTH IN AN OIL-RICH COUNTRY

The Case of Saudi Arabia

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Abstract. The causation relationship between economic growth and military expenditures in developing countries has received growing focus in recent years. One of the arguments in this field is that military spending absorbs a significant proportion of the limited financial resources in LDCs. The present study examines the causal relation in two models: defense spending with total real economic growth and defense spending with non-oil real growth, in the case of an oil-rich country, Saudi Arabia, for the period 1970-2003. Using Johansen's cointegration procedure, VECM, and standard Granger causality, the study showed the existence of bi-directional causality between economic growth and defense spending, and a uni-directional causality running from non-oil economic growth to defense spending. Moreover, the dynamic effect of one variable on the other beyond the sample period was assessed.

I. INTRODUCTION

Even though the issue of causality between defense spending and economic growth in LDCs has received increasing focus during the past two decades, no conclusive result, however, has been reached. The inclusiveness regarding the direction of causality between these two variables is due partially to the nature of issue at hand; defense spending has not only economic implications, but also, and more importantly, military as well as political aspects.

Theoretically, there is no definite prediction of the direction of causation between economic growth and military spending. However, one can identify

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two opposing views. The first one, which is essentially a Keynesian-type argument, believes in the positive trade-off between military spending and economic growth. Higher aggregate demand generated by military expenditure leads according to this view to the creation of employment opportunities, and the construction of infrastructure. Supporters of this view believe that the opportunity cost of military expenditure is relatively small and resources allocated to such expenditure might otherwise have gone to private consumption or social development (*i.e.* housing, medical care and education), which contributes little to economic growth.

The second view postulates, however, that it is improbable for military spending to increase domestic demand by substantial amount. The reason lies in the heavily dependence of most developing countries on foreign supplies to satisfy their military needs. Moreover, advocates of this view argue that the claimed employment creation will be rather small because military spending in the majority of LDCs centers on buying weapon rather than paying armies. Furthermore, the international developments took place during the past two decades, represented mainly in the collapse of the Soviet Union and end of the cold war, led to a noticeable decline in the military aids, forcing therefore LDCs to rely on domestic resources to support their military procurements.

From empirical point of view, however, studies covering this area of research can be categorized according to their findings into three groups: one group found positive effects of military expenditure on economic growth. Defense spending boosts economic growth through stimulating aggregate demand and producing positive externalities such as human capital development that result from technology transfer and improvement in security enforcement, which encourage private investment. Benoit (1973) study, for example, claimed that military expenditure in developing countries had net positive development effects. We must, however, take this conclusion with cautious since he used several non-measurable contributions of military programmes to national economy. Benoit came back in 1978 to contradict the prevailed common perception, that military spending is among those factors that contribute to economic depression in LDCs. He found in a sample of 44 developing countries that defense spending was positive correlated with economic growth rates. He argues that in LDCs only small percentage of the decrease in military spending goes to productive investment.

Similar conclusions reached also by subsequent studies such as Frederiksen and Looney (1982) and Melman (1988). From a different

perspective, Knight *et al.* (1996), for instance, argue that military spending can be economically productive to the extent that it offers more national security and improves the enforcement of property rights, thus, promoting private investment and growth. Moreover, Brumm (1997) examined the hypothesis that enhanced national defense might foster economic growth by increasing the security of property rights. He found that military expenditure share of GDP is positively related to the growth rate of per capita GDP.

On the other hand, there is a second group of empirical studies that ended up with opposite conclusions, *i.e.* defense expenditure diverts resources away from productive activities and leave adverse impact on economic growth. Devoting a large proportion of government expenditure to military would leave other productive sectors like education, health, and infrastructure with less financial resources. Lim (1983), Degree and Sen (1983), Faini *et al.* (1984) and others have found negative relation between the two variables. More recently, Klein (2004) studied the data on Peru and found negative effect of military expenditure on economic growth, indicating the existence of crowding-out effect.

Between these two conflicting results, there is the third group that reached inconclusive results on the direction of causality between economic growth and military expenditure, concluding, therefore, that neither growth nor defense spending can be treated as exogenous. One of these studies is Chowdhury (1991) who examined data for 55 developing countries and concluded that the relationship between economic growth and defense spending cannot be generalized across countries. He could not find any case supporting the prevailed view that defense spending promotes economic growth.

Kim (1996) analyzed trade-offs relation between military spending, quality of life, and economic growth for 101 countries. He found that countries with larger defense burden are more likely to have lower level of quality of life. He also found that defense burdens have no effect on economic growth.

The ambiguity over the direction of causality between defense spending and economic growth is attributed to several factors. Among them are the level of economic development, structural and policy differences, methodological differences, the specification of variables under investigation, and the type of causality techniques used (Masih and Masih, 1997). Defense expenditure can itself be an engine of growth through the indirect means of effective aggregate demand, capital formation, improved efficiency and technological progress.

Examining military data of most of the developing countries over the past 20 years, one could easily notice that despite economic difficulties these countries have faced, military importation remained large. The ratio of military import to total imports in LDCs averaged to 7% over the past two decades. The proportion of military spending to GDP, on the other hand, is in fact higher in LDCs relative to more advanced countries. In the Middle East, for example, about 12% of GDP on average goes to military expenditure.

The primary purpose of the present study is to investigate the probable relationship between defense spending and economic growth in Saudi Arabia. Moreover, in order to isolate the effect of oil sector, the causal relationship between defense spending and non-oil GDP is also examined. The rest of this paper is organized as follows: Section II gives a brief background analysis of military expenditure in Saudi Arabia. Section III outlines the methodology followed and data used. Estimation results and the conclusion are presented in Sections IV and V, respectively.

II. SAUDI ECONOMY AND MILITARY SPENDING

Since 1968, the share of military spending in real GDP in Saudi Arabia has been well above 10%, with an average of 13.5%. The ratio reached its peak of 20% in 1986. Military spending in this oil-rich country represents large share of total government expenditure. The annual average of military spending during the period of 1968 to 2003 was more than 33% of total government spending. In 1986, almost half of government expenditure was devoted to defense and security expenses.

These figures taken by themselves are considered quite large, especially when one knows that the government runs budget deficit since mid-1980s and still need considerable financial resources to carry over many awaiting municipal and regional development projects to meet the increased demand resulting from high population growth. On the other hand, one must not, however, view these figures in isolation from the political environment prevailed in the Middle East during the past three decades. The Gulf region has witnessed three major wars, which created high tendency for governments in the region to increase their purchases of military and security equipments.¹ The region, in fact, remained unstable, security wise, since 1990.

¹These wars were: the Iran-Iraq war lasted from 1980 to 1988; the Iraq-US war of 1990-1991; and Iraq-US war of 2003.

Moreover, the long-standing Arab-Israeli conflict creates on-going fear and distrust in both sides, which led all countries in the Middle East, including Saudi Arabia, to race for building their military forces and boosting, therefore, their military burden. Furthermore, and more recently, the growing tendency of Iranian government to possess nuclear weapon and the huge investment injected in Iranian military sector would worsen in one way or another the already unstable environment in the Gulf region.

Therefore, considering all the above factors, one might somehow justify the high proportion of Saudi government expenditure on military and security sector. The concern of this paper, however, is to determine how military spending affected economic growth in Saudi Arabia. This question is an empirical one and will be dealt with in the next section.

Saudi Arabia, in an attempt to take advantages of the high military contracts, decided in the early 1980s to launch economic offset programmes. Foreign companies, especially the Americans, British, and French ones, who win large military contracts, were required to invest a proportion of contracts value in high-tech projects with Saudi partners. The objectives of these programmes are to upgrade the general technology level in the country through the transfer of advanced technology in the Kingdom; creating therefore more investment opportunities and more jobs, and promoting import-substitution strategy. After years of implementing offset programmes, it is argued that they have played important role, though smaller than expected, in establishing advanced industrial base for private sector in the country.

It is argued that the general technology level of an arms importing country may be upgraded through the transfer of defense technology, which may lead to human capital improvement, and installation of dual-use equipment in the recipient country (Li and Mirmirani, 1998).

III. METHOD AND DATA

Within a vector auto regression (VAR) framework, two causality relationships will be examined in this paper. The first is between defense spending and real GDP, while the second is between defense spending and non-oil real GDP. The first step is to check the properties of our time series, *i.e.* the stationary order of the variables under investigation. It is very important to ensure that variables are stationary of the same order before proceeding in other estimations. Then, Johansen's maximum likelihood procedure will be applied to detect any likely long run relationship between variables. If cointegration exists between two variables, then standard

Granger causality cannot be used since it will ignore any possible long run relationship. Vector error correction, instead, will be applied to test for Granger causality direction. Finally, the relative importance of each variable in explaining changes in the other variable beyond the sample period will be assessed by using variance decomposition techniques.

The data, which cover the period of 1968-2003, are taken from the annual report of Saudi Arabian Monetary Agency (SAMA) and from SIPRI military expenditure database.

IV. ESTIMATION RESULTS

UNIT ROOT TESTS

To avoid the potential problem of estimating spurious relationships, the time series properties of the variables under investigation were tested for unit root. The well known Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) tests were applied for each series to test for the presence of unit roots. The test results presented in Table 1 indicate that the hypothesis of a unit root

TABLE 1
Unit Root Tests

Variable	ADF		PP	
	μ	$\mu + \tau$	μ	$\mu + \tau$
RY	-2.67	-2.53	-2.39	-2.16
DSR	-1.94	-2.10	-2.68	-2.79
NRV	-2.38	-3.54	-2.48	-1.13
Δ RY	-3.63*	-3.93**	-5.35**	-5.58**
Δ DSR	-5.30**	-5.40**	-8.13**	-8.16**
Δ NRV	-1.79	-2.56	-2.15	-2.65
$\Delta\Delta$ NRV	-4.52**	-4.51**	-6.56**	-6.48**
99% critical value	-3.64	-4.27		
95% critical value	-2.95	-3.56		

Notes: * denotes significance at 5% level.
** denotes significance at 1% level.

Lag length is chosen by minimizing the Akaike's final prediction error (FPE) and Schwarz Bayesian criteria (SBC). Statistics in column μ present results when only intercept is included, while statistics in column $\mu + \tau$ present the case when intercept and trend are included.

cannot be rejected for the real GDP (RY) and defense spending ratio (DSR) at at least 1% significance level and these variables are therefore integrated of order one, denoted I (1). For non-oil real GDP (NRY), it was found to be integrated of order two, I (2). Since DSR and NRY are integrated of different order, cointegration approach cannot be applied.

COINTEGRATION TESTS

The next step is to apply Johansen's maximum likelihood procedure to test for the presence of long-run equilibrium relationship between defense spending and economic growth. If we let Z be a $p \times 1$ vector that contains:

$$Z_t = (Ry_t, DSR_t),$$

where all elements of this vector are first differenced stationary, that is they are I (1). Following Johansen procedure, we assume that Z_t has a vector autoregressive (VAR) representation take the form:

$$Z_t = \mu + \Pi_1 Z_{t-1} + \Pi_2 Z_{t-2} + \dots + \Pi_k Z_{t-k} + v_t, \quad (1)$$

where μ is the intercept and v_t are the disturbances term. Equation (1) can be reparameterized as:

$$\Delta Z_t = \mu + \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \dots + \Gamma_k \Delta Z_{t-k} + v_t, \quad (2)$$

where the rank of the parameter Γ_k represents the number of cointegrating vectors.

TABLE 2
Johansen's Cointegration Test Statistics

System	Null Hypothesis	Alternative Hypothesis	λ_{\max}	Trace Value	99% CV	95% CV
RY	$r = 0$	$r = 1$	20.98	21.56	20.04	15.41
DSR	$r \leq 1$	$r = 2$	0.58	0.58	6.65	3.76

λ_{\max} is the maximum eigen value statistic.

Results presented in Table 2 show the existence of cointegration relationship between the logarithm of real GDP and the ratio of defense spending. The maximal eigen values and the trace tests reject the hypothesis of no cointegration at 1% significance level indicating, therefore, the existence of one cointegration equation. This means that there is one common stochastic trend deriving the two variables. The results reveal also that defense expenditures have negative relationship with economic growth.

The finding implies the existence of causation relationship, but the direction of causation needs further investigation.

CAUSALITY TEST

To test for the direction of causation between the ratio of defense spending and each of the real GDP and non-oil real GDP, we adopt two approaches: vector error correction model (VECM), and the standard Granger causality approach. The first will be applied for the relationship between the ratio of defense spending and real GDP, while the second approach will be used for testing the causation between defense spending and non-oil real GDP. As Granger (1988) noted, if two variables are cointegrated, which is the case for real GDP and the ratio of defense spending, then using standard Granger causality test will be misleading. The reason is that it can result in finding no causal relationship in either direction despite the fact that the two variables are cointegrated, *i.e.* they share common stochastic trend. In the presence of cointegration, an error-correction term should be added to the VAR model used to estimate causality. Thus, we will estimate the following equations:

$$(1-L)RY_t = \alpha_0 + \delta_1 ECT_{-1} + \sum_{m=1}^M \alpha_1 (1-L)RY_{t-m} + \sum_{m=1}^M \alpha_2 (1-L)DSR_{t-m} + u_t \quad (3)$$

$$(1-L)DSR_t = \beta_0 + \gamma_1 ECT_{-1} + \sum_{m=1}^M \beta_1 (1-L)DSR_{t-m} + \sum_{m=1}^M \beta_2 (1-L)RY_{t-m} + v_t \quad (4)$$

where L is the lag operator and ECT_{-1} represents the error-correction term lagged one period obtained from the cointegrating equation. The u_t and v_t are mutually uncorrelated white noise residuals. This formulation, known as vector error-correction model (VECM), has the merit of allowing for long-run equilibrium as well as short-run dynamics. It imposes a restriction on the long-run performance of the endogenous variable by using the error-correction term. Moreover, the inclusion of error-correction term adds another route through which causality can be identified. The direction of causality can be detected in this model through one or more of the following three channels: (1) the coefficient of the error-correction term; (2) the coefficients of the lagged independent variables; and (3) the coefficients of the error-correction term and the lagged independent variables.

For non-oil real GDP and defense spending, and due to the absence of primary evidence of cointegration between these two variables, standard Granger causality will be applied. Since Granger test requires mean-stationary process, we use the first and the second differences of defense spending and non-oil real GDP, respectively. By doing so, we can avoid any

results that may lead to an incorrect inference about causal effects. Thus, the estimated equations are:

$$(1 - L)RY_t = \alpha_0 + \sum_{m=1}^M \alpha_1 (1 - L)NRY_{t-m} + \sum_{m=1}^M \alpha_2 (1 - L)DSR_{t-m} + u_t \quad (5)$$

$$(1 - L)DSR_t = \beta_0 + \sum_{m=1}^M \beta_1 (1 - L)DSR_{t-m} + \sum_{m=1}^M \beta_2 (1 - L)NRY_{t-m} + v_t \quad (6)$$

where the tested null hypotheses are $H_0: \alpha_2 = 0$ and $H_0: \beta_2 = 0$, for Equations (5) and (6), respectively.

Table 3 presents results of Granger causality tests between economic growth and defense spending using vector error correction model (VECM) and taking into account the existence of negative long-run relationship between these two variables. The results indicate the existence of bi-directional causation relationship between economic growth and defense spending. At least two channels in each equation are identified to be significant. For Equation (3), from one side, the coefficient of the error correction term is found to be significant at 5% level. From the other side, Wald χ^2 test statistics revealed the significance of the coefficients of error correction term with the coefficients of the lagged independent variable at 1% level, indicating, therefore, the existence of causality from defense spending to economic growth.

TABLE 3
Granger Causality Test Statistics:
Economic Growth and Defense Spending

Dependent Variable	Defense Spending Granger Cause Economic Growth			Economic Growth Granger Cause Defense Spending		
	ECT ₋₁	Δ DSR	ECT and Δ DSR	ECT ₋₁	Δ RY	ECT and Δ RY
Δ RY	-0.18** (-2.98)	0.04	8.54***			
Δ DSR				0.70 (0.86)	6.72**	6.78**

- Figures in the ECT columns are the coefficients of the error correction terms in the relevant equation. Numbers in parentheses are the usual t-statistics.
- Values presented in the other columns are the Wald χ^2 statistics.
- *, **, *** denote 10%, 5%, and 1%, respectively.

With regard to Equation (4), however, Wald χ^2 test statistics indicate the significance of the lagged independent variable from one side, and the error

correction term with the lagged independent variable from the other side, at 5% level. This implies that changes in economic growth affect defense spending in Saudi Arabia.

Finally, to ensure that the estimated equations are consistent with the standard assumptions, several tests are applied to each equation and results are presented in Table 4. No evidence was found that might violate these assumptions.

TABLE 4
Diagnostic Tests

Dependent Variable	Functional Form RESET	Serial Correlation		Heteroskedasticity	
		LM(1)	LM(4)	White's Het.	ARCH
ΔRY	0.44	0.96	4.91	12.79	1.02
ΔDSR	2.40	0.02	3.01	11.62	0.04

Notes:

- RESET is the Ramsey's Regression Specification Error Test, and the entries are F-statistic for testing the functional form of mis-specification.
- LM(1) and LM(4) are Breusch-Godfrey Serial correlation test, and entries are $\chi^2(1)$ and $\chi^2(4)$ for testing the null of no 1st and 4th order serial correlation in the residuals.
- Entries in the column of White's Heteroskedasticity are $\chi^2(1)$ statistic for testing the null of no Heteroskedasticity in the residuals.
- ARCH is the Autoregressive Conditional Heteroskedasticity, and the entries are $\chi^2(1)$ statistic for testing the null of no Heteroskedasticity in the residuals.

TABLE 5
Standard Granger Causality Test Statistics:
Non-Oil Economic Growth and Defense Spending

Dependent Variable	Defense Spending Granger Cause non-Oil Economic Growth	Non-Oil Economic Growth Granger Cause Defense Spending
	ΔDSR	ΔNRT
ΔNRY	4.89*	
ΔDSR		9.27***

- The entries are the Wald χ^2 statistics for testing the null hypothesis that all the coefficients of the lags of the independent variables are zeroes.
- *, **, *** denote 10%, 5%, and 1%, respectively.
- Lag lengths were selected based on Akaike's final prediction errors criterion.

For non-oil real GDP and military spending, though we have established before that both of these variables are integrated of different order and therefore cannot be cointegrated, results of Table 5 show, however, evidence of Granger causality. The results indicate the existence of short-term uni-directional causality running from non-oil economic growth to defense spending. Wald χ^2 test statistics is found to be significant in this case at 5% level. Moreover, the diagnostic tests presented in Table 6 indicate in general the absence of any violation to the standard assumptions.

TABLE 6
Diagnostic Tests

Dependent Variable	Functional Form RESET	Serial Correlation		Heteroskedasticity	
		LM(1)	LM(4)	White's Het.	ARCH
Δ NRV	0.01	1.05	4.79	3.60	0.34
Δ DSR	1.21	1.17	4.85	5.70	1.03

Notes:

- RESET is the Ramsey's Regression Specification Error Test, and the entries are F-statistic for testing the functional form of mis-specification.
- LM(1) and LM(4) are Breusch-Godfrey Serial correlation test, and entries are $\chi^2(1)$ and $\chi^2(4)$ for testing the null of no 1st and 4th order serial correlation in the residuals.
- Entries in the column of White's Heteroskedasticity are $\chi^2(1)$ statistic for testing the null of no Heteroskedasticity in the residuals.
- ARCH is the Autoregressive Conditional Heteroskedasticity, and the entries are $\chi^2(1)$ statistic for testing the null of no Heteroskedasticity in the residuals.

VARIANCE DECOMPOSITION

The objective of this section is to conduct a further test on the relationship between variables under investigation to assess the dynamic effect of one variable on the other beyond the sample period. To this end, we calculate the proportion of forecast error variance for each variable due to its own innovations plus those from other variables.

Tables 7 and 8 show the proportion of the forecast error of each variable in the two systems of equations. Results for five time horizons are presented to ensure that the dynamic nature of the system is captured. Table 7 reveals that economic growth is more exogenous since a large proportion of its variance is explained by its own innovations, even in the longer time horizon. For one period ahead, all of the variations in real income (RY)

TABLE 7
Variance Decomposition of the System: ΔRY , ΔDSR

Time Horizon (Years)	Decomposition of ΔRY Variances		Decomposition of ΔDSR Variances	
	ΔRY	ΔDSR	ΔRY	ΔDSR
1	100.00 (37.69)	0.00 (62.31)	62.31 (0.00)	37.69 (100.00)
2	99.82 (40.33)	0.18 (59.67)	55.96 (2.86)	44.04 (97.14)
3	99.35 (43.34)	0.65 (56.66)	46.70 (10.75)	53.30 (89.25)
4	98.62 (46.44)	1.38 (53.56)	42.07 (13.88)	57.93 (86.12)
10	89.40 (64.17)	10.60 (35.83)	27.02 (25.35)	72.98 (74.65)

Note: Figures present estimated proportions of variations of each of ΔRY and ΔDSR explained by its own and the other variable innovations. Figures in parenthesis are the estimated proportions based on the ordering DSR preceding RY.

TABLE 8
Variance Decomposition of the System: ΔNRY , ΔDSR

Time Horizon (Years)	Decomposition of ΔNRY Variances		Decomposition of ΔDSR Variances	
	ΔNRY	ΔDSR	ΔNRY	ΔDSR
1	100.00 (84.22)	0.00 (15.78)	15.78 (0.00)	84.22 (100.00)
2	96.53 (73.29)	3.47 (26.71)	39.59 (16.71)	60.41 (83.29)
3	96.87 (74.76)	3.13 (25.24)	39.63 (16.95)	60.37 (83.05)
4	97.18 (75.35)	2.82 (24.65)	39.36 (16.96)	60.64 (83.04)
10	97.45 (75.56)	2.55 (24.44)	40.08 (17.52)	59.92 (82.48)

Note: Figures present estimated proportions of variations of each of ΔNRY and ΔDSR explained by its own and the other variable innovations. Figures in parenthesis are the estimated proportions based on the ordering DSR preceding NRY.

comes from its own innovation. In the tenth period, however, the contribution of military expenditures in explaining the forecast error variance of economic growth was more than 10%. On the other hand, we notice that economic growth is more powerful in explaining variations in military spending specially in the shorter time horizon.

On the other hand, Table 8 shows somehow similar results to that obtained in Table 7 above, in that military spending contribute little in explaining the forecast error variances of non-oil real GDP. Almost all of the variations in non-oil real GDP forecast error come from its own innovation. In contrast, the results show that non-oil real income accounts for 40% of the error in the ratio of defense spending in the ten years time horizon. It is worth noting, however, that the results of Tables 7 and 8 must be taken with cautious, since they are not robust with different causal ordering.

V. CONCLUDING REMARKS

This study presents an empirical analysis of the relation between defense spending and economic growth in Saudi Arabia over the period 1970-2003. The purpose was to examine the presence and direction of causality in two systems of models: the first one is defense spending with real GDP growth; and the second is defense spending with non-oil real GDP growth. To this end, the statistical properties of the time series were first investigated, followed then by several econometrics techniques, including Johansen's maximum likelihood procedure, vector error correction models (VECM), and standard Granger causality test. Moreover, we apply the analysis of variance decomposition to test the relationship between variables beyond the sample period.

Our empirical estimates clearly indicate the presence of cointegration between defense spending and real economic growth. On the other hand, and because non-oil real GDP was found integrated of higher order, cointegration test could not be applied. For causation tests, results show the existence of bi-directional causality in the first model and uni-directional causality in the second. The finding of negative causation between defense spending and each of total economic growth is consistent with many empirical studies on developing countries. Reduction in defense expenditure would make financial resources available for use in other activities such as education, health, and other social programmes. Kollias (1997) argues that countries with high growth rates may divert resources from defense into other productive activities.

In addition, the results support the argument of crowding-out effect. Defense expenditure is essentially a part of government spending, and thus an increase in this spending would divert domestic credit from civilian production and raises the cost of these credits for private sector. As a result, economic growth may deteriorate.

It is worth noting, however, that this study examined only direct and instantaneous effects of military spending on economic growth. It ignores other possible indirect effects such as investment, employment, and politics.

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