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Defense Spending and Economic Performance: Evidence from the Arabian Countries (*)

أثر النفقات العسكرية على الأداء الاقتصادي لمجموعة من الدول العربية

Basim Makhool

باسم مكحول

Dept. of Economics, An-Najah National University, Nablus, Palestine.
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Abstract

This study examines the relationship between defense spending and economic growth in a group of the Arab countries. Regression equations were estimated based on time-series and pooled data sets. The results confirmed that the relationship between military spending and economic growth hinges upon circumstances and does not follow some general law applicable to all places. Growth retardation and acceleration have been recorded in country-wise regression analysis, though precise coefficients differ from one country to another.

تهدف هذه الدراسة إلى فحص و استكشاف العلاقة بين النفقات العسكرية و النمو الاقتصادي لمجموعة من الدول العربية و ذلك باستخدام تحليل الانحدار للسلاسل الزمنية. تبين من التحليل الإحصائي بان العلاقة بين النفقات العسكرية و النمو الاقتصادي تعتمد بشكل أساسي على الظروف المحيطة في كل دولة و لا يمكن التوصل إلى علاقة محددة يمكن تعميمها على جميع الدول التي شملتها الدراسة. أظهرت النتائج الإحصائية وجود علاقة إيجابية بين النفقات العسكرية و النمو الاقتصادي لبعض الدول، و علاقة سلبية لدول أخرى. إلا أن أهمية و قيمة هذه العلاقة تختلف من دولة إلى أخرى.

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Introduction

The theoretical and empirical literature variously ascribes beneficent or pernicious developmental consequences of military expenditures. Common sense tells us that military are an economic burden due to limited resources. This has inspired a series of empirical studies about possible spill-over effects of military expenditures and tradeoffs between military expenditures and other kinds of public expenditures like health, education, welfare, etc. The repercussions of heavy defense spending are of interest for both empirical and policy reasons. However, economic theory does not tell us whether greater military spending will accelerate or obstruct economic growth.

Empirical evidence has suggested substantial cross-sectional and over-time variations in the relationship due to sample variations, specification choices, different time periods. In general, they do not support the view that defense spending encourages sustained economic growth.[2]

This paper aims at investigating the impact of military expenditures on economic growth for a group of Arabian countries employing time-series methods.[3] As seen from table (1) in the appendix, these countries have spent 6.6% and 23.95% of gross domestic products and of government expenditures on military services respectively.

Literature Review

One can argue that defense spending can either spur or hinder economic performance. Proponents of military spending justify this on economic as well as national security grounds [Benoit 1973]. Opponents of military spending criticize it on the ground of its profound opportunity cost [Leontif and Duchin 1983]. Two questions could summarize the defense spending-economic growth debate: What kind of impact does military spending has on economic performance? And how does this impact occur?

A. What kind of impact does military spending has on economic performance?

Most of the studies have focused on the influence of military expenditures on economic growth through their effects on the modernization process, the availability of investment fund, the vitality of export industries, and the research and technological innovations [Benoit 1973, Biswas and Ram 1985, Frederikson, etc. 1986].(4) In this regard, empirical studies tried to figure out the direction, magnitude, timing, of the relationship between defense spending and economic performance.

B. How does this impact occur?

It is essential to distinguish between the first and the second-order effects. The first-order (short-run) effects of military expenditures are to stimulate demand and boost employment. However, these favorable effects tend to be offset by the second-order (long-run) effects of military spending. Since these expenditures are more apt to have negative effects on private saving and investment, inflation, employment, balance of payment and industrial productivity they are expected to hurt growth in the long-run. Therefore, both the direct and the indirect effects of military expenditures must be considered in a net assessment of their economic impact [Chan 1985]. Several approaches have been suggested to explain the mechanism of such impacts. The following is a brief discussion of the main perspective as summarized by Chan:

1. The modernization or spill-over model. It contends that military spending is pro-development since it has favorable effects such as introducing the people to modern skills and attitudes, the military's capital expenditures (e.g., for roads, bridges, airports, R&D and technological etc.) have alternative civilian values and strengthen the country's infrastructure needed by the productive sectors, and by boosting aggregate demand, military expenditures encourage fuller capacity utilization of the existing production facilities. However, the model recognizes the negative effects of military spending including the crowding-out effect of civilian investments, productivity effect (the government sector is characterized by slower productivity growth

compared with the private sector) and the income shift effect (increased military spending necessarily reduces the civilian domestic product). However, the positive direct and indirect effects of military expenditures outweigh its negative effects. This model is mostly associated with Benoit's research. Emile Benoit stated that "the evidence pointed strongly to the conclusion that, whether or not defense activities had a favorable net effect on growth in the sample countries [44 developing countries during the 1950s and 1960s], they had certainly not had an unfavorable one." (5)

2. The capital formation model: This model underscores the importance of private capital as the main driving force behind future economic growth. Military spending will absorb part of the funds that would otherwise be used to finance private investment. Military spending is financed mainly thorough taxes or government borrowing from capital markets both internal external. Therefore, military spending crowds out private investment. In addition, the inflationary pressure that military spending accentuates encourages a mass psychology in favor of immediate consumption and against saving [Deger and Smith 1983]. Thus military spending is counter-developmental and adds more pressures on the available and expected financial resources.

3. The balance of payment or the export-led growth model: it emphasizes the negative economic effect on the balance of payments through the chronic displacement of capital and talent from the dynamic and more effective civilian sector to the military sector. This leads to a slower export growth which in turn causes slower economic growth. Also, for the developing countries, their military spending tends to be more import-demanding than other forms of public spending thus contributing more to the unfavorable balance of payments.

4. Technological displacement model: it stresses the significant amounts of human and material resources consumed by the modern weapon industries for research and development. This diversion of resources from the civilian sector has detrimental long-run effects on a country's productivity and its technological position.

Data, Methodology, and Econometric Models

The study focuses on the Arabian countries as its target population. However, due to unavailability of enough data on some countries, the analysis is limited to sixteen Arab cases. The time period of the study covers 1967 to 1987. Data is taken from the World Bank Tables (1989) and from the US Arms control and Disarmament Agency (ACDA) which makes considerable use of data produced by the Central Intelligence Agency (CIA). Considerable ambiguities arise of both the conceptualization and measurement of dependent and independent variables in the defense-economic performance debate. The effect of defense spending need not be limited to economic growth, it also affects other indicators of performance like inflation and unemployment, etc. However, economic growth has been the main concern of most of the empirical analysis.

Also, the measurement of defense burden is problematic and controversial. Most of the studies have used the ratio of military expenditures to GDP or GNP as a measure of defense burden. Alternative measures have been suggested like the growth rate of military expenditures, the ratio of military spending out of public expenditures or the military personnel as a ratio of the country's population [Chan 1985]. These alternative measures need not always produce the same conclusions. In this study, the growth rate of military expenditures and the ratio of military expenditures to gross national products will be used. The former is theoretically valid using neoclassical production function while the latter will be used for the purpose of comparison among alternative measures. Economic performance is measured by the rate of growth of the real gross national product which is going to be used as the dependent variable. Also, military expenditures and its growth are measured in real values. The study will focus on macro-statistical analysis using time-series and cross-sectional regression analysis. For the cross-sectional data, the average of each variable over the study period of each country is used as an observation.

Conventional and augmented neoclassical growth models will be considered. Starting with a conventional neoclassical growth model where output Y is a function of labor L, capital K and military spending M and by

taking total derivatives and manipulating the expression, we can derive the following growth equation:[7]

$$\dot{Y} = \beta_0 + \beta_1\left(\frac{I}{Y}\right) + \beta_2 \dot{M} + u \qquad (1)$$

where a dot over a variable denotes its growth over time, I is investment, and u is the classical random disturbance.[8] Some researchers have used M/Y as a measure of defense burden but the interpretation of its coefficient is not obvious. Also output Y may change without a change in military expenditures M, thus defense burden will change without any change in resource allocation between sectors. Therefore, M/Y may not reflect accurately the effect of military expenditures on economic performance [Chan 1995].[9]

One approach to quantify the military-growth arguments is to divide the mechanisms through which military expenditures affect economic performance into two mechanisms: (a) the military sector generates positive or negative external effects, and (b) there may be important factor productivity differences between the civil and the military sectors [Biswas and Ram 1986]. This approach was developed by G. Feeder in his famous article "On Exports and Economic Growth" [Feeder 1983]. The model was developed to study the effects of exports on economic performance, then its was applied to study the effects of military expenditures on economic performance.

Assuming two sectors economy, the military sector Ym and the civilian sector Yc. The military sector may act as an externality factor for the civilian sector. An augmented production function for each sector (assumed to be a function of labor and capital) can be written as:

$Yc=c(L_C, K_C, Ym)$, and $Ym=m(L_m, K_m)$,

where Yc, and Ym are output of the civilian and military sector respectively. L and K are labor and capital in each sector and the lowercase subscripts c and m indicate sectoral inputs. Postulating that the total input usage is given by: $L=L_c+L_m$ and $K=K_c+K_m$. Using the partial derivatives of the production functions with respect to inputs, let

$$\frac{Ym_L}{Yc_L + Yc_m * Ym_L} = \frac{Ym_K}{Yc_K + Yc_m * Ym_K} = (1 + \delta) \quad \ldots\ldots\ldots\ldots 2$$

is added to the right hand side of equation (2) to reflect the relative factor productivity differences in the two sectors.[10] In terms of the notation used in equation (2), Yc_m would reflect the external effect of the military sector on the civilian sector. If $Yc_m > 0$ and/or > 0, then increased military output will imply a higher rate of growth of total output which is the sum of *Yc* and *Ym*. With few reasonable assumptions, Feder [1983] derived the following econometric specification:

$$\dot{Y} = \alpha\left(\frac{I}{Y}\right) + \beta \dot{L}\left[\frac{\delta}{1+\delta} + YCm\right]\left[\dot{M}\left(\frac{M}{Y}\right)\right] \quad \ldots\ldots\ldots\ldots 3$$

Equation (3) enables to test the hypothesis that both $Yc_m + = 0$. Since we are interested in the overall effect of military spending, we will test the hypothesis that the sum of external effect and productivity differences is zero.[11] Population growth will be used instead of labor growth since I do not have access to such data. Since our focus will be limited to the effect of military expenditures on economic growth, using population growth instead of labor force growth need not be problematic given that population growth and labor force growth are highly correlated.

The models will be estimated using least squares techniques. Specification tests of autocorrelation, multicollinearity and hetroscedasticity have been undertaken and correction were done when necessary. The direction of the effect runs from military spending to economic growth. However, the opposite could be valid as well leading to a simultaneous determination. This issue of causal ordering will be tested in a separate paper. In this, paper the effect of military spending on economic growth will tested as done in numerous leading article in the subject.[12]

Statistical Results

Table (1) presents the statistical results of the conventional and the augmented model. Only the coefficients of military burden variables have been reported since these variables are the focus of the study. The estimates

show that the relationship between military spending and economic growth hinges upon the prevailing circumstances, nature of the expenditure and the concurrent governmental policies. Therefore, the relationship does not follow some general law applicable to all times and places. Growth retardation and acceleration have been recorded in country-wise regression analysis, though precise coefficients differ from one country to another.

A positive and statistically significant effect of military expenditures has been reported for five countries (Jordan, Kuwait, Monaco, Oman, and Saudi Arabia). This significant and positive effect ranged from 0.11 to 1.28 for Morocco and Oman respectively. This means that an increase of 10% points in the defense burden (measured by the growth rate of military expenditures in constant prices) leads to an increase of annual growth by 1.1% and 12.8%, which is definitely a non-trivial gain in economic growth. Therefore, military expenditures are pro-development for these countries in accordance with the modernization model. Available macro-statistical analysis does not provide enough evidence to explain such results. More in-depth and country specific analysis is needed. Scholars agree that the effect of military spending on the economy depends on the nature of the expenditures (salaries or equipment, spend in domestic markets or used to finance foreign imports, etc.), the prevailing circumstances and current government policies [Chan 1985]. Pervious studies did not find strong and consistent relationship between military spending and economic performance for developing counties. Negative effects were found for some countries and positive effects were found for others in the developing world.[13]

Positive but statistically insignificant effects have been found for eight countries (Bahrain, Egypt, Libya, Somalia, Sudan, Syria, United Arab Emirates and Tunisia) indicating that the effects of military expenditures on economic growth is negligible and does not differ from zero. Negative yet statistically insignificant effects have been reported for Algeria, Mauritania, and Yemen (Sana).

There have been a direct correspondence between the estimates of the conventional and augmented neoclassical models using growth rate in military expenditures as a measure of defense burden in the conventional

model (the coefficients of M^* and $M^*(M/Y)$. Both models conveyed the same conclusions. However, the estimated coefficients have not been robust over the alternative measure of defense burden in the conventional model, the ratio of military expenditures to the gross domestic product M/Y. The direction of the effect switched in some cases as well as the statistical significance. Therefore, one can observe either effect (positive or negative) depending on the measure of defense burden being used. However, as discussed earlier, the growth of military expenditures is a more justifiable indicator of defense burden than the ratio of military spending to gross domestic product.

A cross-sectional regression analysis has been done. The averages of the dependent and independent variables for each country were used, thus each observation represents a country. The result is reported at the bottom of

(Table 1): Coefficients of the Defense Expenditure Variables in the Conventional and Augmented Neoclassical Models Independent Variables

	Country	M^*	M/Y	$M^*(M/Y)$	# of obs
1.	ALGERIA	0.0047(-.81)	1.07(-.87)	1.08 (.6)	21
2.	BAHRAIN	.18 (1.6)	1.3 (.4)	1.19 (.77)	12
3.	EGYPT	0.004 (.12)	0.12(.78)	0.66 (.04)	21
4.	JORDAN	0.38 (4.32)**	0.4 (-.57)	1.24 (4.9) *	17
5.	KUWAIT	0.75 (4.66)**	3.84(.48)	3.5 (3.83) **	20
6.	LIBYA	0.004 (.85)	0.2 (-.19)	0.05 (1.39)	16
7.	MOROCCO	0.11 (2.65)*	-0.59(-1.1)	1.9 (2.9)*	19
8.	.A MAURITANI	-0.006(-.09)	-0.11(-.96)	-0.001(-.03)	18
9.	OMAN	1.28 (7.4)**	-0.34(-.12)	3.72(6.35)**	17
10.	S.ARABIA	0.66 (3.8)**	-3.73(-1.46)	3.6 (2.6)*	19
11.	SOMALIA	0.05 (.56)	-2.6(-1.14)	0.77 (058)	18
12.	SUDAN	0.22 (1.24)	-2.5 (-.8)	6.88 (1.8)	19
13.	SYRIA	0.10 (1.05)	-0.26(-.3)	0.63 (.98)	21
14.	U. A. E	0.05 (2.04)	-8.5 (-.5)	1.6 (1.3)	14
15.	TUNISIA	0.009 (.59)	-0.57(-.59)	0.19 (.61)	21
16.	YEMEN	(S)-0.59(-1.56)	-0.8(-1.65)	0.04 (.13)	18
	ALL COUNTRIES	**0.3(1.87)**	**0.45(.93)**	**0.17 (1.005)**	**16**

Note-Dependent variable is the annual rate of real GNP. Numbers in parentheses are *t*-statistics. * is significant at = 5% and ** is significant at = 1%. table (1) under the heading "ALL COUNTRIES". The cross-sectional result suggests that, overall, there is no statistically significant effect of military expenditures on economic growth, even though the estimated effect is positive but it is not different from zero. This conclusion lends support to the modernization model mainly Benoit's argument that whether or not defense activities had a favorable net effect on growth they had certainly not had an unfavorable one.

Conclusions

Statistical analysis has shown that the relationship between military spending and economic growth rests upon situations and does not follow some general law applicable to all times and places. Military expenditures have been found to slow down and quicken economic growth in country wise regression analysis, though precise coefficients differ from one country to another.

Significant and insignificant beneficial effects have been recorded as well as insignificant dubious effects. A positive and statistically significant effect of military expenditures has been reported for five countries (Jordan, Kuwait, Monaco, Oman, and Saudi Arabia). This significant and positive effect ranged from 0.11 to 1.28 for Morocco and Oman respectively. Positive but statistically insignificant effects have been found for eight countries (Bahrain, Egypt, Libya, Somalia, Sudan, Syria, United Arab Emirates and Tunisia) indicating that the effects of military expenditures on economic growth is negligible and does not differ from zero. Negative yet statistically insignificant effects have been reported for Algeria, Mauritania, and Yemen (Sana).

In general, the results indicate that there is no consistent, statistically significant connection between military spending and economic growth. One can observe positive and negative relationship by focusing on certain time period, limiting the sample to countries with certain characteristics or by adopting certain types of specification.

Appendix

Table (1): Average Military Expenditures as a Percentage of Gross National Product (M/GNP) and of Government Expenditures (M/GOVEXP). All Variables are Measured in Real values.

Country	M/GNP	M/GOVEXP
ALGERIA	2.771	8.8402
BAHRAIN	4.5113	12.340
EGYPT	15.844	31.679
JORDAN	26.005	47.295
KUWAIT	4.4809	12.059
LIBYA	9.1111	23.243
MOROCCO	4.9658	15.502
MAURITANIA	7.1258	17.959
OMAN	27.16	45.906
S. ARABIA	15.257	28.697
SOMALIA	3.2151	14.747
SUDAN	3.7387	19.447
SYRIA	14.956	37.028
U. A. E.	2.4788	6.9999
TUNISIA	4.095	30.514
YEMEN	7.9811	31.110
AVERAGE	6.6061	23.960

Source: Calculated by the author using the ACDA and World Bank tables.

Margin

(1) I gratefully acknowledge the suggestions given by Dr. Omar Abdle-Razaq.

(2) For a survey of literature, see Chan 1985.

(3) Countries included in the study are: Algeria Bahrain, Egypt, Jordan, Kuwait, Libya, Morocco, Mauritania, Oman, Saudi Arabia, Somalia, Sudan, Syria, United Arab Emirates, Tunisia and Yemen (sanae').

(4) For a survey of empirical studies see Chan 1985.

(5) Benoit, Defense and Economic Growth in Developing Countries, p.4.

(6) Because officials are reluctant to cut back other spending or raise taxes, they resort to budget deficit and public debt to finance military expenditures thus boosting future inflationary pressures.

(7) Starting with a production function in the form
Y=f(L, K, M), the change in output over time is given as

$$\frac{dY}{dt} = \frac{\partial Y}{\partial L}\frac{dL}{dt} + \frac{\partial Y}{\partial K}\frac{dK}{dt} + \frac{\partial Y}{\partial M}\frac{dM}{dt}.$$

Dividing both sides by output Y to convert to proportionate rate of change, yields

$$\frac{dY}{dt}\frac{1}{Y} = \left(\frac{\partial Y}{\partial L}\frac{L}{Y}\right)\frac{dL}{dt}\frac{1}{L} + \left(\frac{\partial Y}{\partial K}\frac{K}{Y}\right)\frac{dK}{dt}\frac{1}{K} + \left(\frac{\partial Y}{\partial M}\frac{M}{Y}\right)\frac{dM}{dt}\frac{1}{M}.$$

The above equation gives us the proportionate rate of change in output, labor and military expenditures. While for capital stock, the second right hand term is not multiplied by K/K to avoid getting the proportionate rate of capital stock since data are not available on capital stock. Instead the formula gives us the incremental capital output ratio (change in capital stock/output) so we can use investment (change in capital stock) over output as a regressor (I/Y). However the interpretation of the coefficients are different. For labor and military expenditures it will be output elasticity's with respect to these inputs while for change in capital stock it will reflect the marginal productivity of capital.

(8) The interpretation of the parameters is well known: $_1$ is an indicator of the marginal product of capital, $_2$ and $_3$ are the elasticity's of output with respect to labor and military expenditures.

(9) Assume that military spending remained constant at one billion $, while the GNP has increased from 10 billion to 12 billion $. Defense burden decrease from 0.1 to 0.8, even though the actual amount of military spending did not change.. Since the relative distribution of resources is altered when military spending remains constant while the GNP changes. Therefore, the decrease in defense burden might be misinterpreted as the cause of economic growth by 20%, while economic growth could be the result of other factors. Accordingly, using the ratio of military spending to GNP as a measure of defense burden could be misleading.

(10) Taking the partial derivatives of the augmented sectoral production functions with respect to L and K, yields

$$\frac{dYc}{dL} = \frac{dYc}{dL} + \frac{dYc}{dYm}\frac{dYm}{dL} = Yc_L + Yc_m * Ym_L$$

$$\frac{dYc}{dK} = \frac{dYc}{dK} + \frac{dYc}{dYm}\frac{dYm}{dK} = Yc_K + Yc_m * Ym_K$$

$$\frac{dYm}{dL} = Ym_L$$

$$\frac{dYm}{dK} = Ym_k$$

Thus

$$\frac{dYm/dL}{dYc/dL} = \frac{Ym_L}{Yc_L + Yc_m * Ym_L},$$

$$\frac{dYm/dK}{dYc/dK} = \frac{Ym_K}{Yc_K + Yc_m * Ym_K}$$

(12) This does not imply that the externality effect is zero and the productivity difference is zero but the sum of the two is zero.

(13) For a list of such articles, we refer to Chan 1985.

(14) For a lsit of such studies we refer to Chan 1985.

References

1. American Control and Disarmament Agency, various issues.
2. Benoit, Emile. (1973) *Defense and Economic Growth in Developing Countries. Lexington*, Mass.: D. C. Heath.
3. Biswas, Basudeb and Ram, Rati.(1985). Military Expenditures and Economic Growth in Less Developed Countries: An Augmented Model and Further Evidence. *Economic Development and Cultural Changes*. 34: 361-372.
4. Chan, Steve. (1985). The Impact of Defense Spending on Economic Performance: A Survey of Evidence and Problems. *ORBIS* (Summer): 403-434.
5. Deger S. and Smith R.(1983). Military Expenditure and Growth in Less Developed Countries. *Journal of Conflict Resolution* 27 (June): 347-48.
6. Feder, G. (1983). On Exports and Economic Growth. *Journal of Development Economics*. 12 (February): 59-73.
7. Frederikson, Peter C. and Lonney, Robert E.(1986). Defense Expenditures, External Public Debt and Growth In Developing Countries. *Journal of Peace Research*. 23:329-337.
8. Leontif, W. and Duchin, Fay. (1983). *Military Spending: Facts and Figures, Worldwide Implications and Future Outlook*. New York: Oxford University Press. 1983.
9. World Bank Tables, 1989.