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The Differential Effects on Economic Growth of Government Expenditures on Education, Welfare, and Defense*

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This paper investigates the differential impact of the various types of the government expenditures on economic growth. Evidence from 58 countries suggests that (1) the growth rate of educational expenditures has a significant positive impact on economic growth; (2) the growth rate of welfare expenditures has an insignificant negative impact on economic growth; and (3) the growth rate of defense expenditures has a positive impact on economic growth that is insignificant for all 58 countries but significant for a subset of 47 countries for which data is available for a longer time period.

I. Introduction

The impact of government size on economic growth is still, despite extensive debate, an unsettled issue. According to Ram (1986), government provides public goods and services which enhance the productivity of private sector inputs, harmonizes conflicts between private and social interests, and prevents exploitation by foreigners. Therefore, government expenditures are critical in the process of economic development, and increased government expenditure is necessary for output growth. On the other hand, supply siders argue that government regulations impose costs

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on firms, and that the increased taxes associated with increased government spending create inefficiencies and reduce the incentives to work, save, and invest. Thus, large government expenditures cause slow output growth.

Appeals to the empirical evidence thus far have failed to settle this dispute. Using a cross-country sample, Landau (1983) examined the effect of government expenditure on economic growth and concluded that an increase in government expenditure's share of real GDP reduces the growth rate of per capita real GDP. Barro (1989) modified Summers and Heston's (1988) data on government expenditure by defining the real government investment share as the ratio of government expenditures on education and defense to real GDP and defining the real government consumption share as the ratio of government expenditures to GDP minus the real government investment share. He found a significant negative relationship between the government consumption share and the growth of real per capita GDP and a positive but insignificant relationship between the government investment share and the growth of real per capita GDP. Kormendi and Meguire (1985) performed a cross-section analysis of the macroeconomic determinants of economic growth, using data for 47 countries from *International Financial Statistics*. They found that the mean growth rate of the ratio of government expenditure to output has a positive but insignificant impact on economic growth. On the other hand, Ram (1986) using Summers and Heston's (1984) international comparable data for 115 countries for the period 1950-1980, found that for both cross-section and time series data the growth rate of government expenditures had a positive effect on the growth rate of real GDP.

The above research, by focusing primarily on the impact of total government expenditure on economic growth, largely disregards differences in the impact of the various components of government expenditure. In practice, as Landau (1985) recognized in his pioneering paper, different types of government expenditure may have very different impacts on the economy and on economic growth. Landau employed data for developing countries for 1960-1980 to study the impact on economic growth of five categories of government expenditures — consumption expenditures, education expenditures, defence expenditures, transfer expenditures, and capital development expenditures. He concluded that the government consumption expenditure share of GDP has a negative impact on the growth of per capita output, but the other types of government expenditures have little impact on output growth.

In this paper, we examine the impact of three different types of government expenditures — defense, welfare, and education — on the

growth rate of per capita GDP using cross-section data from both developed and developing countries for the period of 1975-1985. We use Summers and Heston's (1988) international comparable data for 121 market economies on real GDP, investment, and government expenditures, and data on each component's share of total government expenditures published by the International Monetary Fund to determine expenditures on each component of government expenditure. Our main contribution is to establish, using an estimating equation derived from an aggregate production function, that growth of education expenditures has a significant positive impact on the growth rate of per capita real GDP, that growth of welfare expenditures has an insignificant negative impact on the growth rate, and that the impact of defense expenditures on the growth rate is less clear.

Our analysis differs from Landau's (1986) in the following ways: we conduct a cross-section analysis, while Landau preformed a pooled cross-section time series analysis. Our estimating equation is derived from an aggregate production function. Our measure of government expenditure, the compound annual growth rate of government expenditure over the period of study, differs from Landau's measure, the lagged three-year average ratio of government expenditure to GDP. Our data is for a different set of countries and for a different time period. Our choice of countries and time period was dictated by the availability of IMF data on government expenditure shares.

The next section describes our theoretical framework. Section 3 describes our data set. Section 4 presents and discusses our empirical results. Section 5 concludes the paper.

II. The Anlaytical Framework

The theoretical framework is based on a constant returns to scale aggregate production technology that incorporates government expenditures as well as the labor force and the capital stock.[1] The aggregate production function can be written as:

$$(1) \qquad Y = F(L, K, G_e, G_d, G_w),$$

where Y is real aggregate output, L is the labor force, K is the total capital

[1] Ashauer's (1989) study is based on a similar aggregate production function with labor, capital, and total government expenditures as the arguments.

stock, and G_e, G_d, and G_w are government expenditures on education, defence and welfare, respectively.

Dividing both sides of equation (1) by L, and setting $y = Y/L$, $k = K/L$, $g_e = G_e/L$, $g_d = G_d/L$, and $g_w = G_w/L$, we obtain the following expression for y, output per worker:

$$(2) \qquad y = f(k, g_e, g_d, g_w).$$

Totally differentiating equation (2) yields;

$$\begin{aligned}(3) \qquad dy &= f_1\, dk + f_2\, dg_e + f_3\, dg_d + f_4\, dg_w \\ &= f_1[(dKL - DLK)/L^2] + f_2[(dG_eL - dLG_e)/L^2] \\ &\quad + f_3[(dG_dL - dLG_d)/L^2] + f_4[(dG_wL - dLG_w)/L^2]\end{aligned}$$

where $f_1 = dy/dk$, $f_2 = dy/dg_e$, $f_3 = dy/dg_d$, and $f_4 = dy/dg_w$. Dividing both sides of equation (3) by $y = Y/L$ yields equation (4) which relates the growth of output per worker to the ratio of investment to output and the growth rate of each category of government expenditure, i.e.,

$$\begin{aligned}(4) \qquad dy/y &= f_1\, dK/Y - f_1(K/Y)(dL/L) + f_2\, dG_e/Y \\ &\quad - f_2(G_e/Y)(dL/L) + f_3\, dG_d/Y - f_3\, (G_d/Y)(dL/L) \\ &\quad + f_4\, dG_w/Y - f_4\, (G_w/y)(dL/L) \\ &= -[f_1(K/Y) + f_2(G_e/Y) + f_3(G_d/Y) + f_4(G_w/Y)](dL/L) \\ &\quad + f_1\, dK/Y + f_2(G_e/Y)(dG_e/G_e) + f_3(G_d/Y)(dG_d/G_d) \\ &\quad + f_4(G_w/Y)(dG_w/G_w).\end{aligned}$$

Letting $\dot{y} = dy/y$, $\dot{L} = dL/L$, $I/Y = dK/Y$, $\dot{G}_e = dG_e/G_e$, $\dot{G}_d = dG_d/G_d$, $\dot{G}_w = dG_w/G_w$, $b_1 = f_1$, $b_2 = f_2(G_e/Y)$, $b_3 = f_3(G_d/Y)$, $b_4 = f_4(G_w/Y)$, $b_4 = f_4(G_w/Y)$, $b_5 = -[f_1(K/Y) + f_2(G_e/Y) + f_3(G_d/Y) + f_4(G_w/Y)]$, we can rewrite equation (4) as:

$$(5) \qquad \dot{y} = b_1 I/Y + b_2\dot{G}_e + b_3\dot{G}_d + b_4\dot{G}_w + b_5\dot{L}.$$

The form of equation (5), is similar to Ram's (1986) preferred estimating equation.[2] This form may be contrasted with Landau's

[2] Ram's dependent variable, the growth rate of real GDP, differs from our dependent variable, the growth rate of real per capita GDP. However, the growth rate of real GDP is equal to the growth rate of per capita GDP plus the population growth rate.

estimating equation which includes the share of GDP spent on various government activities and Kormendi and Meguire's (1985) specification which includes the growth rate of the share of GDP spent by government. Ram has argued that specifications such as ours which include the growth rate of government expenditures are preferred on both theoretical and empirical grounds to those which include the share of government expenditures.

It is difficult to sign the coefficients of government expenditures. The sign of b_2 (the coefficient for the growth rate of educational expenditures) should be positive, as educational expenditures contribute to the formation of human capital which should have a positive effect on the rate of economic growth. The sign of b_3 (the coefficient for the growth rate of defense expenditures) is a matter of dispute. It has been argued that defense expenditures increase the productivity of private capital and labor, and thus increase the rate of economic growth by increasing national security, by increasing the level of research and development and by introducing new technologies. Others have argued that defense expenditures reduce the rate of economic growth by increasing political tensions and thus reducing national security and by diverting scarce investment and technical talents from the civilian economy. However, Gold (1990) has argued that defense spending is not an important explanation of the performance of the U.S. economy. Thus, empirical evidence is required to determine the impact of defense expenditures on economic growth. The sign of b_4 (the coefficient for the growth rate of welfare expenditures) is also theoretically indeterminate. Lack of food may limit workers in low income developing countries to a few hours of hard work per day, according to Schultz (1961). In these countries an increase in the growth rate of welfare expenditures that benefits the poor may increase both the quality of labor and the quantity of labor. In the developed nations, given their higher absolute living standards and large welfare expenditures, an increase in the growth rate of welfare expenditures may cause a decrease in both the quality of labor and the quantity of labor. Also, inefficiencies resulting from the additional taxes required to finance these expenditures can decrease output growth.

The sign of b_1 (the marginal product of capital) should be positive. The sign of b_5 (the negative sum of the capital elastiticy of output and the government expenditure elasticities of output) will be negative unless the sum of the government expenditure elasticities of output, $b_2 + b_3 + b_4$, which can be positive or negative, is negative and larger in absolute value than the capital elasticity of output, $f_1 K/Y$, which should be positive.

III. Data

Our data set is constructed from Summers and Heston's (1988) international comparable data on real gross national product, private investment, consumption, and government expenditure for 121 market economies for the period 1950-1985 and from the International Monetary Fund's *Government Financial Statistics Yearbook* annual data on the share of total government expenditure allocated to defense, welfare, and education. We combine these two data sets to obtain data on each category of government expenditure.[3] Since the IMF government expenditure share data is not available prior to 1972, and is unavailable after 1972 for some countries, our combined data consists of annual data for 1972-1985 for 70 countries. For some of these 70 countries the data is imcomplete. Complete data on expenditure shares exist for 47 countries for the 11-year period from 1975-1985, complete data exist for 58 countries for a 10 year period from either 1976-1985 or 1975-1984, and complete data exist for larger subsets for shorter time periods. The countries in the combined data set are listed in the appendix and grouped by the time period for which complete data is available. Also, data on the growth rate of the labor force are unavailable for many countries. Thus, following Ram (1986), Landau (1983), and many others, we use the population growth rate as a proxy for the labor force growth rate.[4]

IV. Regression Results

Columns 1 and 2 of Table 1 report the results of estimating equations (5) using cross-section data for 47 countries for the period 1975-1985 and

[3] To determine real expenditures for each category of government expenditures from Summers and Heston's data on real government expenditures that excludes transfers and the IMF data on nominal government expenditure shares that includes welfare expenditures, we first specify welfare expenditures, W, as $W = w(W + G)$, where G equals Summers and Heston's real government expenditures excluding welfare expenditures and w equals the IMF's welfare share of total nominal government expenditures. Solving for W yields $W = [w/(1-w)]G$. Real educational expenditures, E, and real defense expenditures, D, can than be determined as $E = e(G + W)$ and $D = d(G + W)$, where e and d equal the IMF's nominal expenditure shares for education and defense respectively. Since no feasible alternative is available, we use the nominal shares of nominal government expenditures as if they were real shares of real government expenditures.

[4] Using the population growth rate as a proxy for the labor force growth rate alters the interpretation of the government expenditure coefficients. Now government expenditures that influence the participation rate can influence economic growth. Previously, government expenditures could influence economic growth only by altering the quality of labor or capital or overall economic efficiency.

Table 1

ESTIMATED COEFFICIENTS FOR EQUATION (5)

Variable (Coefficient)	1 N = 47	2 N = 58	3 N = 47	4 N = 58
Constant	−0.012	0.011	−0.854	0.008
	(−0.093)	(1.04)	(−0.4)	(0.65)
Capital, I/Y	0.22	0.112	0.216	0.128
(b_1)	(3.60)	(2.06)	(3.43)	(2.08)
Education exp., $\dot{G}_e$	0.20	0.169	0.18	0.157
(b_2)	(2.71)	(2.49)	(2.11)	(2.07)
Defense exp., $\dot{G}_d$	0.138	0.021	0.14	0.022
(b_3)	(2.76)	(0.49)	(2.81)	(0.52)
Welfare exp., $\dot{G}_w$	−0.089	−0.002	−0.096	0.009
(b_4)	(−1.76)	(−0.05)	(−1.73)	(0.18)
Population, $\dot{L}$	−0.672	−1.04	−0.51	−1.065
(b_5)	(−2.33)	(−4.56)	(−1.46)	(−4.12)
Africa			−0.007	0.005
(b_6)			(0.79)	(0.57)
Latin America			−.005	−.001
(b_7)			(−0.63)	(−0.095)
Adjusted r^2	0.48	0.41	0.55	0.51

t values are in parentheses.

for 58 countries for the period 1976-1985 or 1975-1984. Each observation in the cross-section consists of a country's average value for each variable for the relevant time period. We also estimated equation (5) for the 63 countries for which complete data is available for at least eight consecutive years and for each subset with the members of OPEC, identified in the Appensix, excluded. These results, which are available from the authors, do not differ significantly from the results reported in Table 1.

The equation's explanatory power as measured by the adjusted r squres is high for cross-section data. The signs and significance of the coefficients are consistent with our hypotheses. The estimated coefficient for investment's share of real GDP, b_1, and for the growth rate of educational expenditures, b_2, are both positive and significant for both subsets. The

estimated coefficient for the growth rate of defense expenditures, b_4, is positive for both subsets but significant at the 5 percent level for only 47 country subset. The estimated coefficient for the growth rate of welfare expenditures, b_4, follows a similar pattern. It is negative and insignificant for both subsets but its absolute t value is much larger for the 47 country subset. The estimated coefficient for the population growth rate, b_5, is negative and significant. According to equation (4), this indicates that the sum of the capital elasticity of output and the government expenditure elasticities of output is positive. Alternatively, this indicates that population growth has a negative impact on the growth of per capita income.[5] That is, an increase in the population tends to decrease per capita income. This result is consistent with the diminishing returns to labor assumption of standard growth models, and is consistent with Barro (1989) and Kormendi and Meguire's results.

Equation (5) appears to perform better for the 47 country subset than for the 58 countries subset. The adjusted r squares are smaller and, except for the population variable and the constant, the absolute values of the coefficient estimates and their t statistics are smaller for the larger data sets. The means and standard deviations of the variables reported in Table 2 provide an explanation for these results. The average growth rate of per capita GDP is lower and the growth rates of population, defense expenditures, and welfare expenditures are higher for the countries in the larger data set. Apparently, higher population growth rates — not the higher growth rates of defense and welfare expenditures — explain the slower economic growth of the additional countries.

A common view is that given all other factors countries located in Latin America and Africa have grown more slowly than other countries. To test this view we include in columns 3 and 4 regional dummy variables for sub-saharan Africa, b_6, and Latin America, b_7, that equal 1 if a country is located in the indicated region and equal 0 if the country is located elsewhere. The coefficients of the regional dummy variables are insignificant and the regional dummies add little to the explanatory power of the equation indicating that the other variables previously included in model control for the particular characteristics of the Latin American and African Countries.

V. Conclusion

Using data on the share of each component of total government ex-

[5] Since we use population as a proxy for the labor force, this interpretation implicitly assumes that the labor force participation rate is constant.

Table 2

SUMMARY STATISTICS

Variable (Notation)	Data Subset All Countries N = 47	N = 58
Growth rate of per capita GDP ($\dot{y}$)	0.0186	0.0142
	(0.024)	(0.0261)
Population growth rate ($\dot{L}$)	0.0154	0.0179
	(0.0114)	(0.0137)
Investment share of GDP (I/Y)	0.161	0.1539
	(0.0502)	(0.0537)
Growth rate of defense exp. y ($\dot{G}_d$)	0.0323	00378
	(0.0619)	(0.075)
Growth rate of welfare exp. ($\dot{G}_w$)	0.0323	0.0357
	(0.0771)	(0.0728)
Growth rate of educational exp. ($\dot{G}_e$)	0.0207	0.0211
	(0.0452)	(0.0567)
Growth rate of total gov. exp. ($\dot{G}$)	0.0361	0.0382
	(0.0259)	(0.0292)

Standard deviations are in parentheses.

penditures published by the IMF and Summers and Heston's (1988) international comparable data on real GDP, investment, and government expenditures we determined that expenditures on defense, welfare, and education have different impacts on economic growth. The growth rate of education expenditures has a positive and significant impact on economic growth in all cases. The growth rate of welfare expenditures has a negative impact on economic growth in all but one case, but this impact is insignificant in all cases. The growth rate of defense expenditures has a positive impact on economic growth that is significant for one subset of countries but is insignificant for the other subset.

Appendix

Countries Included in the Data Set

Countries for Which Complete Data
Is Available for 1975-85

Argentina	Ghana	Papua New Guinea
Australia	Iran*	Portugal
Austria	Italy	Republic of Korea
Bangladesh	Jordan	Singapore
Barbados	Keyna	Spain
Belgium	Luxembourg	Sri Lanka
Brazil	Malawi	Sweden
Canada	Malta	Tanzania
Chile	Mauritania	Thailand
Costa Rica	Mexico	Tunisia
Cyprus	Morocco	The Netherlands
Denmark	Nepal	United Kingdom
Fed. Rep. of Germany	New Zealand	United States
Fiji	Nigeria*	Uruguay
Finland	Norway	Venezuela*
France	Pakistan	

Additional Countries for Which Complete Data
Is Available for 1976-85 or 1975-84

Bolivia	Mali	Switzerland
Egypt	Paraguay	U. Arab Emirates*
El Salvador	Senegal	Zimbabwe
Liberia	Sierra Leone	

Additional Countries for Which Complete Data
Is Available for at Least Eight Consecutive Years

Botswana	Cameroon	Dominican Repu.
Kuwait*	Syrian Arab Rep.	Togo

* Member of OPEC

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