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Government Expenditure and Economic Growth: An Empirical Investigation

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Abstract

This paper examines the empirical evidence on the contribution that government and, in particular, capital expenditure make to the growth performance of a sample of developing countries. Using the Denison growth accounting approach, this study finds that social expenditures may have a significant impact on growth in the short run, but infrastructure expenditures may have little influence. While current expenditures for directly productive purposes may exert a positive influence, capital expenditure in these sectors appears to exert a negative influence. Experiments with other explanatory variables confirm the importance of the growth of exports to the overall growth rate.

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Summary

In recent years it has been more clearly realized that greater efforts should be made to direct adjustment policies toward growth. This realization has been reinforced by the complaint that setting targets for aggregate government spending while ignoring its composition has rendered the level of expenditure even less likely to enhance growth. Using evidence from a sample of developing countries, this paper examines the contribution of government expenditure to economic growth.

The paper begins by describing empirical results suggesting that the overall level of government spending and aggregate growth are only marginally related. There is a suspicion, however, that the results obtained from aggregate relationships mask important differences in the impact of various types of spending on growth. The Denison growth-accounting framework is used to investigate this possibility.

Empirical testing of the Denison model showed little relationship between the share of aggregate government current expenditure in gross domestic product (GDP) and the growth rate. Government expenditure may be disaggregated into spending on directly productive economic sectors, spending for social purposes, and spending on infrastructure. The conclusions of the study are that social capital expenditure on health, housing, and welfare may have a significant impact on growth in the short term. However, capital infrastructure expenditure may have little influence on real growth, and directly productive capital expenditure may even exert a negative influence. At the same time, current expenditures on directly productive sectors appear to exert a positive influence on growth.

Further tests also suggest that different categories of capital spending have different impacts on the growth rates of the economy. Lastly, experiments with explanatory variables used in other studies confirm the importance of the growth of exports to the overall rate of growth in the economy.

I. Introduction

In recent years it has been increasingly realized that much more work would be required in program design to more effectively direct adjustment policies toward growth. 1/ There has been a complaint that in setting targets for aggregate government spending and ignoring its composition, the quality of expenditure has deteriorated with respect to the growth objective. This criticism, in turn, has often been translated into a call for higher levels of investment spending, highlighting a potential conflict between adjustment and growth.

This paper examines evidence on the contribution that government expenditure, and in particular capital expenditure, can make to the growth process. Such an empirical investigation is important both in assessing the relevance of a widely used growth model and in understanding the role of government spending in the growth experience of developing countries. The results could assist policymakers in designing growth-oriented fiscal adjustment programs and in setting expenditure priorities.

The investigation begins in Section II by describing empirical evidence that suggests there is little relationship between the overall level of government expenditure and aggregate economic growth in the economy. However, there is a strong suspicion that this result may hide important sector differences between various types of spending. Section III develops a framework to analyze the contribution of government expenditure to economic growth, and Section IV uses this framework to empirically examine this relationship, both in the aggregate and broad functional categories, for current and capital government spending. In Section V different types of spending and various conditioning variables are combined to offer the best-fitting model explaining the growth performance of this sample of developing countries.

II. Government Expansion and Economic Growth

Many of the developed countries between 1945 and 1965 presumed the necessity of expanding public spending and increasing the relative size of the government sector. The underlying philosophy contended that greater government intervention was the best, if not the only, way to achieve certain economic and social goals. Developed countries have questioned the validity of this philosophy in recent years. Not only has there been growing skepticism concerning the possible achievements of public spending, but there has also been increased recognition of the

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1/ See, for example, International Monetary Fund (1987); Intergovernmental Group of Twenty-Four on International Monetary Affairs (1987); Corbo, Goldstein, and Khan (1987); Hernandez-Cata (1988); and Khan and Montiel (1988).

consequent undesirable side effects of tax financing. This has resulted in deliberate policies to curtail the growth in government spending and even to reduce its level.

In the developing countries, the task of reorganizing the economic structure and promoting faster growth also led to policies of ever-rising public spending and public intervention. However, in the stringent financial environment in which many of these countries found themselves following the 1973 and 1979 oil shocks, a similar movement to curtail public expenditure growth can be detected. Often implicit in the public debate surrounding this policy change is the suggestion that an overly high level of government spending may adversely affect economic growth.

Is it true empirically that countries with higher rates of government spending have lower rates of growth? Although this is an important question, direct empirical investigation has been minimal, with researchers coming to conflicting conclusions. Landau (1983), using a sample of 96 developing countries, concluded that a larger government size, as measured by the share of government consumption expenditures in gross national product (GNP), depressed the growth of per capita incomes. This conclusion was largely confirmed by a more comprehensive study (Landau (1986)), which included, along with four components of government expenditure, a wide range of possible influences on the growth rate, for example, per capita income, the structure of production, population characteristics, and world economic conditions. These explanatory variables were not derived from a rigorously specified growth model, but were regarded as "plausible" influences on economic growth.

On the other hand, Rubinson (1977) concluded that a larger government size, indicated by the share of government revenue in GNP, promotes economic growth by reducing "dependence," especially in poorer developing countries. This was contradicted by the results of a later study by Marsden (1983). However, more recently, Ram (1986) employed a sample of 115 developed and developing countries for the period 1960-80 and, using a production function approach, concluded that the impact of government size on growth is in almost all cases positive, with the relationship being stronger for lower income countries. Interestingly, Grossman (1988) used a simultaneous equation model allowing for a nonlinear relationship between growth in government and total economic growth. This model identified a weak positive effect, which was absent in the equivalent linear model.

The reasons for this confusion in the literature are readily apparent in a cursory examination of the basic data on growth performance and government size. Regression equation (1), Table 1, describes the relationship between the growth rate of real GDP and the ratio of total government expenditure to GDP for a sample of 42 developing countries. From this equation it is clear that there is little discernible relationship between the rate of growth and the

Table 1. The Growth of Real GDP and Aggregate Government Expenditures, Averages 1980-85

(Dependent Variable = Real Growth Rate of GDP)

Equation Number	Constant	Independent Variables: Total expenditure to GDP	Total current expenditure to GDP	Total capital expenditure to GDP	N 1/	$\bar{R}^2$	F
1	1.8646 (1.121)	0.3274 (0.619)			42	0.01	0.38 (1,40)
2	1.5191 (0.949)		-0.0212 (0.351)	0.2742 * (2.126)	42	0.06	2.27 (1,40)

Notes: Coefficients with * significant at 5 percent level.
** significant at 1 percent level.
t statistics shown in parentheses below coefficient.

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Argentina	Dominican Republic	Liberia	Thailand
Barbados	Egypt	Maldives	Trinidad and Tobago
Belize	El Salvador	Malta	Tunisia
Bolivia	Greece	Mauritius	Uruguay
Botswana	India	Mexico	Venezuela
Brazil	Indonesia	Pakistan	Yemen Arab Republic
Burma	Iran, I.R. of	Panama	Zaire
Cameroon	Israel	Singapore	Zambia
Chile	Kenya	Sri Lanka	Zimbabwe
Colombia	Korea	Syrian Arab Republic	
Costa Rica	Kuwait	Tanzania	

overall size of the government. Although the coefficient appears positive in sign, it is statistically insignificant. A dummy variable identifying low, middle, and higher per capita income countries was introduced into the equation. This variable did not alter the results, and was itself insignificant, indicating that there was no identifiable problem of lack of sample homogeneity, at least with respect to per capita income.

Since for many developing countries, government spending represents a high proportion of GDP, the regression model implies that the growth of a variable is being regressed on a large component of itself. Thus to avoid this possible source of simultaneity, equation (1) was rerun using the growth rate of nongovernment GDP as the dependent variable. Although not shown here, the results remained insignificant, with the coefficient displaying a negative sign.

Total government spending was then broken down into a number of components: capital, current, total nondefense, total noninterest, and total nondefense noninterest expenditures. From Table 1, regression equation (2), it is evident that current expenditures show a negative relationship, although the coefficient is nonsignificant. These statistically nonsignificant results were on the whole repeated for the other expenditure aggregates, both individually and jointly. The exception, as can be seen in equation (2), was capital expenditures, which showed a statistically significant positive relationship with real growth rates, although the regression as a whole had poor explanatory power.

Although obtained from admittedly crude data, these overwhelmingly poor statistical results highlight the complexity of the problem facing empirical research in this field. Under varying assumptions of the relevant growth rate to be explained, and under differing assumptions of the relative importance of different types of expenditures, it is difficult to establish any significant relationship between the growth in the economy and the relative size of aggregate government expenditure or its composition. However, from the diverse results obtained using different expenditure categories, one might speculate that different types of government spending have different effects on a country's growth rates. If so, this would imply that the composition and quality of government expenditures, rather than its overall magnitude, may be critical to understanding its influence on growth. It is this possibility that is explored in the remainder of this paper.

III. Government Expenditure and Economic Growth: An Analytical Framework

Obviously, the empirical evidence presented in the previous section is hard to assess, most especially because of an underlying controversy at the analytical level over the influence of government spending on economic growth. Some would argue that all government expenditure,

regardless of whether it is of a current or capital nature, has a deleterious effect on economic growth. This is based on a view that centralized decision-making, a lack of profit motive, and the absence of competition--all of which typify government operations--imply that government production is always less efficient than private sector production. 1/ Assuming this lower productivity, any increase in government expenditure, by increasing the share of productive resources used by government, would slow economic growth in the economy as a whole and may impede the accumulation of human and physical capital and the pace of innovation in the private sector. This conclusion would, of course, have to be modified as the proportion of government purchases of privately produced output in total expenditure increases relative to government own-produced services.

Others, however, would disagree with an unqualified endorsement of the efficacy of the market system. They would point to large noncompetitive firms in the private sector that are able to insulate themselves from market forces. 2/ Moreover, some would point out that if social returns are greater than private returns, the market system will break down and the private sector may well underinvest in some key areas necessary for growth. The "structuralists," in particular, would go further and postulate that in most developing countries economic growth is not possible unless the government intervenes to remove impediments to economic growth (Hirschman (1967); Diaz-Alejandro (1981); Taylor (1983)).

Of course, much of this controversy over the growth effects of government expenditures arises from our incomplete picture of the growth process and the determinants of economic expansion. Given what appear to be legitimate but conflicting arguments, it would seem necessary to adopt an empirical approach and examine available evidence on the relationship between government expenditure and economic growth. To do so, the correct procedure would be to include government spending in a general model of economic growth and estimate its impact after correcting for the influence of other explanatory variables.

Given the state of the art in empirical modeling of economic growth, it seems useful to commence with Denison's growth accounting methodology to identify the main sources of economic growth and organize our thinking on this subject (Denison (1974)). In this approach the aggregate production possibilities of a country are assumed to be

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1/ Buchanan and Tullock's (1962) and Downs' (1957) theories of public decision-making pinpoint how the interest of the small vocal minority may be served at the expense of the general public. Niskanen (1971) has also attempted to show that bureaucracies providing goods and services tend to be greater than their efficient size.

2/ See, for example, Galbraith (1967).

determined by the state of technology, physical capital, and human capital. In this approach, the growth rate of real output, y, is defined as:

$$y = \lambda + a + \beta k + (1-\beta)h \qquad (1)$$

so that the growth in output is decomposed into four sources: (1) physical capital growth, k; (2) human capital growth, h; (3) technical change, a; and (4) the change in the efficiency of the use of resources, λ.

Although not appearing explicitly in equation (1), an examination of each element of the basic growth accounting identity reveals the potential importance of government expenditure:

(i) The most obvious influence is the direct contribution of government capital spending in physical capital. However, this positive effect will only occur if there is a net increase in physical capital. Insofar as government tax and revenue-raising measures and the financing of government expenditure decreases the investable surplus of the private sector, an increase in government capital expenditure may actually slow down economic growth. This negative effect arises from less efficient government capital expenditure crowding out more productive private capital expenditure. Given the possibility of this substitution, it seems important to include the relationship between government and private investment.

For this reason, Blejer and Khan (1984) made a distinction between public investment related to the development of infrastructure, which is likely to be complementary to private investment, and other types of government investment, which may substitute for private capital. Other studies have also stressed the effects of government expenditures on private sector capital formation (von Furstenberg and Malkiel (1977); Sundararajan and Thakur (1980)), with some support for the thesis of government investment crowding out private investment. 1/ The importance of looking at net rather than gross capital formation also highlights the problem of the depreciation of government assets, and stresses the important contribution that recurrent spending on operations and maintenance makes to growth in slowing down the depreciation of public infrastructure.

(ii) A second possible influence of government expenditure is in increasing human capital formation. Governments have increasingly undertaken functions like health and education that can enhance the labor force's productivity. With regard to the impact on economic growth, the distinction between government current and capital expenditure appears blurred. Although health and education sectors

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1/ Recently, using time series data for the United States, Aschauer (1988) identified a strong positive relationship between public capital formation and productivity.

typically benefit from substantial government capital expenditure, the impact on human capital is just as likely, particularly in the short run, to come from current spending. It would seem important, therefore, to include current as well as capital expenditures in the social sector as explanatory variables in describing the growth of human capital. At the same time, due to longer gestation periods than other types of expenditure, the impact on growth may not show up immediately.

(iii) A third possible influence of capital expenditures on the growth rate arises from its influence on technological change. In advanced countries government expenditure on research and development has often been felt to have important spin-off effects for the rest of the economy, and has led to enhanced growth in technologically advanced industries. Developing countries, too, have apparently benefited from research and development expenditures on new agricultural techniques and seed varieties, which have been the product of government expenditure programs. Obviously, it is difficult to investigate this effect empirically, although it should be noted that the major part of such expenditure is likely to be classified as current, contradicting the assumed primary importance of capital expenditure for growth.

(iv) A fourth influence of government expenditure on the growth rate, that arising from the more efficient use of resources, is even more difficult to quantify. One of the traditional reasons for government intervention, however, is the breakdown of the market system: the classic case of underinvestment in public goods. Many of these public goods may be viewed as essential, although unquantifiable, inputs to the private sector production process. The maintenance of internal security and public order, for example, may be an essential precondition for a healthy investment environment.

Recently, economists of the structuralist school have gone further, arguing for an even more active role for government in removing the barriers to economic growth. Development economists more generally have long stressed the importance of basic infrastructural investment as a necessary prerequisite for economic growth. This emphasis has mirrored the arguments of early national income accountants who wanted to treat a large portion of government expenditure as an intermediate input to the production process. All such considerations suggest that the composition, as much as the level of government capital expenditures, is important for economic growth.

From the above discussion, the influence of government recurrent expenditures on the rate of economic growth is somewhat ambiguous. On the one hand, it could be argued that the overall impact is likely to be negative, insofar as the government's use of resources for consumption substitutes for savings and subsequent growth in the private sector, or insofar as government uses these resources less productively than the private sector. On the other hand, a positive association could be argued on at least two grounds. First, as noted previously, many current expenditures such as those directed to augmenting and

maintaining human capital, or to law and order, are important prerequisites for a successful deployment of growth-related private sector resources. Second, many studies have stressed the importance of capacity utilization for economic growth. Certainly in the public sector, growth in many developing countries would be better promoted by ensuring that existing productive capacity is better utilized and maintained, through increased operations and maintenance expenditures, rather than by increasing productive capacity through capital spending.

IV. Expenditure and Economic Growth: The Evidence

However, despite this ambiguity at the analytical level, the regressions in Table 1 show that the relationship between government expenditure aggregates and economic growth is weak. This section explores two possible causes for the failure to identify significant relationships. First, important data problems encountered in international comparisons have distorted the true relationship between government expenditures and economic growth. Second, by examining only aggregative relationships, important and perhaps conflicting influences on growth from different types of spending have been overlooked.

1. Comparability of the data base

Cross-country research must overcome a number of difficult statistical and conceptual problems. 1/ For such comparisons, the national income estimates of different countries (measured in domestic units of currency) are usually converted into a single currency by using official exchange rates. This approach is inadequate in view of the exchange rate instability, exchange restrictions, and multiple exchange practices that characterize most developing countries. Moreover, it is generally recognized that foreign exchange rates tend to reflect the relative prices of those goods and services entering foreign trade, and are not typical of relative prices within countries. There is also evidence of large cross-country variation in the relative prices of nontraded goods and services, with the relative prices of manufactures being much higher than those of services in developing countries than they are in industrial countries. This has led to the conclusion that, on the whole, the level of income of low-income countries tends to be understated relative to high-income countries (see Kravis, Heston, and Summers (1982)). This also implies that cross-country comparisons, based on the government expenditure to GDP ratio, could understate or overstate the size of government depending on the labor intensity and import content of government spending relative to other sectors of the economy.

To overcome many of the above problems, constant price data, constructed by Summers and Heston (1984), were used; these deflate

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1/ Some of these difficulties are discussed in Diamond and Tait (1988).

government consumption expenditure aggregates 1/ and correct for changes in international terms of trade. A total sample of 102 countries covering the period 1960-80 was broken down into 23 advanced countries and 79 developing countries. To overcome the volatility of real GDP, five-year averages were taken of growth rates and these were compared to the corresponding average share of real government consumption expenditure in GDP. Results of the cross-country ordinary least squares (OLS) regressions for the sample are shown in Table 2.a (advanced countries) and Table 2.b (developing countries). These suggest a preponderant negative relationship between the share of government consumption expenditure in GDP and the rate of economic growth.

Equation (5) in both tables shows that the relationship between the real growth rate of GDP and the real share of government consumption expenditure is negative in the period 1960-80. This relationship is, however, only significant at the 95 percent level for the developed countries. Cross-section data for all four time periods were pooled, and a dummy variable for time was added, as in equation (6), to capture any time trend in both series. As can be seen the level of significance is improved, and in both samples the negative relationship between real growth and the proportion of real government consumption expenditure becomes significant at the 5 percent level. In both samples, however, the adjusted R^2 is extremely low, suggesting that government consumption expenditure is only one, rather insignificant, explanation of the growth performance in the sample countries.

To test for stability of this relationship, the 1960-80 period was split arbitrarily into equal five-year periods, and the regression results for each period are shown in equations (1)-(4) in both sections of Table 2. These equations indicate that the relationship between the real growth rate and the share of government consumption in real national income is highly unstable over time, although the basic relationship remains negative. 2/ Further checks on the stability of this negative relationship are reported in the Appendix.

2. Composition of aggregate expenditure

Although improving the comparability of international data may strengthen the relationship between the growth rate and government outlays, there are obvious concerns that aggregate relationships may hide important differences between different types of spending. To test

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1/ Following national accounting conventions, government consumption excludes transfers, such as subsidies and domestic interest payments, which are included in subsequent definitions of current expenditure which follow Government Finance Statistics (GFS) conventions.

2/ Landau (1983), employing cross-section data for 96 countries and variables for investment in education, climatic conditions, energy consumption, and degree of openness of the economy, has also found a negative relationship between the share of real government consumption expenditure in GDP and the growth rate of per capita GDP.

Table 2. Relationship Between Government Consumption Expenditure Share of Real GNP and the Growth of Real Gross National Income

a. Advanced Countries

Equation Number	Time Period	Constant	Independent Variable Government Share (G)	Time Dummy	R^2	$\bar{R}^2$	S.E.E.	N
1	1960-65	7.507 (6.073)	-0.1665 (-1.731)	--	0.12	0.08	1.53	23
2	1966-70	7.348 (4.6130)	-0.1915 (-1.543)	--	0.10	0.06	1.97	23
3	1971-75	5.276 (4.857)	-0.1342 (-1.603)	--	0.11	0.066	1.39	23
4	1976-80	2.852 (2.638)	-0.1988 (-0.252)	--	0.003	--	1.41	23
5	1960-80 Pooled	5.923 (6.335)	-0.130 (-1.817)	--	0.14	0.09	1.15	92
6	1960-80 Pooled	7.682 (10.902)	-0.109 (-2.278)	-0.8098 (5.448)	0.29	0.28	1.03	92

b. Developing Countries

Equation Number	Time Period	Constant	Independent Variable Government Share (G)	Time Dummy	R^2	$\bar{R}^2$	S.E.E.	N
1	1960-65	4.374 (3.700)	0.027 (0.4319)	--	0.002	--	0.03	79
2	1966-70	6.4487 (5.6329)	-0.0066 (-1.118)	--	0.016	0.003	2.89	79
3	1971-75	9.087 (5.236)	-0.2338 (-2.673)	--	0.085	0.073	3.78	79
4	1976-80	6.609 (3.578)	-0.116 (-1.345)	--	0.023	0.01	-0.12	79
5	1960-80 Pooled	5.9846 (5.4498)	-0.0666 (-1.187)	--	0.018	0.05	-0.07	79
6	1960-80 Pooled	6.9627 (7.986)	-0.0973 (-2.389)	-0.1830 (-1.004)	0.022	0.016	-0.08	316

the importance of the composition of expenditures, the growth accounting model was employed. For the purpose of this empirical investigation, the average growth rate of GDP during the 1980-85 period at constant prices was taken as the dependent variable for a sample of 42 developing countries. The size of the sample was limited by the availability of an internationally comparable functional breakdown of capital expenditures derived from the GFS Yearbook. As a first step, capital and labor input variables were used to explain average real growth rates of the sample countries (Table 3, equation (1)). Although both variables had the correct sign, only the private investment variable was significant at the 5 percent level, and the degree of explanation of the regression was rather low.

The ratio of total government expenditure to GDP was introduced into the model, but little altered the goodness of fit (Table 3, equation (2)). The coefficient displayed a positive relationship, but was statistically nonsignificant. When this aggregate was decomposed into current and capital expenditures, the overall explanatory power of the model improved, with the capital expenditure to GDP ratio showing a significant positive relationship (Table 3, equation (3)).

3. Composition of current expenditure

Although little relationship could be identified between aggregate current expenditure and economic growth, the diverse nature of current expenditures implies that aggregate relationships could be misleading, with some types of current spending exerting a positive influence and some a negative influence on economic growth. To explore this possibility, total current expenditure was then disaggregated into different functional components and introduced into the basic regression model (Table 3, equations (4) and (5)). Current expenditure on infrastructure--defined as expenditures on electricity, gas, water, roads, waterways, and other transport and communications (GFS categories 8.4-8.7) as a ratio of GDP--was not significant, although it did display a positive sign. On the other hand, current expenditures on directly productive services, defined as those in agriculture, forestry and fishing, mining, manufacturing and construction, and other economic services (i.e., GFS categories 8.2, 8.3, 8.8) as a ratio to GDP, showed a positive influence on economic growth that was significant at the 5 percent level (Table 3, equation (4)).

Human capital can be viewed as the product of the number of workers and some indicator of the average human capital per worker. The average human capital per worker may be felt to at least partially depend on the education and training of individuals, as well as their general health and well being, as supported by the provision of basic needs such as housing. While recognizing the importance of private sector and public enterprise expenditure on human capital formation, one could also expect some positive relationship between government expenditures in this area and economic growth. To test for this, social security expenditure in the areas of education, health, social security, welfare, housing,

Table 3. The Growth of Real GDP and the Composition of Government Expenditure

Equ. No.	Const.	Independent Variables: Private invest.	Increase in labor force	Total govt. expen. to GDP	Total govt. current expen. to GDP	Current expen. infra-structure ratio GDP	Current expen. directly productive ratio GDP	Current expen. social sector ratio GDP	Current expen. educ. ratio GDP	Govt. capital expen. ratio GDP	N 1/	$\bar{R}^2$	F
1	-2.2881	0.2888 **	0.1830								38	0.13	3.77
	(0.884)	(2.739)	(0.313)										(2,35)
2	-4.6808	0.3292 **	0.2830	0.5347							38	0.15	3.17
	(1.501)	(3.019)	(0.469)	(1.077)									(3,34)
3	-4.3172	0.3279 **	0.0225		0.0088					0.2737 *	38	0.20	3.31
	(1.427)	(3.102)	(0.037)		(0.162)					(2.041)			(4,33)
4	-4.5135	0.3708 **	-0.3717			0.3419	0.7858 *	-0.0613		0.2384	38	0.29	3.56
	(1.478)	(3.617)	(0.586)			(0.754)	(2.149)	(0.536)		(1.889)			(6,31)
5	-5.1646	0.3920 **	-0.1443			0.3776	0.7795 *		-0.2754	0.2562	38	0.30	3.66
	(2.016)	(3.838)	(0.230)			(0.830)	(2.145)		(0.805)	(2.037)			(6,31)

Notes: Coefficients with * significant at 5 percent level.
** significant at 1 percent level.
t statistics shown in parentheses below coefficient.

1/ Sample of countries:

Argentina	Egypt	Liberia	Trinidad and Tobago
Bolivia	El Salvador	Mauritius	Tunisia
Botswana	Greece	Mexico	Uruguay
Brazil	India	Pakistan	Venezuela
Burma	Indonesia	Panama	Yemen Arab Republic
Cameroon	Iran, I.R. of	Singapore	Zaire
Chile	Israel	Sri Lanka	Zambia
Colombia	Kenya	Syrian Arab Republic	Zimbabwe
Costa Rica	Korea	Tanzania	
Dominican Republic	Kuwait	Thailand	

community, and social services (i.e., GFS categories 3, 4, 5, 6, 7) as a proportion of GDP was used as an explanatory variable (Table 3, equation (4)). However, the coefficient was statistically insignificant and displayed a negative sign. Much the same result was obtained when current spending on education alone was an independent variable (Table 3, equation (5)).

4. Composition of capital expenditure

As previously noted, while the growth accounting framework does not rule out favorable influences on economic growth emanating from government current spending, this approach tends to emphasize the importance of capital expenditure for economic growth. Certainly, at the aggregate level, it does appear that countries with higher relative government capital expenditures (as a share of GDP) have higher growth rates on average than other countries after allowance is made for the influence of private capital formation and the increase in the labor force. 1/ However, as with the current expenditures, the discussion of the various ways that capital expenditures may influence the growth rate also suggests that the rather poor explanatory power of aggregate expenditure may result from the different influences of its components.

On the question of the importance of the composition of capital spending, again the evidence from this admittedly limited sample of countries would lead to a qualified affirmative response. As shown in Table 4, a country's relative capital expenditure on infrastructure (GFS categories 8.4-8.7) was positively related to its growth rate and highly significant at the 1 percent level, while capital expenditure for directly productive purposes (GFS categories 8.2, 8.3, 8.8) showed a negative relationship, although the coefficient was not significant (Table 4, equations (1) and (2)). In contrast to current expenditures, capital expenditures both for social purposes (GFS categories 3, 4, 5, 6, 7) and for education alone (GFS category 3) were positively related to the growth rate and significant at the 1 percent level (Table 4, equations (3) and (4)).

When all categories of capital expenditure were included in the basic model, due to collinearity between them, the significance of each type of capital expenditure was reduced, but the same relative contribution to the growth rate was maintained, even when the impact of current spending was allowed for (Table 4, equations (8) and (9)). From these results one would conclude that government capital spending in

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1/ A result in line with Tanzi's conclusion that "While few would deny there is a connection between investment and growth, especially over the longer run, there is circumstantial evidence that high-growth countries generally have a high investment rate, in practice the connection between investment and growth is tenuous at best" (Tanzi (1988), p. 34). See also the reviews of empirical literature in Solow (1988) and Hernandez-Cata (1988).

Table 4. The Growth of Real GDP and Government Capital Expenditure

(Dependent Variable = Real Growth Rate of GDP)

Equation Number	Constant	Independent Variables: Private investment	Increase in labor force	Capital expenditure infra-structure ratio GDP	Capital expenditure directly productive ratio GDP	Capital expenditure social sector ratio GDP	Capital expenditure education ratio GDP	Current expenditure ratio GDP	N 1/	$\bar{R}^2$	F
				A. Dependent Variable: Aggregate Real Growth Rate							
1	-4.0413	0.3586 **	-0.0473	0.6685 *					38	0.22	4.46
	(1.546)	(3.391)	(0.078)	(2.071)							(3,34)
2	-3.2604	0.3077 **	0.2937		0.3369				38	0.13	2.84
	(1.183)	(2.818)	(0.480)		(0.586)						(3,34)
3	-2.5978	0.2480 **	-0.2750			1.5970 **			38	0.31	6.51
	(1.077)	(2.4963)	(0.4761)			(3.041)					(3,34)
4	-3.325	0.2418 *	0.2647				3.3548 **		38	0.30	6.27
	(1.369)	(2.403)	(0.484)				(2.946)				(3,34)
5	-2.3218	0.2667 *	-0.4162	0.2567	-0.7110	1.7740 *			38	0.31	4.30
	(0.898)	(2.508)	(0.709)	(0.732)	(1.1599)	(2.521)					(5,32)
6	-3.0313	0.2539 *	0.2086	0.2153	-0.7646		3.8969 *		38	0.30	4.16
	(1.192)	(2.3195)	(0.358)	(0.592)	(1.205)		(2.418)				(5,32)
7	-1.2569	0.2489 *	-0.4625	0.2132	-0.7828	1.9517 *		-0.3154	38	0.29	3.56
	(0.392)	(2.224)	(0.772)	(0.588)	(1.238)	(2.514)		(0.572)			(6,31)
8	-2.5487	0.2454 *	0.2142	0.1959	-0.7949		4.0535 *		38	0.28	3.38
	(0.831)	(2.137)	(0.362)	(0.522)	(1.218)		(2.354)				(6,31)
				B. Dependent Variable: Growth Rate of Agricultural Sector							
9	1.1111	0.0973	-0.0596	0.3917	-0.5421		-2.6883	0.0213	36 2/	0.07	1.45
	(0.410)	(1.018)	(0.097)	(1.198)	(0.974)		(1.768)	(0.339)			(6,29)
				C. Dependent Variable: Growth Rate of Manufacturing Sector							
10	-0.4217	0.1791	1.766	-0.7821	-0.2142		9.5239 **	-0.2221	36	0.28	3.32
	(0.082)	(0.987)	(1.520)	(1.261)	(2.028)		(3.302)	(1.863)			(6,29)
				D. Dependent Variable: Growth Rate of Services Sector							
11	-0.8883	0.2375 *	0.3276	0.0197	-1.5459 *		4.5148 **	-0.6632	36	0.38	4.51
	(0.323)	(2.445)	(0.526)	(0.059)	(2.732)		(2.921)	(1.038)			(6,29)

Notes: Coefficients with * significant at 5 percent level.
** significant at 1 percent level.
t statistics shown in parentheses below coefficient.

1/ Sample of countries:

Argentina	Egypt	Liberia	Trinidad and Tobago
Bolivia	El Salvador	Mauritius	Tunisia
Botswana	Greece	Mexico	Uruguay
Brazil	India	Pakistan	Venezuela
Burma	Indonesia	Panama	Yemen Arab Republic
Cameroon	Iran, I.R. of	Singapore	Zaire
Chile	Israel	Sri Lanka	Zambia
Colombia	Kenya	Syrian Arab Republic	Zimbabwe
Costa Rica	Korea	Tanzania	
Dominican Republic	Kuwait	Thailand	

2/ Because data are not available for the Islamic Republic of Iran and Israel, these countries are excluded.

directly productive sectors such as agriculture, mining, and manufacturing has tended to slow down the growth rate, while capital spending on infrastructure and the social sector generally has tended to raise the growth rate. In particular, capital expenditure on education seems to offer the most significant explanation for differences in the growth performance of this sample of developing countries.

5. Capital expenditure and sectoral growth rates

Given that aggregate growth rates often hide diverse sectoral growth rates when developing economies are undergoing structural change, this suggests the relationship between sector growth rates and the sectoral composition of capital expenditures should also be investigated. Using World Bank data for the period 1980-85, the average real aggregate growth rate of each country was decomposed into the growth rates of three broad component sectors: agriculture, manufacturing, and services. Table 4, equation (8), including all components of capital spending and total current expenditures, was then repeated for each sectoral average growth rate as the dependent variable. The results are shown in Table 4, equations (9)-(11).

The explanatory power of the regression model varies markedly between sectors. Capital spending has had the least impact on the agricultural sector (where one might expect other factors such as climate to be more important) and the most impact on the services sector, where the government's own services typically dominate. Moreover, the great variation between different sectors in the sign and the size of the regression coefficients also reflects great disparity between those coefficients obtained using the aggregate growth rate as the dependent variable. Inconclusive as these results are, they do seem to indicate the importance of disaggregation and suggest that different categories of capital spending do have different impacts on different sectors. At the same time, it is notable that when coefficients are statistically significant, capital expenditures on directly productive purposes and infrastructure always display a negative relationship with growth, while capital expenditure on education is always positively related.

V. Other Determinants of Growth Performance

The previous two sections have separately presented empirical evidence on the relative importance of different types of capital and current expenditures for economic growth. When combining expenditure variables with the most explanatory power, the best fitting model explaining cross-country differences in economic growth is Table 5, equation (1). This shows positive significant influences on the growth rates from current expenditure in directly productive sectors, capital expenditure in education, and nongovernment capital formation. The growth in the labor force has a positive but nonsignificant relationship with the growth rate, and, more surprisingly, capital expenditure on

Table 5. The Growth Rate of Real GDP and Selected Variables

(Dependent Variable = Real Growth Rate of GDP)

Equation Number	Constant	Independent Variables: Private investment	Increase in labor force	Current expenditure directly productive ratio GDP	Capital expenditure infra-structure ratio GDP	Capital expenditure education ratio GDP	Growth of exports	Exports ratio GDP	External interest rate	N	$\bar{R}^2$	F
1	-4.2724	0.2711 *	0.1885	0.6519 *	-0.2118	3.4788 *				38	0.38	5.51
	(1.817)	(2.653)	(0.345)	(2.393)	(0.537)	(2.680)						(5,32)
2	-2.5169	0.2150 *	-0.1123	0.7039 *	0.1665	3.5449	0.0537 *			33	0.43	4.95
	(1.119)	(2.071)	(0.211)	(2.743)	(0.414)	(0.197)	(2.637)					(6,26)
3	-6.1748	0.4406 **	0.5690	0.4823	-0.0863	3.5119 *		-0.0602		37	0.47	6.32
	(2.391)	(3.404)	(1.032)	(1.847)	(0.232)	(2.898)		(1.799)				(6,30)
4	-4.4727	0.2714 *	0.4029	0.5500	-0.1439	3.2452 *			-0.0322	35	0.32	3.62
	(1.543)	(2.327)	(0.555)	(1.657)	(0.328)	(2.348)			(0.141)			(6,28)

Notes: Coefficients with * significant at 5 percent level.
** significant at 1 percent level.
t statistics shown in parentheses below coefficient.

infrastructure displays a negative though nonsignificant relationship. The latter result contrasts with the significant positive relationship shown by this variable when used alone in the basic model. This is indicative of the collinearity existing between the infrastructure and the education capital expenditure variables, with the latter capturing the influence of both variables.

Although comparable with other cross-country analyses, 1/ the overall goodness of fit of this model is low, with an adjusted $\bar{R}^2$ of 0.38. This raises the question of whether other explanatory variables could substantially improve our explanation of the relative growth performance of this sample of developing countries. Other empirical studies in this area suggest possible ways in which Denison's methodology could be extended to include other influences on growth performance.

For example, it seems evident that the growth accounting methodology, based on a production function approach, assumes a country operates close to the production possibility frontier. As a consequence, this analytic framework includes a parameter to capture the impact on growth arising from the more efficient uses of resources (λ, in equation (1)). Developing economies, where rigidities and inefficiency seem more prevalent or at least more identifiable, inevitably find it difficult to attain their production possibility frontier. Even in advanced countries various studies have employed an indicator of capacity utilization to control for the influence of the business cycle, and have pointed to declining capacity use as an important explanation of the productivity slowdown of the 1970s and 1980s (Tatom (1980); Aschauer (1988)).

For developing countries, usually with highly dependent economies, capacity utilization is ultimately dependent on overseas markets for goods and on adequate external capital inflows. Recently, Feder (1983), as well as Otani and Villaneuva (1988), has successfully explained the relative growth performance in developing countries using variables such as the growth in exports and the cost of external borrowing. At the same time, external conditions may have an influence through their impact on technological change (parameter a, equation (1)). While the economics of technological progress is a new and relatively undeveloped area of economic theory, it has been argued that technological advances in developing countries are typically imported. That is, in developing countries, technological advances do not arise from original research, but rather from the assimilation and adaptation of already existing technologies derived principally from the more developed countries. It may be possible to capture the degree of this potential contact by an indicator of the economy's outward orientation (see Landau (1983)).

1/ For example, Ramanathan (1982) in cross-country regressions estimating growth performance in developing countries typically reports values of the R^2 in the range of 0.3-0.4.

With these considerations in mind, the following variables were introduced in the regression model: the growth rate of exports, the export to GDP ratio, and the cost of external borrowing in real terms. As shown in Table 5, only the growth rate in exports was significant at the 5 percent level; it also improved the overall fit of the model, confirming Otani and Villaneuva's findings on the importance of this variable and the direct impact on growth of an export-led growth strategy. The introduction of the export to GDP ratio, an indicator of the openness of the economy, considerably improved the overall fit of the model. However, the variable itself was statistically insignificant and had the wrong sign. Similarly, the average external interest rate on public borrowing, an indicator of the cost of external funds, was not statistically significant, although it did display the correct sign.

VI. Concluding Remarks

Obviously, considerable caution should be exercised in interpreting these statistical results, given the extent to which data limitations inevitably constrain our empirical tests. The Denison growth accounting framework is based on a dynamic relationship, which data limitations have forced us to examine in comparative terms. As a result, the legitimacy of moving from intertemporal changes to differences in levels can be questioned. Moreover, if available time series data had been of a sufficient length, it would have been preferable to test this model for individual countries. Thus the empirical question should be framed in dynamic terms: whether increases in government spending tend to slow down or accelerate growth in the economy. However, due to data problems we were forced to pose the empirical question in terms of levels: have countries with higher relative government expenditures had higher growth rates on average after allowance is made for other causal factors, such as private capital formation and the accumulation of human capital?

Unfortunately, there is also the suspicion that any interpretation of the empirical results may be further constrained insofar as we have only been able to include imperfect indicators of the latter causal factors. Further, the basic dynamic relationship presupposes some lag structure in the causal relationship, which is also difficult to capture in a cross-country approach. The lack of empirical relationship may also reflect the limitations of the theoretical framework used to explain economic growth. If the empirical results are difficult to understand, this may merely reflect theoretical shortcomings of the model on which they are based. As indicated previously, there are many ways that capital expenditure could influence growth apart from the direct one described by the Denison framework. 1/

However, notwithstanding these qualifications, our results would lead us to some tentative conclusions. First, for the admittedly limited sample of countries examined, at the aggregate level public

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1/ For a review of different approaches, see Anderson (1987).

spending does not appear to have exerted a major influence on the real growth of the economy. Second, although this also appears to be true for aggregate current expenditure, it does not seem to be true of capital expenditure in aggregate. Third, further explanation shows these conclusions may be misleading without examining the structure of expenditures. When this is done, it may be the case that while social capital expenditure on health, housing, and welfare may have a significant impact on growth in the short term, capital infrastructure expenditure may have little influence on real growth, and directly productive capital expenditure may even exert a negative influence. At the same time, current expenditure in directly productive sectors appears to exert a significant positive influence on growth. Lastly, experiments with other explanatory variables confirm the importance of the growth of exports to the overall growth rate, although this does not appear related to the degree of openness of the economy.

Relation Between Government Share of GDP and Growth Rate of National Income (Time Series)

As an extra check on the stability of the results, time series data for the period 1960-80 were used to test the same basic relationship for each country in the sample. Experience has varied between countries. For advanced countries, the relationship is often highly significant and consistently negative, with the notable exception of France and Japan. 1/ For the developing countries, as might be expected given a large heterogeneous sample, the experience is more mixed. Although for the majority of countries the relationship is negative, for many countries the relationship is not statistically significant. There are, however, a few exceptions where the relationship is highly significant and positive (e.g., Burundi, Indonesia, Madagascar, Pakistan, Swaziland, and Uruguay).

These time series results suggest further work may be required to refine the specification of this relationship, especially by making allowance for time lags, and perhaps disaggregating total government expenditure by function and economic type. Obviously, and perhaps more important, with time series data we are faced with a potential simultaneity problem that arises because as an explanatory variable the proportion of government consumption expenditure in GDP may both influence the growth rate and be influenced by it. 2/

1/ For similar negative results for a sample of 16 advanced countries, but using the growth rate of per capita GDP as the dependent variable, see Landau (1985).

2/ Although this line of inquiry is not pursued here, a discussion of this causality problem and some preliminary results are contained in Diamond and Tait (1988), Appendix II.

APPENDIX

Advanced Countries

Positively related		Negatively related	
Significant	Nonsignificant	Significant	Nonsignificant
France	Netherlands	Australia	Austria
Japan	Turkey	Belgium	Canada
		Denmark	Iceland
		Finland	Italy
		Germany	Luxembourg
		Greece	New Zealand
		Ireland	Norway
		Malta	Portugal
		South Africa	Spain
		Sweden	United States
		Switzerland	
		United Kingdom	

APPENDIX

Developing Countries

Positively related		No relationship	Negatively related	
Significant	Nonsignificant		Significant	Nonsignificant
Burundi	Benin	Bangladesh	Angola	Afghanistan
Indonesia	Burkina Faso	Barbados	Brazil	Algeria
Madagascar	Cameroon	Colombia	Chile	Argentina
Pakistan	Côte d'Ivoire	Costa Rica	El Salvador	Bolivia
Singapore	Mali	Dominican Republic	Gabon	Botswana
Swaziland	Mauritius	Honduras	Ghana	Burma
Trinidad and Tobago	Nigeria	India	Israel	Central African Republic
Uruguay	Rwanda	Iraq	Iran, I.R. of	Chad
	Senegal	Nepal	Jamaica	Congo
	Zaire	Papua New Guinea	Liberia	Cyprus
		Philippines	Panama	Ecuador
		Suriname	Paraguay	Egypt
		Syrian Arab Republic	Peru	Ethiopia
		Venezuela		Fiji
				Gambia
				Guatemala
				Guinea
				Guyana
				Haiti
				Jordan
				Kenya
				Korea
				Lesotho
				Malawi
				Malaysia
				Mauritania
				Mexico
				Morocco
				Mozambique
				Nicaragua
				Niger
				Sierra Leone
				Sri Lanka
				Sudan
				Tanzania
				Thailand
				Togo
				Tunisia
				Uganda
				Zambia
				Zimbabwe

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