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PUBLIC EXPENDITURE AND ECONOMIC GROWTH: A DISAGGREGATED ANALYSIS FOR DEVELOPING COUNTRIES*

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In this paper, we examine the growth effects of government expenditure for a panel of 30 developing countries over the 1970s and 1980s, with a particular focus on disaggregated government expenditures. Our methodology improves on previous research on this topic by explicitly recognizing the role of the government budget constraint and the possible biases arising from omitted variables. Our primary results are twofold. First, the share of government capital expenditure in GDP is positively and significantly correlated with economic growth, but current expenditure is insignificant. Second, at the disaggregated level, government investment in education and total expenditures in education are the only outlays that are significantly associated with growth once the budget constraint and omitted variables are taken into consideration.

1 Introduction

The recent revival of interest in growth theory has also revived interest among researchers in verifying and understanding the linkages between fiscal policies and economic growth. Over the past decade and a half, a substantial volume of empirical research has been directed towards identifying the elements of public expenditure (at its aggregate and disaggregate levels) that bear significant association with economic growth. This empirical literature varies in terms of data sets and econometric techniques, and often produces conflicting results.[1] Explanations offered to account for these varied and conflicting results can broadly be divided into two categories. According to the first, it is

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[1]Consider, for example, the association between government size (as measured either by the level of total public expenditure or by the level of public consumption expenditure) and economic growth. According to some studies, such association is significant and positive (Ram, 1986; Romer, 1989, 1990). The same association has been found to be significant and

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the differences in the set of conditioning variables across studies that are responsible for the lack of consensus in the results (Levine and Renelt, 1992). In contrast, the second category consists of a handful of studies (Helms, 1985; Mofidi and Stone, 1990; Kneller *et al.*, 1999) that suggest this variation in the results, in part at least, reflects the widespread tendency among researchers to ignore the implications of the government budget constraint for their regressions. In particular, the latter view emphasizes the need to consider both the sources and the uses of funds simultaneously for a meaningful evaluation of the effects of taxes or expenditures on economic growth.

In addition to producing conflicting views, the existing literature displays a disturbing trend. Most of the conclusions drawn regarding the growth effects of public spending are based either on the experiences of a set of developed countries or on the basis of large samples consisting of a mixture of developed and developing countries. Accordingly, there remains little by way of understanding the process by which public expenditure policies shape the growth prospect for developing countries.[2] This trend has continued despite the long-standing view among development experts not only that there exists a significant difference in the composition of public expenditure between developed and developing countries, but also that the difference is profound in the way in which public expenditures shape the outcome in these two sets of countries.[3]

The primary objective of this paper is to examine the growth effects of public expenditure by sector for a set of developing countries, paying attention to the 'sensitivity' issue arising from initial conditions and conditioning variables while also recognizing the possible existence of correlation between the expenditures in different sectors that may result in spurious coefficients in the growth equation due to omitted variables. Here, we are not interested in the financing of any particular public expenditure *per se*, but we include the important financing variables (government budget surplus/deficit and tax revenue) to avoid the coefficient biases that would result from their omission (Kneller *et al.*, 1999). Further, where government expenditure components are found to be individually significant, we include them jointly to investigate whether their apparent individual roles are genuine, or spurious in the sense of being attributable to other components with which they are correlated. In other words, from an econometric perspective, we again control for possible

negative in other studies (e.g. Landau, 1983, 1985, 1986; Grier and Tullock, 1989; Alexander, 1990; Barro, 1990, 1991). Yet other studies have found this association to be insignificant or fragile (e.g. Kormendi and Meguire, 1985; Levine and Renelt, 1992). A similar variation in results can also be observed among studies which look for the growth effects of public expenditures at disaggregated levels.

[2]Notable exceptions include the contributions by Landau (1986), Devarajan *et al.* (1996) and Miller and Russek (1997).

[3]For example, empirical evidence suggests that low- and high-income countries differ significantly in terms of effective use of infrastructure resources and this efficiency effect may account for nearly 40 per cent of the growth differential between these two sets of countries (Hulten, 1996). Also, please refer to the World Bank Report (1988) for further details.

omitted variable bias that will result should any component of government expenditure that is important for growth be excluded from the model. Thus, on one hand, by focusing our attention exclusively on developing countries and, on the other, by recognizing the full implication of the government budget constraint and the potential collinearity between the expenditure components, we aim to make a distinct and meaningful contribution to the literature.[4]

Our disaggregated analysis is also valuable from the policy perspective. Our results for the growth effects of public expenditures by individual sectors of the economy give rise to information that is particularly useful for developing countries, which are resource constrained and where the allocation of limited public resources between sectors is an issue of paramount importance. In this regard, our main contribution is the finding that education is the key sector to which public expenditure should be directed in order to promote economic growth. This result is novel and overturns previous findings of negative or insignificant positive effects of education expenditure on growth for developing countries (Landau, 1986; Devarajan *et al.*, 1996; Miller and Russek, 1997). However, as argued above, our analysis is more satisfactory from an econometric perspective than earlier studies.

Our two principal empirical findings can be summarized as follows.

1. The share of government capital expenditure in GDP is positively and significantly correlated with economic growth, while the growth effect of current expenditure is insignificant for our group of countries.
2. At the disaggregated level, government investment in education and total expenditures in education are the only outlays that remain significantly associated with growth throughout the analysis.

Other findings of our analysis are the following.

3. Although public investments and expenditures in other sectors (transport and communication, defence) initially have significant associations with growth, these do not survive when we incorporate the government budget constraint and other expenditure components into the analysis. This is in contrast to the prevailing view (e.g. Easterly and Rebelo, 1993) that the correlation between transport and communication expenditure and growth is one of the most robust findings.
4. The private investment share of GDP is associated with economic growth in a significant and positive manner.
5. There is strong evidence that a government budget deficit gives rise to adverse growth effects.

[4]The primary objective of our study overlaps with those by Landau (1986) and Devarajan *et al.* (1996). These studies, however, only focus on the expenditure side of the budget constraint and ignore the revenue side. The study by Miller and Russek (1997) pays relatively more attention to the government budget constraint. In contrast to ours, the focus of their study has been to investigate how the growth effect of a public expenditure varies with the mode of financing such expenditure.

The remainder of the paper is organized as follows. Section 2 discusses our data and its sources. Section 3 presents a baseline analysis of the impact of government expenditure categories on growth, which is extended in Section 4 to examine the implications of omitted variable bias and the government budget constraint. Section 5 concludes.

2 Data and Variables

We use data on public expenditures for both current and capital expenditures,[5] at aggregated and disaggregated levels, for 30 developing countries[6] using decade averages over the period 1970–90. Our data are drawn from the Central Government Consolidated accounts for these countries.

Although the *Government Financial Statistics*, published annually by the International Monetary Fund (IMF), is a primary source for data on government expenditures at aggregate level, it is not appropriate for our study. This is because, although *Government Financial Statistics* publishes data for total expenditures by sector and aggregate capital and current expenditures, it does not provide any data for sectoral current and capital expenditures. Consequently, the usefulness of this data source is limited for our analysis as, in addition to the aggregate capital and current expenditures, we wish to study the effects of capital and current expenditures by sector (e.g. defence, education, health, agriculture, transport and communication, and manufacturing).

To overcome this problem, we constructed a data set after consulting a large collection of World Bank *Country Economic Reports* and *Public Expenditure Reviews*.[7] From these, information about the central government's total, current and capital expenditures by sector was extracted over 1970–90 for 30 developing countries, and hence these countries constitute our sample. Although we aimed at collecting the data for as many countries and as many years as possible, we were constrained by unavailability of the relevant documents in the World Bank Archives for many countries after 1990. Further, due to the number of missing observations for the government expenditures

[5]We have followed the *Government Financial Statistics Yearbook* (published by IMF, 1986) guidelines for classifying expenditures into current and capital expenditures.

[6]The countries are listed in the Appendix. According to the World Bank classification, the sample has 17 low-income countries, nine lower middle-income countries and three upper middle-income countries. Only the Bahamas falls slightly above middle-income countries.

[7]In an earlier exercise, Easterly and Rebelo (1993) collected data on public investment by sectors. We differ from this existing data set on two grounds. First, our data set includes information on both public investment expenditures and current expenditures by sector. Second, the measure of public investment used by Easterly and Rebelo also includes investment by public enterprises. In contrast, we strictly follow the *Government Financial Statistics* guidelines and exclude public enterprise investments. We acknowledge that this narrower definition may give rise to some bias in the results. At the same time (as acknowledged by the authors themselves) the measure used by Easterly and Rebelo (1993) creates a tendency to overstate public investment by including investments by public firms that have activities and goals similar to those of the private sector.

data, it is impractical to conduct an analysis at the annual frequency and hence our analysis is conducted using decade averages.

Data for other variables have been drawn from two different data sources. Initial GDP per capita, population, initial human capital, life expectancy, political instability, private investment, initial trade ratio, black market premium and the terms of trade have been extracted from the Barro and Lee (1994) data set. Growth of GDP per capita, agriculture's share in GDP and broad money (M2) have been extracted from the World Development Indicators of the World Bank.

Unless we state otherwise, a data point for a variable corresponds to the decade average value (1970–79, 1980–89) of that variable. The details of the variables and their data sources are included in the Appendix.

3 Baseline Results

To start with, we classify the variables into three distinct sets: **I**, **M** and **Z**. The set **I** consists of variables that commonly appear as conditioning variables in growth regressions. The set **Z** includes variables that often have been included in previous studies as indicators for monetary policies, trade policies and market distortion. Finally, the set **M** consists of variables that are of particular interest for the present study, namely central government expenditures and their major components at aggregate and sectoral levels. These variables are expressed as percentages of GDP. In total, we consider 20 such variables, as detailed in the Appendix. To make our tables digestible, however, we do not report results for variables with no significant association with growth at the most elementary stage of our analysis, i.e. in the base regression (1) below.

Operationally, we use a panel set-up in which the dependent variable (growth rate in real GDP per capita, GR_{it}) is observed twice (as decade averages) for each country for 1970–79 and 1980–89. The system includes a separate constant term, β_{0t}, for each decade. The other coefficients are constrained to be the same for both time periods. Panel estimation is carried out by the seemingly unrelated regression method, with two equations for each country (one equation for each decade). Thus, the disturbance term, u_{it}, for country i at time t, is allowed to be correlated with term $u_{it'}$ for the same country at the different date, t'. The variance of u_{it} varies with t but not with i. In practice, the estimated correlations of the error terms across the time periods turn out to be small and insignificant (see Tables 1–3).

3.1 Base Regressions

Initially, we examine whether the variables of interest (i.e. the elements of the set **M**) are significantly correlated with growth after controlling for the **I** variables. For this, we run a series of base regressions each of which includes all conditioning (**I**) variables and one government expenditure (**M**) variable:

$$GR_{it} = \beta_{0t} + \sum_{j=1}^{6} \beta_j^I I_{j,it} + \beta^M M_{it} + u_{it} \quad (1)$$

Following Levine and Renelt (1992), Barro (1991) and Barro and Sala-i-Martin (1995, 1999), we include log of initial GDP per capita, initial school enrolment ratio,[8] private investment share of GDP, log of life expectancy and an index of political stability in the set **I**.[9] It has been emphasized by a number of studies (e.g. Cashin, 1995; Kocherlakota and Yi, 1997) that, while the provision of public goods is growth-enhancing, the distortionary taxes that need to be raised to fund the provision of the same public goods may have growth-diminishing effects. Accordingly, it is necessary to control for tax revenue in order to make a proper assessment about the growth effects of public spending. Keeping this view and the primary objective of this paper in mind, we have also included tax revenue as a percentage of GDP in the set **I**. Accordingly, the set **I** of the base regression (1) embodies a central idea of the new growth literature, namely that human capital and institutional factors are important determinants of economic growth. In addition, through inclusion of initial GDP, the above model also controls for possible effects of convergence on output growth.

Table 1 summarizes the results from the base regression (1). Out of the 20 categories of public expenditure examined, we report the results only for the six categories (total investment, investment in education, investment in transport and communication, total expenditure on education, total expenditure on transport and communication, and total expenditure on defence) that we find to display a significant association with growth, using a 10 per cent significance level.

We open the discussion with our results for the **I** variables. Among this set, only private investment demonstrates a significant association with growth. This is in congruence with the basic prediction of neoclassical growth theory, and is supported by a number of previous empirical studies (e.g. DeLong and Summers, 1991; Levine and Renelt, 1992; Mankiw *et al.*, 1992). Some other results, however, are less in tune with the theoretical predictions. For example, our analysis shows no sign of convergence among this group of countries. We suspect this may be due to the fact that our sample includes a number of poor countries (such as Sub-Saharan countries), which experienced dismal growth performances (often negative growth rates) over a

[8]We also considered average schooling years as a proxy for the human capital stock. However, we dropped this variable from our analysis due to the absence of data for a quarter of the countries in our sample.

[9]Levine and Renelt (1992) also include average annual population growth rate in the set **I**, but we dropped it from the analysis since it was always insignificant, perhaps due to the lack of variability in its values. We did, however, verify that all our results remain unaltered when this variable is included in the analysis.

TABLE 1
GROWTH REGRESSIONS WITH CENTRAL GOVERNMENT EXPENDITURES

	Capital expenditure	*Education investment*	*Transport and communication investment*	*Education expenditure*	*Transport and communication expenditure*	*Defence expenditure*
Government expenditure	0.171***	1.516***	0.389*	0.681***	0.394**	0.257*
	(0.056)	(0.431)	(0.206)	(0.239)	(0.191)	(0.135)
I variables						
Tax revenue	–0.030	0.041	–0.020	–0.096	–0.044	–0.003
	(0.055)	(0.052)	(0.062)	(0.068)	(0.067)	(0.064)
Private investment	0.265***	0.242***	0.246***	0.283***	0.249***	0.294***
	(0.053)	(0.053)	(0.059)	(0.055)	(0.058)	(0.058)
Initial GDP per capita	0.005	0.004	0.003	0.005	0.003	0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Initial human capital	–0.012*	–0.011*	–0.014**	–0.009	–0.016**	–0.013*
	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Initial life expectancy	0.076	0.050	0.116	0.015	0.136	0.093
	(0.070)	(0.068)	(0.078)	(0.075)	(0.079)	(0.070)
Political instability	–0.007	–0.006	–0.014	–0.004	–0.016	–0.025
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.019)
R^2	0.50	0.51	0.44	0.51	0.46	0.56
	0.52	0.57	0.53	0.56	0.55	0.64
Observations	30	29	29	28	28	25
	30	29	29	28	28	25
Regression test (p value)	61.602	67.891	46.465	56.926	46.465	65.499
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(1) coefficient (p value)	0.018	0.002	0.176	0.139	0.162	0.164
	(0.922)	(0.993)	(0.342)	(0.462)	(0.392)	(0.413)

Notes: The column heading shows the specific government expenditure category (M_{it}) used in the regression. Estimation is by the seemingly unrelated regression technique, which allows the error term to be correlated across the two decades and to have a different variance in each period. The dependent variable is growth rate in real GDP per capita. Standard errors of coefficients are shown in parentheses. The first R^2 is for the 1970s and the second R^2 reported is for the 1980s. Similarly the first number of observations is for the 1970s and the second number of observations reported is for the 1980s. The number of observations differs across models due to the lack of availability of some explanatory variables for specific countries. The serial correlation coefficient is the AR(1) value in a regression of residuals for 1970s and those for 1980s, with the p value being that for the Breusch–Pagan test, where the null hypothesis is that the residuals of the equations for two decades are uncorrelated. The regression test is a Wald χ^2 test with the null hypothesis that the coefficients are zero. For the coefficients, *indicates significant at 10 per cent, **significant at 5 per cent and ***significant at 1 per cent.

prolonged period of time.[10] Surprisingly, initial human capital is found to have a negative effect on growth, with this sometimes being significant.[11] In terms of direction, the relationships between growth and the remaining two conditioning variables accord well with theoretical predictions, but neither of these associations is significant for this group of countries.

As already noted, our preliminary analysis indicates that the GDP shares of only six out of 20 categories of public spending individually display an association with economic growth. Table 1 shows the levels of significance across these to be varied.[12] The most significant associations are obtained for total capital expenditure, for total expenditure in the education sector and for investment expenditure in the education sector. The significant association between the share of central government capital expenditure in GDP and economic growth is not entirely surprising in the light of the conclusions drawn by previous studies (e.g. Easterly and Rebelo, 1993; Cashin, 1995; de la Fuente, 1997) that are based on either developed countries or a large pool of developed and developing countries. However, to our knowledge, Landau (1986) is the only panel study that included total capital expenditure in the regression for developing countries, but found its association with growth to be insignificant. Thus, our result here contains new information.

Our result on total education expenditure differs from conclusions drawn by previous studies, irrespective of whether these are based on data for a large pool of countries (e.g. Barro and Sala-i-Martin, 1995, 1999) or developing countries (e.g. Landau, 1986; Devarajan *et al.*, 1996). These earlier results indicate that the association of this variable with growth is either insignificant or non-robust.

Our result regarding the association between investment expenditure in the education sector and economic growth also merits some comment. Due to the lack of readily available data, the analysis of the impact of this variable on growth is almost non-existent in the literature. To our knowledge, the only exception is Easterly and Rebelo (1993), who study a large pool of developed and developing countries. Not only do we find investment in education to be highly significant, but the magnitude of the effect of this variable on growth is considerable: a 1 percentage point increase in central government investment in education in relation to GDP is associated with an increase in the average annual growth rate of real GDP per capita by 1.5 percentage points. Although not significant in their case, Easterly and Rebelo (1993) find simi-

[10]In the growth literature (e.g. Azariadis and Drazen, 1990) often these countries have been referred to as the countries in a 'development trap'.

[11]This result draws support from a number of recent cross-country studies that found economic growth to be uncorrelated with increases in educational attainment (see, for example, Benhabib and Spiegel, 1994; Gemmell, 1996; Temple, 1999a, 1999b; Pritchett, 2001).

[12]The fact that all six expenditure variables reported in Table 1 appear significant is somewhat striking. This is not always the case in previous studies and such difference in result is indicative of the real value to the data that we have collected over the commonly used IMF sources.

larly large effects for investment in education. The explanation for this effect may lie in the strong externalities of investment in education in raising the productivity of both human and physical capital. Theoretical justification of this view is readily available in the new growth literature.

Results for the other three expenditure variables draw mixed support from the existing literature. For example, the positive and significant association between total expenditure in the transport and communication sector and growth finds support in the study by Aschauer (1989). Support for the positive association between investment expenditure in the transport and communication sector and growth can be obtained in the study by Easterly and Rebelo (1993). We, however, find this association to be significant only at the 10 per cent level. Finally, our preliminary analysis suggests a positive and significant (at the 10 per cent level) association between defence spending and growth. In the existing literature, this association has sometimes been reported as positive and significant (Benoit, 1978; Fredriksen and Looney, 1982). At the same time, other studies have found it to be negative (Deger and Smith, 1983; Knight *et al.*, 1996), while in yet other studies the growth effect of defence expenditure has been found to be neutral (Biswas and Ram, 1986).

3.2 Robustness Checks

The robustness of the results from the base regression (1) to the inclusion of **Z** variables is now examined, focusing only on the **M** variables that are associated with growth in a significant manner and included in Table 1. This analysis is conducted in two stages. First, following Easterly and Rebelo (1993), we expand the set of regressors to include the ratio of broad money (M2) to GDP in 1970 and the trade share[13] of GDP in 1970 (TR):

$$\mathrm{GR}_{it} = \beta_{0t} + \sum_{j=1}^{6} \beta_j^I I_{j,it} + \beta^M M_{it} + \beta_1^Z \mathrm{M2}_{it} + \beta_2^Z \mathrm{TR}_{it} + u_{it} \tag{2}$$

The purpose of including these variables is to control for the effects of monetary policy and the degree of openness which, according to previous studies (e.g. Levine and Renelt, 1992; King and Levine, 1993), are potentially important correlates of economic growth. Next, we expand the set of regressors to include other variables:

$$\mathrm{GR}_{it} = \beta_{0t} + \sum_{j=1}^{6} \beta_j^I I_{j,it} + \beta^M M_{it} + \beta_1^Z \mathrm{M2}_{it} + \beta_2^Z \mathrm{TR}_{it} + \beta_3^Z \mathrm{BMP}_{it} + \beta_4^Z \mathrm{TT}_{it} + u_{it} \tag{3}$$

More specifically, we include the black market premium (BMP) and the growth rate of the terms of trade (TT) in (3). These control for market distortions and capture the adverse effect of external shocks that a number of

[13]Rodrik (1998) has also argued in favour of including the trade share when estimating the relationship between fiscal variables and growth.

countries in our sample experienced during the period of our analysis. These two variables have also appeared as significant correlates of growth in previous studies (e.g. Fischer, 1993; Devarajan *et al.*, 1996; Barro and Sala-i-Martin, 1999). The results are reported in Table 2.

In the spirit of Levine and Renelt (1992), we certify that the variable under consideration has a robust association with economic growth if the coefficient of the **M** variable remains significant and of the same sign as in Table 1 after inclusion of these additional variables. As our results indicate, none of the six expenditure variables fails the robustness test. In fact, in most cases, we observe an improvement in the level of significance. In contrast, for the countries in our sample, of the four **Z** variables only the growth of the terms of trade shows significant association with economic growth in some cases.

Therefore, the results of the base regression in Table 1 have not been unduly distorted by omission of variables capturing monetary policies, trade policies or market distortions.

4 Omitted Variables and the Government Budget Constraint

4.1 The Government Budget Constraint

We noted in Section 1 that almost all previous studies of the association between government expenditure and growth are subject to potential biases because they omit variables that enter the government's budget constraint. This is the case also for the regressions (1)–(3) above, whose results have been summarized in Tables 1 and 2.

Kneller *et al.* (1999) discuss the importance of the government budget constraint in the context of the growth effects of fiscal policy for developed countries. Our discussion primarily follows Kneller *et al.* (1999).[14] Generalizing the notation of Section 3, let $M_{j,it}$ be the fiscal variable j relating to country i at time t. The set of fiscal variables include government expenditure, government revenue and budget deficit items. If there are m such distinct elements, then the government budget constraint implies the identity

$$\sum_{j=1}^{m} M_{j,it} = 0$$

Allowing each element to have an impact on growth leads to a generalization of the growth regression (1) as

$$\mathrm{GR}_{it} = \beta_{0t} + \sum_{j=1}^{5} \beta_j^I I_{j,it} + \sum_{j=1}^{m} \beta_j^M M_{j,it} + u_{it} \tag{4}$$

[14]Miller and Russek (1997) make arguments similar to those of Kneller *et al.* (1999), but they do not consider omission bias in their econometric analysis (see footnote 4).

TABLE 2
ROBUSTNESS CHECKS FOR EFFECTS OF GOVERNMENT EXPENDITURE

	Total investment		*Education investment*		*Transport and communication investment*		*Education expenditure*		*Transport and communication expenditure*		*Defence expenditure*	
Government expenditure	0.201***	0.201***	1.803***	1.997***	0.431**	0.471**	0.679***	0.675***	0.471**	0.515**	0.324**	0.372**
	(0.057)	(0.060)	(0.446)	(0.446)	(0.213)	(0.220)	(0.245)	(0.248)	(0.198)	(0.205)	(0.149)	(0.149)
Z variables												
Initial M2	0.024	0.017	0.026	0.018	0.019	0.013	0.018	0.014	0.019	0.014	–0.030	–0.039
	(0.026)	(0.026)	(0.025)	(0.025)	(0.028)	(0.028)	(0.029)	(0.029)	(0.027)	(0.028)	(0.030)	(0.030)
Initial trade ratio	0.002	0.004	0.014	0.020	–0.004	0.000	–0.009	–0.005	0.002	0.004	–0.002	0.002
	(0.026)	(0.014)	(0.014)	(0.014)	(0.016)	(0.017)	(0.014)	(0.015)	(0.016)	(0.017)	(0.014)	(0.014)
Black market premium	—	0.001	—	0.001	—	0.002	—	0.001	—	0.002	—	0.003
		(0.002)		(0.002)		(0.003)		(0.002)		(0.003)		(0.002)
Growth rate of terms of trade	—	0.028	—	0.089*	—	0.064	—	0.085*	—	0.044	—	–0.010
		(0.052)		(0.048)		(0.055)		(0.051)		(0.056)		(0.061)
R^2	0.56	0.56	0.56	0.62	0.47	0.49	0.52	0.53	0.51	0.53	0.58	0.54
	0.49	0.51	0.55	0.54	0.53	0.54	0.57	0.59	0.54	0.55	0.66	0.72
Observations	29	28	28	27	28	27	27	26	27	26	24	23
	29	28	28	27	28	27	27	26	27	26	24	23
Regression test	72.009	72.220	84.546	91.711	49.005	50.304	57.553	51.182	55.232	56.7317	73.073	75.940
(*p* value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(1)	–0.086	–0.076	–0.155	–0.154	0.115	0.138	0.132	0.177	0.064	0.064	0.088	0.088
(*p* value)	(0.643)	(0.688)	(0.412)	(0.423)	(0.544)	(0.472)	(0.494)	(0.366)	(0.741)	(0.745)	(0.667)	(0.672)

Notes: See Table 1. As the coefficients for *I* variables are essentially similar to what we found in Table 1, according to the suggestion of a referee we have not reported them here for brevity.

In comparing (4) with equations (1)–(3), it should be noted that tax revenue appeared as a conditioning, or **I**, variable in the earlier equations. However, as this is an element of the budget constraint, we include it in (4) as a variable in the set **M**. Consequently, there are now five rather than six elements of **I**.

Equation (4) cannot be estimated due to the perfect collinearity between the m elements $M_{j,it}$ arising from the identity of the budget constraint. Consequently, (at least) one element $M_{j,it}$ must be omitted. If, for simplicity, we assume $M_{m,it}$ is the single omitted element, then the model to be estimated becomes

$$\mathrm{GR}_{it} = \beta_{0t} + \sum_{j=1}^{5} \beta_j^I I_{j,it} + \sum_{j=1}^{m-1} \gamma_j^M M_{j,it} + u_{it} \tag{5}$$

where, in relation to (4), $\gamma_j = \beta_j^M - \beta_m^M$. From standard results of linear regression analysis, overall measures relating to the estimated regression (including R^2, residuals etc.) and the coefficients β_j^I are invariant to which element of the government budget constraint is excluded. However, the magnitude and significance of $\gamma_j = \beta_j^M - \beta_m^M$ depends on both β_j^M and β_m^M, and therefore depends on which element is excluded. If, however, the excluded $M_{m,it}$ has coefficient $\beta_m^M = 0$, then $\gamma_j = \beta_j^M$ and the coefficient of each included fiscal variable in (5) retains the same interpretation as in (4).

Each of our models reported in Section 3 includes one government expenditure category, together with tax revenue. Therefore, in attaching an estimated coefficient to a specific expenditure component, we implicitly assumed all excluded $\beta_j^M = 0$. We now wish to acknowledge the possibility that the significant association between growth and each of the six components of public expenditure obtained in Section 3 could be the effect of the included expenditure component conditional on the fact that they are financed by the omitted ones. Indeed, by considering these one by one, an association of growth with one category could be spurious in the sense of being attributable to other components of public expenditure with which it is correlated. To eliminate this possibility, we should ideally include all the elements of the government budget constraint, except for one category whose coefficient we anticipate to be zero. Given our sample size, the scope for conducting such an exercise, however, is severely limited.

As a practical alternative, we consider the six components of public expenditure found to have significant impacts on growth in our earlier analysis in the context of three subgroups (total expenditure, total sectoral expenditures and sectoral investment expenditures). The elements of each subgroup are then included jointly in the model along with the budget constraint. Thus, by considering them jointly, we avoid possible spurious statistical significance arising due to correlation between included and excluded elements. Specifically, we consider three models. In the first (model (6.1)), we include total

public current expenditure (CUR) and total public capital expenditure (CAP) along with the total expenditure net of outlays on total capital and current expenditure (OTHEXP(1)). In other words, OTHEXP(1) represents expenditures that are not classified as current or capital expenditure. In the second regression (model (6.2)), we include variables IED and ITC to denote investment expenditure in the education and in the transport and communication sectors, respectively. Here, the variable OTHEXP(2) represents the total expenditure minus the outlays on investment expenditures in the education and transport and communication sectors. Finally, in model (6.3) we include the variables EDU, TC and DF to denote total expenditures in education, transport and communication, and defence sectors, respectively. As before, the variable OTHEXP(3) now represents total public expenditure net of the outlay in the education, transport and communication, and defence sectors. In all the models, expenditure variables are expressed as a percentage of GDP.

Specifically, the models are as follows:

$$\mathrm{GR}_{it} = \beta_{0t} + \sum_{j=1}^{5} \beta_j^I I_{j,it} + \beta_1^M \mathrm{CUR}_{it} + \beta_2^M \mathrm{CAP}_{it} + \beta_3^M \mathrm{OTHEXP(1)}_{it} + \beta_4^M \mathrm{TX}_{it} + \beta_5^M \mathrm{GD}_{it} + u_{it} \tag{6.1}$$

$$\mathrm{GR}_{it} = \beta_{0t} + \sum_{j=1}^{5} \beta_j^I I_{j,it} + \gamma_1^M \mathrm{IED}_{it} + \gamma_2^M \mathrm{ITC}_{it} + \gamma_3^M \mathrm{OTHEXP(2)}_{it} + \gamma_4^M \mathrm{TX}_{it} + \gamma_5^M \mathrm{GD}_{it} + u_{it} \tag{6.2}$$

$$\mathrm{GR}_{it} = \beta_{0t} + \sum_{j=1}^{5} \beta_j^I I_{j,it} + \delta_1^M \mathrm{EDU}_{it} + \delta_2^M \mathrm{TC}_{it} + \delta_3^M \mathrm{DF}_{it} + \delta_4^M \mathrm{OTHEXP(3)}_{it} + \delta_5^M \mathrm{TX}_{it} + \delta_6^M \mathrm{GD}_{it} + u_{it} \tag{6.3}$$

A few additional comments are necessary before we turn our attention to the results. When considering models (6.1)–(6.3), we have seen that perfect collinearity must be avoided by excluding an element of the budget constraint. Ideally, one should omit a component which, according to the theory, has a neutral effect on growth. By including OTHEXP variables, we include the expenditure side of the budget constraint, and we also explicitly include tax revenue (TX) and the budget surplus/deficit (GD), both as percentages of GDP. Therefore, the element we choose to exclude from the models is non-tax revenue. This omission is based on the theoretical prediction (e.g. Barro, 1990) that variation in non-distortionary revenue items is likely to generate insignificant growth effects.[15] Finally, our previous analysis indicates that inclusion of the **Z** variables does not have any substantial impact on the

[15]It is worth noting that this assumption does not bias our results towards finding positive and significant growth effects from fiscal expenditures. In fact, if one assumes that non-tax revenue is distortionary, our obtained coefficient would be an understatement of the actual effect of the respective expenditure category on growth.

TABLE 3
GROWTH REGRESSIONS WITH BUDGET CONSTRAINT

	Total expenditure regression	*Sectoral expenditures regression*	*Sectoral investments regression*
M variables			
Capital expenditure	0.151**	—	—
	(0.059)		
Current expenditure	0.093	—	—
	(0.057)		
Education expenditure	—	1.582***	0.658***
		(0.554)	(0.223)
Transport and communication expenditure	—	–0.001	0.049
		(0.237)	(0.191)
Defence expenditure	—	—	0.021
			(0.111)
Other expenditures	–0.059	0.087**	0.121**
	(0.719)	(0.040)	(0.054)
Tax revenue	–0.006	–0.009	–0.209***
	(0.054)	(0.059)	(0.070)
Government surplus (/deficit)	0.146**	0.153**	0.156***
	(0.062)	(0.063)	(0.057)
I variables			
Private investment	0.214***	0.209***	0.312***
	(0.055)	(0.052)	(0.056)
Initial GDP per capita	0.004	0.006**	0.010***
	(0.003)	(0.003)	(0.003)
Initial human capital	–0.013**	–0.011*	–0.016***
	(0.006)	(0.006)	(0.005)
Initial life expectancy	0.089	0.034	0.055
	(0.067)	(0.070)	(0.063)
Political instability	–0.016	0.000	–0.012
	(0.019)	(0.020)	(0.016)
R^2	0.59	0.70	0.64
	0.55	0.50	0.89
Observations	30	28	21
	30	28	21
Regression test (*p* value)	80.8	105.1	177.3
	(0.000)	(0.000)	(0.000)
AR(1) (*p* value)	–0.019	–0.129	–0.092
	(0.918)	(0.495)	(0.673)

Notes: See Table 1.

government expenditure coefficients. Consequently, we do not include these variables in models (6.1)–(6.3) on the ground of parsimony. Table 3 summarizes our results.

The effects of including the budget constraint, and also jointly considering significant expenditure components, are strikingly evident from Table 3 in comparison with Tables 1 and 2. In particular, of the six expenditure variables, which were previously found to bear significant associations with growth, only three survive in the present analysis. These are total capital expenditure, total outlay in the education sector and investment expenditures

in the education sector.[16] Our results therefore point to education as the key sector for growth. In contrast, none of the variables related to defence and the transport and communication sectors now show any significant association with growth. In the total expenditures model (6.1), we include current expenditure to check whether this plays any role when considered in conjunction with capital expenditures, but it does not. It should also be noted that, in both the total sectoral expenditures and sectoral investment expenditures models (the final two columns of Table 3), other expenditure has a significant and positive coefficient (at a 5 per cent level of significance). However, given the set-up of our models, we cannot separately include all disaggregated expenditure components for practical reasons, and therefore we cannot identify those sectors that make this contribution.

The results on the growth effect of outlay on transport and communication merit some additional comments. There is a general consensus among empirical studies that the association between public investment expenditure in the transport and communication sector and growth is particularly strong and significant. For example, Aschauer (1989) finds that public investment in the transport sector is highly correlated with private sector productivity in the USA for the period 1949–85. Likewise, Easterly and Rebelo (1993) find that public investment in this sector is consistently and positively correlated with growth. In Table 3, however, such evidence is absent.

We account for this on the basis of the two following observations. First, this difference may be due to the fact that, unlike previous studies, our analysis considers only developing countries. Second, and perhaps more substantively, this difference may reflect the presence of omission biases in the previous studies due to their failure to consider the budget constraint and to consider more than one sector simultaneously.

In addition, our analysis brings out into the open the adverse growth effects of government budget deficits.[17] We find that these negative effects for these countries are significant and of considerable magnitude: a 1 percentage

[16]It is interesting to note that some of our results are comparable with those found in the literature that studied developed countries. In the case of sectoral expenditures for developed countries, Miller and Russek (1997) find positive and significant coefficients (1.59 and 1.86) for the education sector, while defence and transport and communication expenditures show no effect. For public investment (for either central government or total government), there are several studies that used developed country samples. For example, after controlling for revenue component(s) of the government budget, Cashin (1995) finds the coefficient for public investment to be significant with a low magnitude (i.e. 0.01) for all Organization for Economic Cooperation and Development (OECD) countries, while Kocherlakota and Yi (1997) find it to be very high (0.14 or more) for the USA and UK. Although we follow the methodology of Kneller *et al.* (1999), we cannot directly compare their results with ours as their focus is different. That is, they consider expenditures to be of productive and unproductive nature and find productive expenditure with high positive and significant coefficients (0.26 or more). Finally, to the best of our knowledge, there is no study using a developed country sample to compare with our analysis for public investments disaggregated by sectors.

[17]A similar view has been expressed by Fischer (1993).

point increase in the government surplus (as a percentage of GDP) is associated with an increase in the annual growth rate of real GDP per capita by an average of 0.15 percentage points. An increase in the budget deficit, of course, has the corresponding negative effect.

We conclude this subsection with two additional observations. It is worth noting that the 'Other expenditure' coefficient appears insignificant in the first column in Table 3, whereas it appears significant in the next two columns. This result is not surprising as the 'Other expenditure' is not the same variable across the three models. Further, the significance of OTHEXP(2) and OTHEXP(3) in the last two columns indicates that these variables include some categories of expenditures that may be potentially important for growth. However, given our sample size, the scope for identifying these variables is limited. Finally, we note that in some cases the coefficient of the same variable (e.g. tax revenue) assumes different values and different levels of significance across the three models. This is due to differences in the number of observations used across the models, resulting from data availability. When the three models are re-run using a common set of countries, this anomaly disappears while preserving the main conclusion of our paper.[18]

4.2 Endogeneity Tests

In measuring the extent to which government expenditures affect economic growth, one has to recognize that fiscal and other economic variables evolve jointly: not only do government expenditures affect economic performance, but reverse causality is also a possibility. Therefore, we now turn to a verification of whether our results in Table 3 may be a manifestation of reverse causation or not. For this, we estimate the growth regression using three-stage least squares (3SLS).

In choosing the instruments for 3SLS, we follow the footsteps of Barro and Sala-i-Martin (1995, 1999). In particular, our set of instruments comprises some of the original variables and lags of the other variables.[19] In the absence of data for government expenditure variables prior to 1970, we have chosen to run the regressions for the periods 1971–79 and 1981–89, instead of 1970s–1980s, so that we obtain at least one set of observations for the government expenditure variables that are predetermined for each equation of the system. Accordingly, the instruments for government expenditure variables are their own observations for 1970 and 1980, respectively. These lagged values are reasonable candidates for instruments since the correlation

[18]For this set of regressions we have used the same countries as used for model (6.3). Due to limited space, we have not included the results of these regressions in the paper but they are available upon request.

[19]For comparison, we also considered agriculture's share in GDP and population as instruments (e.g. Easterly and Rebelo, 1993). The results that we obtain are essentially similar to those reported.

TABLE 4
ENDOGENEITY TEST (3SLS)

	Total expenditure regression	*Sectoral expenditures regression*	*Sectoral investments regression*
Capital expenditure	0.159**	—	—
	(0.063)		
Education expenditure	—	2.245***	1.093***
		(0.541)	(0.297)
Transport and communication expenditure	—	–0.258	0.013
		(0.227)	(0.206)
Defence expenditure	—	—	–0.144
			(0.224)

Note: **Significant at 5 per cent; ***significant at 1 per cent.

between the residuals in the growth regressions for two decades is small and insignificant (Tables 1–3). Given that the initial variables (GDP per capita, human capital and life expectancy) are exogenous to the sample, these variables enter as their own instruments. Finally, the instruments for private investment and political instability are their averages for five years prior to the specific decade. The results are reported in Table 4.[20]

For brevity, we report only the results for the coefficients of the six government expenditure variables that we considered previously. A straightforward comparison of the results with those reported in Table 3 indicates that the sign of the coefficients and the levels of significance of the three significant expenditure variables (i.e. total capital expenditure, investment in the education sector and the total outlay in the education sector) remain unaltered. Accordingly, to the extent that our instruments are valid, the growth effects of these three expenditure variables that we obtained in the previous section should not be attributed to endogeneity. Further, as in Table 3, none of the other three components of expenditures is significant, with some of their coefficients being negative.

5 CONCLUSION

The objective of our study has been to evaluate the growth effects of public expenditures at the aggregate and disaggregate levels for 30 developing countries. The primary contributions of this study are twofold. First, our innovation is to use more detailed data, and to analyse them while taking into account the full implication of government budget constraints (as in Kneller *et al.*, 1999). Second, our exclusive focus on developing countries is impor-

[20]The size of our sample has constrained our ability to include all components of total expenditures in model (6.3). In particular, we had to exclude the variable 'Other expenditures' from the model.

tant, because the role of government expenditure for growth may profoundly differ across developed and developing countries.

Our analysis strongly suggests that government expenditure on education has long-lasting effects on economic prosperity. Underlying rationale for such a result is embedded not only in the new growth literature but also in some neoclassical growth models (e.g. Turnovsky, 2004) where transitional effects are very long lasting. Our result is robust with respect to whether we consider total expenditure in education (in a regression that considers total sectoral expenditures) or investment in education (in a model that focuses on sectoral investment expenditures). Such strong evidence is absent in the existing empirical literature. Accordingly, from the policy perspective, our analysis prioritizes the allocation of scarce government resources towards the education sector for at least some developing countries. Further, our analysis also suggests that aggregate current expenditure has no effect on growth, whereas aggregate capital expenditure has a positive effect. This implies that, for developing countries, decisions on current versus capital expenditure should (at least in the aggregate) favour the latter in order to enhance growth.

Our results should not, however, be interpreted as implying that expenditure on education or on capital projects should be increased irrespective of how these are financed. Indeed, our analysis is careful in considering the role of the government budget constraint. Since tax revenue has a negative impact (although not always significant) on growth, while increasing the government deficit has a highly significant negative effect, the raising of additional finance will moderate the positive effects of education or capital expenditure. Perhaps the importance of our results can be considered most clearly in the context of a transfer of, say, 1 percentage point of government expenditure in relation to GDP from another sector towards education, or from current to capital expenditure, where our results imply that such a transfer will be growth enhancing.

Appendix

The Data

Countries Included (According to the World Bank Classification of Regions). Central and North America (1), Bahamas; South Asia (5), Bangladesh, India, Nepal, Pakistan, Sri Lanka; Sub-Saharan Africa (16), Botswana, Burundi, Congo, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mauritius, Nigeria, Rwanda, Sierra Leone, Sudan, Tanzania, Zaire, Zambia; Middle East and North Africa (3), Morocco, Syria, Tunisia; Latin America and the Caribbean (2), Guatemala, Jamaica; East Asia and the Pacific (3), Indonesia, Malaysia, Thailand.

Definitions and Sources. Definitions for all variables and data sources are presented in Table A1.

TABLE A1
DEFINITION OF VARIABLES AND DATA SOURCES

Variable		*Data sources*
GDP data		
gr	Average growth rate in GDP per capita	World Bank CDROM
lgc	Log of GDP per capita	World Bank CDROM
Government expenditure categories		
cur	Government current expenditure (% of GDP)	World Bank Reports and IMF
cap	Government capital expenditure (% of GDP)	World Bank Reports and IMF
cdf	Government consumption in defence (% of GDP)	World Bank Reports and IMF
ced	Government consumption education (% of GDP)	World Bank Reports and IMF
chl	Government consumption in health (% of GDP)	World Bank Reports and IMF
cag	Government consumption in agriculture (% of GDP)	World Bank Reports and IMF
cmf	Government consumption in manufacturing (% of GDP)	World Bank Reports and IMF
ctc	Government consumption in transport and communication (% of GDP)	World Bank Reports and IMF
idf	Government investment in defence (% of GDP)	World Bank Reports and IMF
ied	Government investment in education (% of GDP)	World Bank Reports and IMF
ihl	Government investment in health (% of GDP)	World Bank Reports and IMF
iag	Government investment in agriculture (% of GDP)	World Bank Reports and IMF
imf	Government investment in manufacturing (% of GDP)	World Bank Reports and IMF
itc	Government investment in transport and communication (% of GDP)	World Bank Reports and IMF
df	Government expenditure in defence (% of GDP)	World Bank Reports and IMF
edu	Government expenditure education (% of GDP)	World Bank Reports and IMF
hl	Government expenditure in health (% of GDP)	World Bank Reports and IMF
ag	Government expenditure in agriculture (% of GDP)	World Bank Reports and IMF
mf	Government expenditure in manufacturing (% of GDP)	World Bank Reports and IMF
tc	Government expenditure in transport and communication (% of GDP)	World Bank Reports and IMF
Other variables		
p	Primary school enrolment ratio	Barro and Lee (1994)
s	Secondary school enrolment ratio	Barro and Lee (1994)
h	Higher education enrolment ratio	Barro and Lee (1994)
psh	A linear combination of p, s and h (see below)	Barro and Lee (1994)
life	Log of life expectancy	Barro and Lee (1994)
as	No. of assassinations per million population per year	Barro and Lee (1994)
rev	No. of revolutions per year	Barro and Lee (1994)
coup	No. of coups per year	Barro and Lee (1994)
pinst	A linear combination of as, rev and coup (see below)	Barro and Lee (1994)
bmp	Black market premium	Barro and Lee (1994)
m2	Broad money (M2) (% of GDP)	World Bank CDROM
tr	Trade ratio (export plus import as % of GDP)	Barro and Lee (1994)
tt	Growth rate of terms of trade	Barro and Lee (1994)
tx	Tax revenue (% of GDP)	*Government Finance Statistics*, IMF
gsd	Government surplus/deficit (% of GDP)	World Bank CDROM
pviw	Private investment (% of GDP)	Barro and Lee (1994)
agr	Agriculture's value added (% of GDP)	World Bank CDROM
pop	Log of population	Barro and Lee (1994)

Human capital (PSH):
Following Landau (1983), we construct the initial human capital (PSH) variable as the weighted sum of the initial enrolment ratios (per cent) in primary and secondary schools and in higher education. The weights are 1 for primary school enrolment ratio, 2 for secondary school and 3 for enrolment in higher education. The weights are approximations to the relative values of three types of education. The PSH variable is necessary because of the high multicollinearity between the separate enrolment rates. The data for average schooling years are missing for one-fourth of the countries in the sample; thus the enrolment rates are probably better available measures of investment in education. The other rationale for taking enrolment rates is that these are more frequently used in the literature (see Easterly and Rebelo, 1993; Barro and Sala-i-Martin, 1995, 1999; among others).

Political instability (PINST):
Following Barro and Sala-i-Martin (1995, 1999), we take the average of each decade of revolutions and coups per year and political assassinations per million inhabitants per year.

Summary Statistics. Table A2 presents summary statistics for the variables used in the results reported in the paper. Data are used primarily as decade averages, relating to the 1970s and 1980s. However, for 3SLS, we take the averages for 1971–80 and 1981–90 instead of 1970–80 and 1980–90, respectively. A suffix of two numbers after a variable name indicates a specific year (e.g. P70 is the primary school enrolment ratio in 1970), while a single number refers to the period for a specific average; for example, gr1 is the average growth rate of GDP per capita for 1970–80, gr2 is for 1980–90, gr3 is for 1971–80 and gr4 is for 1981–90.

Table A2
Summary Statistics

Variable	*Observations*	*Mean*	*Std Dev.*	*Min*	*Max*
gr1	30	0.024	0.028	–0.022	0.111
gr2	30	0.012	0.023	–0.023	0.071
lgc70	30	3.378	0.816	2.087	5.295
lgc80	30	3.490	0.818	2.222	5.518
psh70	30	1.082	0.598	0.246	2.821
psh80	30	1.501	0.650	0.368	3.248
life70	30	1.694	0.068	1.535	1.827
life80	30	1.729	0.067	1.581	1.853
pinst1	30	0.097	0.116	0	0.445
pinst2	30	0.097	0.154	0	0.730
bmp1	29	0.421	0.473	0	2.024
bmp2	30	0.837	1.423	0	7.185
m270	30	0.239	0.107	0.085	0.435
m280	30	0.320	0.142	0.079	0.775
tr70	29	0.445	0.242	0.077	0.925
tr80	30	0.600	0.333	0.157	1.333
tt1	28	0.014	0.070	–0.085	0.176
tt2	28	–0.021	0.027	–0.106	0.011
tx1	30	0.144	0.050	0.045	0.257

TABLE A2
Continued

Variable	*Observations*	*Mean*	*Std Dev.*	*Min*	*Max*
tx2	30	0.150	0.062	0.056	0.284
gd1	30	–0.052	0.033	–0.139	0.002
gd2	30	–0.056	0.044	–0.132	0.114
pvi1	30	0.119	0.058	0.026	0.316
pvi2	30	0.109	0.049	0.034	0.217
cur1	30	0.140	0.060	0.012	0.251
cur2	30	0.159	0.069	0.011	0.304
cdf1	29	0.025	0.026	0.001	0.136
cdf2	28	0.028	0.030	0.002	0.142
ced1	30	0.025	0.015	0.002	0.056
ced2	29	0.026	0.016	0.002	0.061
chl1	30	0.010	0.007	0.001	0.026
chl2	29	0.010	0.008	0.001	0.032
cag1	30	0.008	0.006	0.001	0.029
cag2	30	0.007	0.005	0.001	0.021
cmf1	23	0.002	0.002	0	0.008
cmf2	23	0.003	0.007	0	0.033
ctc1	28	0.007	0.005	0.001	0.022
ctc2	28	0.004	0.003	0	0.011
cap1	30	0.072	0.038	0.004	0.160
cap2	30	0.086	0.049	0.006	0.172
idf1	28	0.003	0.005	0	0.018
idf2	25	0.002	0.005	0	0.018
ied1	30	0.006	0.005	0.000	0.019
ied2	29	0.007	0.006	0.001	0.021
ihl1	30	0.002	0.002	0.000	0.009
ihl2	29	0.004	0.005	0.000	0.027
iag1	30	0.011	0.007	0.001	0.028
iag2	30	0.014	0.012	0.001	0.050
imf1	28	0.008	0.013	0.000	0.066
imf2	28	0.010	0.012	0	0.047
itc1	29	0.016	0.012	0.001	0.046
itc2	29	0.017	0.014	0.001	0.066
te1	30	0.212	0.087	0.017	0.390
te2	30	0.246	0.103	0.019	0.443
df1	28	0.027	0.024	0.000	0.116
df2	25	0.026	0.022	0.002	0.100
edu1	30	0.032	0.015	0.004	0.058
edu2	28	0.033	0.016	0.004	0.067
hl1	30	0.012	0.007	0.001	0.027
hl2	28	0.014	0.008	0.001	0.035
ag1	30	0.019	0.011	0.002	0.049
ag2	30	0.021	0.014	0.002	0.059
mf1	23	0.010	0.014	0.000	0.067
mf2	23	0.014	0.014	0	0.050
tc1	28	0.023	0.015	0.002	0.069
tc2	28	0.022	0.016	0.002	0.074
agr70	29	0.331	0.163	0.07	0.669
agr80	29	0.292	0.144	0.08	0.579
pop70	29	4.005	0.655	2.79	5.744
pop80	29	4.119	0.656	2.95	5.838
popgr70	30	2.572	0.586	1.31	3.609
popgr80	30	2.575	0.658	0.98	3.577

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