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Does Higher Government Spending Buy Better Results in Education and Health Care?

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Abstract

There is little empirical evidence to support the claim that public spending improves education and health indicators. This paper uses cross-sectional data for 50 developing and transition countries to show that expenditure allocations within the two social sectors improve both access to and attainment in schools and reduce mortality rates for infants and children. The size and efficiency of these allocations are important for promoting equity and furthering second-generation reforms.

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I. INTRODUCTION

In a recent paper, Sen (forthcoming) argues that "since premature mortality, significant undernourishment, and widespread illiteracy are deprivations that directly impoverish human life, the allocation of economic resources as well as arrangements for social provision must give some priority to removing these disadvantages for the affected population." In particular, this requires greater provision of basic education and primary health care.

In a similar vein, policy makers are increasingly interested in the composition of public spending. This attention stems in part from the recognition that expenditure allocations in favor of education and health can boost economic growth while promoting equity and reducing poverty (Barro, 1991; Chu and others, 1995; and Tanzi and Chu, 1998). In this light, it is common for various international financial institutions, donors, and NGOs to call for increased government spending in these sectors. In fact, reducing unproductive expenditures and improving expenditure composition and quality is an important element of the second generation reforms in countries that have achieved macroeconomic stability (Camdessus, 1997).

The justification of higher public spending on basic education is often based on its impact on individuals' lifetime incomes (i.e., the social rate of return). Several studies have found that the social rate of return is highest for primary education, followed by secondary and tertiary education (Psacharopoulos, 1994; and World Bank, 1995).[2] At the same time, ample evidence suggests that allocations for tertiary education in many countries are inappropriately high (e.g., Gupta, Clements, and Tiongson, 1998; Sahn and Bernier, 1993; and World Bank, 1995).

The emphasis on increasing public spending on primary health care is generally justified on the basis that such spending ameliorates the impact of disease on the productive life years of the population. It has been shown that the burden of disease in developing countries could be reduced greatly if governments were to make available a minimum package of essential, cost-effective clinical services (World Bank, 1993). In this respect, tertiary health care has been found to provide little health gain. Many studies have concluded that the most cost-effective interventions are often preventive in character, and that in many developing countries public allocations for curative services are excessive (e.g., Sahn and Bernier, 1993; and Pradhan, 1996).

Although the studies that concentrate on social rates of return to education and on the burden of disease provide a compelling reason for policy makers to shift public resources

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[2]Recently, the methodological basis of studies estimating social rates of return of education has been questioned. For example, Bennell (1995; 1996) does not find support for the proposition that basic education has a higher social return than other levels of education (also see Appleton, Hoddinott, and Mackinnon, 1996; Cassen, 1996).

toward basic education and primary health care, they do not yield conclusive evidence that such a reallocation would actually help improve the education attainment and health status of the population. It may well be that public spending crowds out private spending on primary and secondary education and primary health care, or that public resources are used inefficiently and inequitably.

In fact, the evidence on whether the aggregate education and health spending have a beneficial impact on relevant social indicators—taken as a proxy for outputs of public spending on social sectors—is mixed. Furthermore, scant evidence has been presented on the beneficial impact of increased allocations within the two sectors for primary and secondary education and primary health care on social indicators.

Many studies show that the relationship between public spending for education and measures of education attainment is weak (Landau, 1986; Noss, 1991; Mingat and Tan, 1992 and 1998; and Flug, Spilimbergo, and Wachtenheim, 1998). Instead, other variables have been found to be important in explaining education attainment. This includes per capita income (Flug, Spilimbergo, and Wachtenheim, 1998; Mingat and Tan, 1992), the age distribution of the population (Mingat and Tan, 1992), parental perceptions of costs and benefits, and family background or parental education (Appleton, Hoddinot, and Mackinnon, 1996). In contrast, Gallagher (1993) shows that after correcting for its quality and efficiency, spending on education has a positive impact on indicators of education attainment.

Similarly, many studies find that the contribution of public health outlays to health status as measured by infant mortality or child mortality is either small or statistically insignificant (Kim and Moody, 1992; McGuire and others, 1993; Aiyer, Jamison, and Londoño, 1995; Musgrove, 1996; Filmer and Pritchett, 1997; and Filmer, Hammer, and Pritchett, 1998). Carrin and Politi (1995) conclude that poverty and income are crucial determinants of health status indicators but fail to find that public health spending has a statistically significant effect on these indicators. Similarly, Filmer and Pritchett (1997) contend that cross-country differences in income alone account for 84 percent of the variation in infant mortality, with socioeconomic variables accounting for 11 percent, and public spending for less than 1/6 of one percent. These results are echoed by Demery and Walton (1998) who note that "the conclusion that public spending is a poor predictor of good health is a common one (page 26)." In contrast, Anand and Ravallion (1993) and Hojman (1996)—with relatively small sample sizes of 22 observations and 10–20 observations, respectively—do find that public health spending has a statistically significant effect on health status. Similarly, Bidani and Ravallion (1997) find for a larger sample of 35 countries that public spending has a beneficial impact on the health condition of the poor.

Although the evidence presented in the above-mentioned studies in general goes against the presumption that higher public spending on education and health is effective in improving social indicators, some relevant issues are overlooked in these studies. As noted earlier, allocations within the sectors are widely considered to be important in explaining

changes in social indicators, but these studies typically sidestep this issue.[3] In fact, Ogbu and Gallagher (1991) find in a study of 5 African countries that enrollment rates are affected by the composition of public education spending. And in a survey of 10 country studies, Mehrotra (1998) concludes that high education attainment is associated with relatively high public spending on education and a relatively high share of primary education in total education expenditures. Unfortunately, neither paper supports its claim about the efficacy of public spending on basic education with statistical analysis.

Filmer, Hammer, and Pritchett (1998) attempt to address the issue of allocations within the health sector by including a measure of government spending on primary health care in their cross-section analysis of the causal factors of infant mortality. As it turns out, they fail to find a statistically significant impact of primary health care spending on infant mortality rates. But their aggregate health sector data are not necessarily consistent with either the overall fiscal or the intrasectoral data. Measurement errors may have been further exacerbated by the use of statistical techniques to create imputed values for missing observations.

Against this background, this paper seeks to reassess whether expenditure allocations within the education and health sectors matter by using a comprehensive, internally consistent, and up-to-date cross-section data set of public spending and social indicators for 50 developing and transition countries. The statistical results indicate that intrasectoral allocations matter; shifting spending toward primary and secondary education has a positive impact on enrollment rates and student persistence through grade 4; and shifting health spending toward primary care has a favorable effect on infant and child mortality rates.

This paper is organized as follows. Section II discusses the model and the data set; Section III presents the results; and Section IV gives the policy implications.

II. Model and Data

The following equation is used to evaluate the impact of public spending on education and health care:

$$Y_i = f(X_{1i}, X_{2i}, Z_i), \tag{1}$$

where Y_i is a social indicator reflecting education attainment or health status for a country i, which is a function of aggregate public spending on education or health care as a share of

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[3]Also, the absence of a measurable impact of public spending on indicators could be due to a differential effect on poor and nonpoor groups, which are not captured by aggregated social indicators (Bidani and Ravallion, 1997). This possibility is not addressed here because of lack of data on disaggregated social indicators for poor and nonpoor groups.

GDP,[4] X_{1i}; allocations to different programs within the sector (i.e., primary education and primary health care) as a share of total sectoral spending,[5] X_{2i}; and a vector of socioeconomic variables Z_i.

A range of social indicators is available to gauge performance of education and health care spending by the government. Three considerations guided the choice of indicators. First, to facilitate a comparison of results, indicators used by other authors were selected where possible. Second, because many indicators are collected infrequently, and with a lag, the indicators used were those for which the most up-to-date values were available. Finally, as many as possible of the core indicators recently proposed by the Development Assistance Committee (DAC) of the OECD, the World Bank, and the UN to measure development performance were used.[6]

Education attainment is proxied by the gross enrollment ratio in primary and secondary education (the number of enrolled students in percent of the total number of school-age persons), the net enrollment ratio (the number of enrolled school-age students in percent of the total number of school-age persons), and the persistence through grade four (percent of children reaching that grade). Two indicators are used to gauge health status: infant (aged 0 to 1 year) mortality rates and child (aged 0 to 5 years) mortality rates.

In addition to two expenditure variables, the education regressions include the following control variables:

- **Percent of population in the age group 0–14**. It is difficult and costly to expand enrollment rates in countries with low enrollment when the population is relatively

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[4]A drawback of measuring education spending as a share of GDP is that the associated spending per student can vary greatly among countries depending on the level of GDP. However, the results presented in this paper continue to hold even when education and health care spending is expressed in per capita terms. This drawback was overcome by the inclusion of GDP per capita as a control variable (see below). Indeed, the effect of per capita spending can be gauged from the coefficients for spending as a percent of GDP and GDP per capita (the product of these variables equals spending per capita).

[5]It should be noted that an increase in public allocations for, say, primary education, while holding all other spending constant, has an effect on education indicators both directly through X_{2i}, and indirectly, through the overall level of education spending X_{1i}.

[6]The list of core indicators for education and health include: net enrollment in primary education, persistence through grade four, literacy rate of 15 to 24 year olds, adult literacy rate, infant mortality rate, child mortality rate, maternity mortality ratio, births attended by skilled health personnel, contraceptive prevalence rate, HIV infection rate in 15 to 24 year-old pregnant women, and life expectancy at birth.

young (Mingat and Tan, 1992). In countries with less-than-universal enrollment, a high share of young in the population would be expected to be negatively correlated with enrollment rates.

- **Per capita income.** As household incomes rise, the relative cost of enrolling children into school is reduced, suggesting that increasing income would be associated with rising enrollments. Furthermore, at higher income levels, the demand for education would increase, assuming education is a normal good. This impact is captured by GDP per capita in purchasing power parity (PPP) terms.

- **Adult illiteracy rates.** Illiteracy impacts negatively on enrollment rates, as uneducated parents are less likely to enroll their children in school.

- **Urbanization.** Households in urban areas are more likely to send their children to school, because, among other reasons, access to education is typically better in urban areas (Plank, 1987). In addition, the private cost of education (e.g., transportation costs) may be lower for urban households.

- **Child nutrition.** Better nutrition for children makes it easier for enrolled school-age children to continue in school, thereby impacting on enrollment and persistence (Glewwe and Jacoby, 1995). This variable is proxied by child mortality.[7]

Control variables in the health regressions include the following:

- **Per capita income.** Ample empirical evidence suggests that the population's health status improves as per capita incomes rise. As noted above, developments in income per capita are measured in PPP terms.

- **Adult illiteracy rates.** As for education, many studies show a strong inverse relationship between adult illiteracy and infant mortality rates (e.g., Tresserras and others, 1992). A number of studies indicate that female literacy impacts on the health status of infants and children (e.g., Shultz, 1993). However, due to data limitations, the overall—rather than the female—adult illiteracy rate is used.[8]

- **Access to sanitation and safe water.** A sanitary environment, as reflected by increased access to sanitation and safe water, leads to improved health status. Access to safe water, for example, is found to have a significant effect on infant and child

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[7]Other proxies of child nutrition, such as indicators of malnourishment and birth weight, were not available.

[8]In fact, female illiteracy was found to have a weaker effect than overall illiteracy.

mortality (Kim and Moody, 1992; and Hojman, 1996). Because of data limitations, access to sanitation is used in the regressions.

- **Immunization.** There is evidence that an increased vaccination coverage in children has a positive impact on health status (Hojman, 1996). The share of children under one year of age immunized for measles is therefore used as a control variable.[9]

- **Urbanization.** Schultz (1993) finds that mortality is higher for rural, low income, agricultural households, suggesting that increased urbanization is associated with improved health status of the population.

Data limitations prevent adding other controls for socioeconomic characteristics that may affect indicators of education attainment and health status. In particular, private spending on both education and health is omitted due to a lack of data (evidence on the importance of private spending is provided by Psacharapoulos and Nguyen, 1997). Some authors (Bredie and Beeharry, 1998; and Filmer, Hammer, and Pritchett, 1998) propose including other demand factors, such as income distribution, in the regressions for both education and health. Unfortunately, data are not available for a large enough sample. Similarly, data limitations prevent including control variables that capture the factors adversely affecting children's caregivers (e.g., the impact of AIDS epidemic in Africa).[10]

Finally, Mingat and Tan (1998) point to the importance of teacher salaries in driving up the cost of education in low-income countries. They estimate that 50 percent of the difference in education attainment between high-income and low-income countries can be attributed to lower teacher salaries in relation to the rest of the economy in high-income countries that release resources for nonwage inputs, such as textbooks. Data on teacher salaries are not available for a sufficient number of countries to use as a control variable.

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[9]Using DPT immunizations yields the same results. The two types of immunizations are highly correlated, and therefore, only one was included in the regressions.

[10]An attempt was made to circumvent the problem of missing control variables by adding dummies for regions, under the assumption that the variation of omitted controls within regions is dominated by the variance among regions. However, regional dummies were not significant in the education regressions and can not be used in conjunction with other explanatory variables in the health regressions (see below).

However, as teacher salaries are highly correlated with illiteracy and child mortality rates,[11] the latter control variables would be expected to pick up much of the impact of differences in salary levels.

Data on total education and health spending are drawn from a number of sources, including various issues of the IMF's *Government Finance Statistics* (GFS) and *Recent Economic Development* reports. For around 50 developing and transition countries the intrasectoral allocation for education spending (primary, secondary, and tertiary) and health care spending (primary, secondary, and other) are taken from GFS and UNESCO databases, the World Bank's *Poverty Assessments*, *Public Expenditure Reviews*, and World Development Indicators.[12] Most spending and other data are for 1993–1994. The intrasectoral data have been checked for consistency with the aggregates for public allocations to that sector.[13] Available data on education spending typically does not distinguish between primary and secondary education. Consequently, spending on these two levels is analyzed as a single item.

A universally accepted definition of primary health care does not exist. As a result, intrasectoral data for health care are not strictly comparable across sources. Primary health care is defined as public spending on clinics and practitioners according to the GFS categorization.[14] For countries for which this classification is not available, public spending on primary health care or preventive care, as defined in the World Bank's *Poverty Assessments* and *Public Expenditure Reviews*, is used. Secondary health care is defined as hospital services

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[11]The correlation coefficient between illiteracy rates and average teacher salaries as a multiple of GDP per capita was -0.80 for 24 countries for which data were available (data on teacher salaries are from Mehrotra and Buckland, 1998). The correlation coefficient with child mortality rates was -0.72. The correlation coefficient between income per capita in PPP terms and the relative teacher salaries was also relatively high at -0.48.

[12]The list of countries is included in Appendix I.

[13]If the deviation between the sum of intrasectoral spending and total sectoral spending exceeded 10 percent, the observation was dropped.

[14]This measure of primary health care, which includes services provided by clinics and medical, dental, and paramedical practitioners, appropriately captures primary-level health care, as it is the "first point of contact" between clients and a facility in a health system (e.g., Shaw and Griffin, 1995). The GFS disaggregation of health spending—into hospitals, clinics and practitioners, and other spending—is also used by others to examine priorities in the health sector (e.g., Appleton and Mackinnon, 1996).

and curative treatments by medical specialists. To the extent possible, the data for control variables were matched with the year of the spending data.[15]

Figures 1 to 3 present average public spending levels and intrasectoral shares of education and health care spending in the sample countries. These figures show that in the sample countries, the share of education expenditures allocated to primary and secondary education is 79 percent, whereas the share of health care spending allocated to primary care is 16 percent. These numbers are broadly consistent with average intrasectoral allocations previously observed by others (World Bank, 1993; Sahn and Bernier, 1993; and Gupta, Clements, and Tiongson, 1998).

III. Empirical Results

Equation (1) is estimated in a linear form using OLS (correcting for heteroskedasticity) and two-stage least squares (2SLS) regressions.[16] The 2SLS technique is used primarily to address the problem of reverse causality. For instance, higher spending on primary education may have a positive effect on enrollment, but a higher demand for primary education, reflected in higher enrollment rates, may also provide a push for higher spending. A similar dual relationship may exist between public spending on primary health care, on the one hand, and child and infant mortality rates, on the other hand. In addition, 2SLS regressions address potential problems of measurement errors in variables.[17]

In evaluating the regression results, it should be borne in mind that multicollinearity among variables affects the standard errors of coefficients attached to the control variables. However, the variables for overall sectoral spending and intrasectoral distribution of expenditures are generally not correlated with other independent variables, with the important exception of total health care spending.[18]

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[15]For example, intrasectoral education data for 1994 were matched with enrollment data for 1994, if available. If enrollment data for 1994 were not available, observations in the range of 3 years before and after the year of spending were used (1991–1997). Potential problems of measurement error were addressed by running two-stage least squares regressions.

[16]There is no a priori preferred functional form for the "production function" for education and health services. Therefore, regressions were also run in loglinear form, for which summary results are presented.

[17]The data set includes some outlying observations (e.g., Papua New Guinea). However, these outliers did not critically affect the regression results after corrections for heteroskedasticity were made.

[18]The correlation coefficient between total health spending and measles immunization was

(continued...)

Figure 1. Total Education and Health Care Spending
(In percent of GDP)

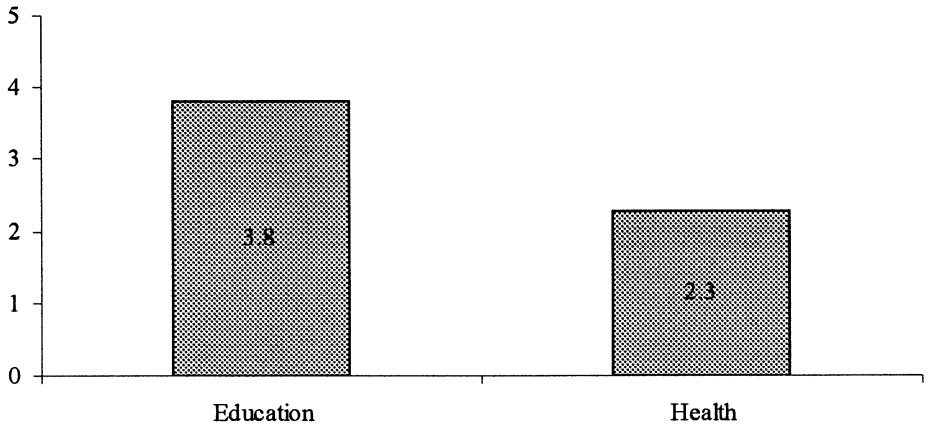


Figure 2. The Intrasectoral Shares of Education Spending
(In 50 selected countries)

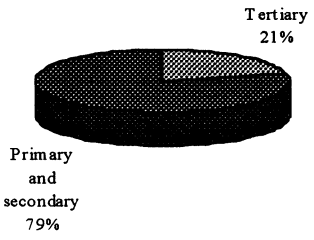
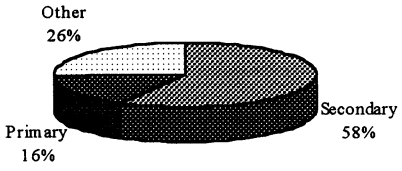


Figure 3. The Intrasectoral Shares of Health Care Spending
(In 40 selected countries)



Sources: UNESCO database; World Bank, "Public Expenditure Review," (Washington: World Bank, various issues); World Bank, "Poverty Assessment," (Washington: World Bank, various issues); IMF, GFS database; and IMF staff estimates.

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[18](...continued)
0.40, and -0.39 for overall health expenditure and adult illiteracy. The two coefficients were significant at the 1 percent level.

A final point is related to the number of observations. This can vary, depending on the availability of data for a specific variable. The number of observations for the health care regressions is relatively low.

A. Education Regressions

Table 1 reports results of the education attainment regressions for all specifications. Three measures of education attainment are used: gross enrollment in primary and secondary education, gross enrollment in secondary education, and persistence through grade four. In most regressions, the explanatory variables account for more than 75 percent of cross-country variation in education attainment. The F-statistic for most regressions is statistically significant at the 1 percent level.[19]

In the regression with gross enrollment in primary and secondary education as the dependent variable, the share of spending on primary plus secondary education in total education spending is statistically significant for the OLS and the 2SLS specifications at a level of 1 percent and 5 percent, respectively, whereas total education spending in relation to GDP is insignificant. In the gross secondary regressions, both education spending variables are statistically significant at the conventional levels of significance. The persistence through grade four is impacted significantly by intrasectoral spending, but not by the level of overall education spending or the control variables. Sargan's test suggests that the 2SLS specifications for all regressions are correct.[20] Finally, results from regressions with gross

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[19]To address heteroskedasticity, White's (1980) corrected covariance and standard errors are used, except for the equation with gross primary plus secondary enrollment as the dependent variable. The latter regression was estimated using the weighted-least squares (WLS) technique, with adult illiteracy used as a weight. This weight can be interpreted as a scaling factor, indicative of the challenge of achieving targeted levels of education attainment, and yields better results than White's corrected regression. The use of a consistent set of instruments in the 2SLS regressions was checked for validity using Sargan's (1964) general misspecification test.

[20]The inclusion of dummy variables for regions did not improve the explanatory power of the regression models, nor did it affect the coefficient estimates and their significance levels.

Table 1. Regression Results for Enrollment Rates and Persistence Through Grade Four 1/

	Enrollment Rates				Persistence Through Grade Four	
	Gross primary and secondary		Gross secondary			
	OLS (Weighted)	2SLS (Weighted)	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Primary and secondary education spending						
(percent. of total education spending)	0.19***	0.19**	0.28***	0.20*	0.17*	0.29**
	(2.88)	(2.01)	(3.99)	(1.80)	(2.04)	(2.82)
Education spending						
(percent of GDP)	1.05	0.80	2.23**	3.27***	1.47	3.70
	(1.33)	(0.69)	(2.05)	(2.65)	(1.08)	(1.62)
Population aged 0–14						
(percent of population)	0.49***	0.50***	-0.73***	-0.77***	-0.14	-0.30
	(3.95)	(3.95)	(-2.90)	(2.96)	(-0.56)	(-0.81)
Adult illiteracy rate						
(percent of population aged 15+)	-0.72***	-0.74***	-0.31**	-0.30**	0.07	0.01
	(-3.73)	(-3.75)	(-2.39)	(-2.32)	(0.53)	(0.04)
Child mortality rate						
(per thousand of children 0-5 years)	-0.06	-0.06	0.008	0.01	-0.11	-0.09
	(-1.03)	(-1.00)	(2.12)	(0.28)	(-1.68)	(-1.35)
Income per capita in PPP terms 2/	0.13*	0.15	0.23***	0.21***	0.01	-0.04
	(1.69)	(1.63)	(3.38)	(3.16)	(0.26)	(-0.74)
Urbanization						
(percent of population)	0.22***	0.20**	0.38***	0.40***	0.12	0.15
	(2.86)	(2.28)	(3.31)	(3.65)	(1.02)	(1.61)
Adjusted R-squared	0.76	0.76	0.83	0.82	0.46	0.28
Number of observations	42	42	43	43	23	23
F-statistic	20.08***	19.69***	31.19***	29.31***	3.63**	2.99**
P-value for Sargan's misspecification test	...	0.31	...	0.34	...	0.32

Source: Authors' calculations.

1/ Except for columns (1) and (2), where regular t-statistics of weighted least squares (WLS) are shown in parentheses, White's heteroskedasticity-corrected t-statistics are shown. The instruments used are: total government expenditures as a percent of GDP, the percent of unallocated education spending, the square of health care spending as a percent of GDP, and the square of health care spending in total government spending, as well as all other control variables of the OLS regressions. The adjusted R-squared for the 2SLS regressions are the adjusted generalized R-squared. Sargan's test is the test of the null hypothesis that the regression equation is correctly specified and that the instrumental variables are valid. ***Indicates significance at the 1 percent level; ** significance at the 5 percent level; and * significance at the 10 percent level.

2/ Coefficient estimates are multiplied by 100.

primary enrollment and net secondary enrollment (not reported) also suggest that the intrasectoral allocation and total level of education spending matters.[21]

The regression results show that socioeconomic variables, such as urbanization, the percent of the population in age group 0–14, adult illiteracy, and per capita income, are important in explaining variances in enrollment rates. Because of multicollinearity, the level of significance of the control variables should be interpreted with caution; nevertheless, findings presented here are broadly consistent with the empirical literature on determinants of education attainment.

Several conclusions can be drawn from the education regressions. First, despite the lack of data on some control variables the regressions explain a large part of the cross-country variation in enrollment rates. Second, the intrasectoral distribution of public spending for education generally has a statistically significant effect on indicators of both access and education attainment. Third, the overall level of education spending has a statistically significant impact on gross secondary school enrollments.[22]

Table 2 reports the results of an analysis of partial variances. For selected regressions, the adjusted R-squared of models of education attainment, with and without the intrasectoral spending variable, are compared. This analysis indicates that including intrasectoral spending

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[21]The coefficient estimate of the share of spending on primary plus secondary education from the WLS regression with gross primary enrollment as the dependent variable was 0.21. The coefficient estimate from an OLS regression with net secondary enrollment as the dependent variable was 0.19. They were both significant at the 5 percent level. OLS regressions with the spending and education attainment variables in logs were also run. These regressions yield similar results for gross primary and secondary enrollment and gross secondary enrollment as dependent variables, but the statistical significance of the intrasectoral spending variable for persistence through grade four regression was reduced.

[22]The regressions do not permit drawing up of conclusions about the effect of changes in the *level* of spending on primary and secondary education—as opposed to the *share* of such spending in total education expenditure. This issue was addressed by re-estimating the education regressions including spending on primary and secondary education as a percent of GDP and omitting the variables for intrasectoral spending and the overall spending. In the four regressions for enrollment, this newly defined spending variable was significant at the 1 percent level; the coefficient estimated ranges between 3.0 and 4.0. In the two regressions for persistence through grade four, spending on primary and secondary education as a percent of GDP was only significant at the 10 percent level, with a coefficient of 2.7 for the OLS regression and 5.5 for the 2SLS regression. These results suggest that, irrespective of the specification, spending for the two sectors matters.

Table 2. Adjusted R-squared of the OLS Education Attainment Regressions

	Gross Primary and Secondary Enrollment	Gross Secondary Enrollment	Persistence Through Grade Four
Including primary and secondary education spending share	0.76	0.83	0.46
Excluding primary and secondary education spending share	0.71	0.81	0.35

Source: Authors' calculations.

increases the explained cross-country variation in education attainment by between 2 percent and 11 percent.[23]

The magnitude of the impact of education spending on education attainment can be put in perspective by examining some of the relevant coefficient estimates. For instance, based on the estimates of the 2SLS regression in column (4) of Table 1, a 5 percentage point increase in the share of outlays for primary and secondary education in total public expenditures for education increases gross secondary enrollment by one percentage point. A one percentage point of GDP increase in spending on education increases gross secondary enrollment by more than 3 percentage points. Although this shows that spending and its intrasectoral allocation have an important impact on education attainment, it also indicates that raising attainment through shifting intrasectoral allocations or increasing total spending on education alone may be very difficult. This illustrates the importance of control variables in explaining education attainment.

[23]Partial variance analysis only yields accurate results if the underlying assumption on the ordering of casual effects is correct (i.e., partial variance analysis assumes here that public spending impacts on social indicators only after all other variables have taken effect). Alternatively, the results of partial variable analysis would be correct if spending has an effect independent from the other explanatory variables. Obviously, these are demanding assumptions, and the results presented here should be interpreted with caution.

Mingat and Tan (1998) provide another reason why the marginal costs of raising indicators of education attainment are so high. They demonstrate for a sample of 125 countries that as primary enrollment rises, resources earmarked for primary education are shifted toward decreasing pupil-teacher ratios (this shift in focus begins to occur at primary enrollment rates of as low as 50 percent). Consequently, these additional resources do not significantly increase enrollment rates or persistence.

B. Health Regressions

Table 3 reports the results of regressions with infant and child mortality rates as dependent variables. On average, the explanatory variables account for more than 75 percent of cross-country variation in infant and child mortality rates. The F-statistic for all regressions is statistically significant at the 1 percent level.

In the health regressions, the share of spending on primary health care is significant at the 10 percent level in both the OLS and 2SLS regressions. In contrast, total health spending is statistically insignificant.[24]

The results for the impact of health spending on infant and child mortality rates should be interpreted with caution. First, because of the above-noted lack of a uniform definition of primary health care, the intrasectoral distribution is not measured consistently across the sample.[25] Second, the sample size is relatively small. Third, the sample used for the health regressions includes eight observations that have zero spending on primary health care, which could reflect institutional differences in these countries (e.g., all primary health care could be private), or simply measurement error.[26] And finally, there is a relatively high degree of correlation between measles immunization and adult illiteracy, on the one hand, and total

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[24]In loglinear form, the regressions yield a different result: intrasectoral spending is insignificant at the 10 percent level but total health spending is significant at the 1 percent level in both equations.

[25]To test for a discernable impact of an inconsistent definition of primary health care, the regressions with a dummy variable to reflect the use of the two different definitions were run. The dummy variable was statistically insignificant, suggesting that the inconsistent measurement of primary health care spending does not bias the results.

[26]These observations were included in order not to reduce the already small number of observations. The regressions were also run for the sample excluding the countries with zero primary health care spending. Although coefficient estimates did not change by much, the statistical significance of intrasectoral spending and total health expenditures increased.

Table 3. Regression Results for Child and Infant Mortality 1/

	Infant Mortality		Child Mortality	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
Primary health care spending				
(percent of total health care spending)	-0.46*	-0.46*	-0.97*	-0.95*
	(-1.91)	(-1.91)	(-2.06)	(-2.00)
Health care spending				
(percent of GDP)	0.28	-0.32	2.50	1.01
	(0.20)	(-0.18)	(0.86)	(0.27)
Immunization against measles				
(percent of infants in total population)	-0.20	-0.20	-0.41	-0.39
	(-0.76)	(-0.79)	(-0.77)	(-0.72)
Access to sanitation				
(percent of population)	0.06	0.09	0.27	0.31
	(0.37)	(0.62)	(0.80)	(0.92)
Adult illiteracy rate				
(percent of population 15 years and older)	1.13***	1.08***	1.85***	1.78***
	(5.09)	(5.13)	(3.75)	(3.81)
Income per capita in PPP terms 2/	-0.22	-0.40**	-0.37	-0.64**
	(-1.30)	(-2.65)	(-1.34)	(-2.13)
Urbanization (percent of population)	-0.41	-0.30	-0.85	-0.69
	(-1.43)	(-1.14)	(-1.56)	(-1.38)
Adjusted R-squared	0.80	0.82	0.74	0.75
Number of observations	30	29	30	29
F-statistic	17.50***	20.09***	12.65***	13.12***
P-value of Sargan's misspecification test	...	0.79	...	0.91

Source: Authors' calculations.

1/ White's heteroskedasticity-corrected t-statistics are in parentheses. The instruments used are: total government spending as a percent of GDP, education spending as a percent of GDP, health care spending as a percent of total spending, and the square of health care spending other than on primary health care. The adjusted R-squares for the 2SLS regressions are the adjusted generalized R-squares. Sargan's test is the test of the null hypothesis that the regression equation is correctly specified and that the instrumental variables are valid instruments. *** Indicates significance at the 1 percent confidence level; ** significance at the 5 percent confidence level; and * significance at the 10 percent confidence level.

2/ Coefficient estimates are multiplied by 100.

health spending, on the other hand. When these control variables are omitted from the regression, the impact of total health care spending becomes statistically significant.[27]

As in the education regressions, control variables are important in explaining variances in health care status, including adult illiteracy and per capita income.[28]

Table 4 reports the results of partial variances for health regressions. These suggest that the primary health care spending variables may explain as much as an additional 4 percent of cross-country variation in health status.[29] This contrasts with the results of Filmer and Pritchett (1997), who contend that the contribution of health outlays to health care status as measured by child mortality rates is almost negligible (less than 1/6 of one percent).

Taking the results reported in columns (1) and (3) of Table 3, the coefficient estimates suggest that increasing the share of primary health care spending in total public health outlays by 5 percentage points—from 18 percent (the sample average) to 23 percent of total health spending—would decrease child mortality rates by 4.9 (per 1,000 children) and infant mortality rates by 2.3 (per 1,000 live births). The average child and infant mortality rates in the sample countries are high at 65 and 55, respectively. This suggests that gains from a reallocation of health resources can be significant.

IV. Conclusions and Policy Implications

Although greater public spending on primary and secondary education and primary health care is being advocated by many, little empirical evidence exists on the beneficial impact of such spending on social indicators. Using a comprehensive and internally consistent data set, this paper provides support for the proposition that the expenditure allocations within social sectors matter for education attainment and health status. The evidence is strongest for the education sector.

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[27]Re-estimating the regressions with primary health care in relation to GDP as an independent variable in place of other health spending variables yields statistically insignificant results, in part due to multicollinearity.

[28]Regional dummies were omitted from the health regressions, just as in the case of the education regressions, but for a different reason. In the health regressions, the dummy variable for Africa is strongly significant, and draws away the statistical significance of the other explanatory variables, including the public spending variables. However, since the focus of this study is to explain cross-country variation in child and infant mortality rates without regard to geography, regional dummies were omitted from the regressions.

[29]The additional variance explained by intrasectoral health spending increases to over 10 percent if insignificant control variables are dropped from the regressions.

Table 4. Adjusted R-squared of the OLS Health Status Regressions

Model	Child Mortality	Infant Mortality
Including primary health care spending	0.74	0.80
Excluding primary health care spending	0.70	0.78

Source: Authors' calculations.

Greater public spending on primary and secondary education has a positive impact on widely used measures of education attainment, and increased primary health care spending reduces child and infant mortality rates. For example, a 5 percentage point increase in the share of outlays for primary and secondary education increases gross secondary enrollment by one percentage point. A similar increase in the share of primary health care spending can decrease infant mortality rates by 2.3 (per 1,000 live births) and child mortality rates by 4.9 (per 1,000 children under 5 years of age).

Some caution, however, is required in using these results for estimating the budgetary resources needed for achieving targets in social areas.[30] For instance, regression estimates showed that performance in the education and health sector is also affected by per capita income, urbanization, adult illiteracy, access to safe sanitation and water, and immunization. Furthermore, there are other important determinants of performance in these sectors, including private sector spending, that were not included in the analysis owing to lack of data.

However, the implications for allocations within the education and health sectors are clear. Alesina (forthcoming) has contended that "many governments of low-income countries do not do enough, either to provide infrastructure or to reduce inequality, and what they do is inefficient and corrupt." If expenditure allocations for education and health care are to boost economic growth and promote the well-being of the poor, policy makers in many developing and transition economies need to pay greater attention to allocations within these sectors. These allocations—both their size and efficiency—are an important vehicle for promoting equity and furthering second-generation reforms.

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[30]Targets in social areas have been established at different foras. For example, the Development Assistance Committee (DAC) of the OECD, building on the results of the 1995 Social Summit in Copenhagen, has established goals that include reaching universal enrollment in primary education and reducing infant and child mortality by two-thirds in all developing countries by 2015 (OECD/DAC, 1996).

Countries with Intrasectoral Education Spending Data

Algeria
Bahrain
Belize
Bolivia
Botswana
Brazil
Bulgaria
Cameroon
Chile
Colombia
Congo
Croatia
Czech Republic
Ecuador
El Salvador
Ethiopia
Fiji
Ghana
Grenada
Guatemala
Guyana
Hungary
Iran, Islamic Republic
Jamaica
Jordan
Korea
Lao, PDR
Madagascar
Malaysia
Maldives
Malta
Mauritania
Mongolia
Myanmar
Panama
Papua New Guinea
Paraguay
Philippines
Romania
Sierra Leone
St. Vincent and the Grenadines
Syrian Arab Republic
Thailand
Togo
Tunisia
Turkey
Uruguay
Vanuatu
Vietnam
Zambia

Countries with Intrasectoral Health Spending Data

Armenia
Bahamas
Barbados
Belize
Bolivia
Botswana
Bulgaria
Croatia
Egypt
El Salvador
Ethiopia
Fiji
Grenada
Guinea
Honduras
Hungary
Jamaica
Jordan
Korea
Latvia
Lithuania
Malawi
Maldives
Mali
Malta
Morocco
Netherlands Antilles
Papua New Guinea
Paraguay
Philippines
Poland
Romania
St. Vincent and the Grenadines
Syrian Arab Republic
Tanzania
Thailand
Trinidad and Tobago
Tunisia
Turkey
Vietnam

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