Public Spending and Outcomes: Does Governance Matter?

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Abstract

This paper examines the role of governance—measured by level of corruption and quality of bureaucracy—and ask how it affects the relationship between public spending and outcomes. Our main innovation is to see if differences in efficacy of public spending can be explained by quality of governance. We find that public health spending lowers child and infant mortality rates in countries with good governance. Our results also indicate that as countries improve their governance, public spending on primary education becomes effective in increasing primary education attainment. These findings have important implications for enhancing the development effectiveness of public spending. The lessons are particularly relevant for developing countries, where public spending on education and health is relatively low, and the state of governance is often poor.

Keywords: Child mortality; Education attainment; Governance; Infant mortality; Public spending.

JEL classification: E62; O23

1. Introduction

The role of good governance has been emphasized in recent years as a key to development effectiveness. For example, it has been argued that merely allocating public resources for right goods and services may not lead to desirable outcomes if budget institutions—involving planning, management, and execution—are malfunctioning (World Bank 1998). While this proposition seems pretty straightforward and difficult to disagree with, no serious empirical work has been carried out to support it. In this paper, we study the impact of public spending on outcomes at different levels of governance.[1] The basic idea is to examine the link between specific budget allocations and outcomes, and see how these relationships are affected with improved governance.

A number of past studies (see Section 2 for references) have looked at the link between public spending and outcomes (e.g., impact of public spending on economic growth or on other outcomes such as health status or education attainment). In cases where public spending is found to have low or negligible impact, two explanations are given: First, it is argued that the link between public spending and development outcomes could be severed because an increase in public provision could lead to a "crowding out" of provision by the private sector. This line of reasoning does not question the efficacy of public spending per se; instead, it contends that due to substitution by public for private spending, additional public provision in many cases has a negligible net marginal effect. The second set of possible reasons for the ineffectiveness of public spending includes poor targeting and/or institutional inefficiencies such as leakage in public spending and weak institutional capacity.

In providing assistance to developing countries, a common approach adopted by most donor agencies is to ask for increases in budgetary allocation for programs on education and health. While in most cases this may be necessary, it is certainly not, by itself, sufficient to ensure enhancement or improvement in actual service delivery. Bad budget management has frequently been cited as one of the main reasons why governments in developing countries find it difficult to translate public spending into effective services (World Bank 1998). Characteristics of a public expenditure management system that

[1] According to World Bank (1994) "Good governance is epitomized by predictable, open, and enlightened policy making (that is, transparent processes); a bureaucracy imbued with a professional ethos; an executive arm of government accountable for its actions; and a strong civil society participating in public affairs; and all behaving under the rule of law.

contribute to the effectiveness of service delivery and lead to better outcomes include: (a) a comprehensive and properly approved budget; (b) internal control mechanisms (including well-functioning and transparent financial management and procurement systems) to ensure that funds are spent as intended; and (c) regular and timely reports to the legislature on actual expenditure in comparison to budgeted amounts. In the absence of such a system, public funds are likely to be wasted and/or misappropriated. A reasonable proposition, therefore, can be made: Managing public resources to promote development requires well-trained, skillful personnel, working in an institutional setting with an incentive system to reduce fraud and promote cost efficiency. The main objective of this research is to empirically examine a testable version of this proposition. More specifically, we address the following three questions:

1. How effective is public spending in improving social indicators such as infant mortality? Could public resources help achieve better education outcomes?
2. What is the contribution of a public expenditure management system that promotes cost efficiency by reducing corruption in enhancing the link between public spending and social outcomes?
3. How important is the public sector's institutional capacity—in particular, human resources—in providing effective services that lead to better development outcomes?

The remainder of this paper is organized as follows. Section 2 provides a brief review of the links between public spending and development outcomes that have been studied in the past. This section also provides the motivation behind our research. Section 3 describes a model that gives us estimable equations. In Sections 4 and 5 we discuss our experiments with institutional variables that affect the spending-outcome link in health and education sectors, respectively. Section 6 presents our concluding remarks.

2. Public Spending and Outcomes: What Do We Know?

There is a fair amount of research on the relationship between public spending and outcomes. The research on endogenous growth in the 1990s has produced several models linking public spending with the economy's long-term growth. Aschauer (1989), Barro (1990, 1991), Levine and Renelt (1992) Easterly and Rebelo (1993), and Devarajan, Swaroop, and Zou (1996), among others, have studied the relationship between public spending and economic growth. A number of these studies find

conflicting results regarding the growth impact of different types of sectoral spending. For example, Easterly and Rebelo (1993) show that public investments in transport and communication in developing countries is positively correlated with growth, with a very high coefficient. On the other hand, using data from 43 developing countries over 20 years Devarajan, Swaroop, and Zou (1996) find that capital spending—in particular, public investments in transport and communication—has a negative correlation with per-capita real GDP growth.

In addition to the work on the relationship between public spending and economic growth, many researchers have examined the link between sectoral public spending (mostly in the health and education sectors) and outcomes in those sectors. For example, Harbison and Hanushek (1992) examined 12 studies on developing countries that look at the association between public education spending and educational outcomes. Six of these studies report a statistically significant positive relationship between the two; others found no evidence of any measurable impact of spending on outcomes. Elley (1992), Hanushek (1995), Mingat and Tan (1992, 1998) also find that that there is little if any relationship between public education spending and educational outcomes. Using cross-section data—1994 data for 50 developing and transition countries—Gupta, Verhoeven, and Tiongson (1999) find that primary health care spending is positively associated with child and infant mortality rates. In an earlier study, Bidani and Ravallion (1997) looked at 35 developing countries in 1990 and found a positive effect of public health spending on outcomes such as life expectancy and infant mortality rates. Filmer and Pritchett (1999) provide a good survey of studies linking public spending with health outcomes. In their own work, they find that the two are very tenuously related. According to their results, doubling public spending from 3 to 6 percent of GDP would improve child mortality by only 9 to 13 percent.

What do these weak links between public spending and development outcomes indicate? Does it mean that these governments (mostly in developing countries) are spending on unproductive activities? Should they not be spending on education and health? Generally, it is difficult to draw such policy conclusions from cross-country data, as much depends upon the country specific situation. However, it is possible that these studies do not shed light on the "true" relationship between public spending and development outcomes. The link between public spending and desirable outcomes may, in practice, be

severed when there is no incentive mechanism in the public sector to use available funds for productive purposes. In explaining the negative link between capital spending and per capita growth, Devarajan, Swaroop, and Zou (1996) note that this may reflect a problem in the link between public spending and service delivery. They argue that while public capital stocks in developing countries have been shown to be associated with economic growth, it may be the case that public spending—as measured from budget documents of countries—does not create any productive capital.

Surveying the literature on the link between public spending and outcomes, Pritchett (1996) notes that all of the negative or ambivalent findings on public spending could potentially be a reflection of differences in the efficacy of spending. These differences could arise due to a variety of reasons including corruption and patronage, and need not necessarily be attributed to bad economic policy. In other words, a unit's worth of public spending does not necessarily buy a unit's worth of service. A good example supporting this theory comes from a public expenditure tracking survey done in Uganda, a poor Sub-Saharan African country. In a survey of 250 primary schools in Uganda, Ablo and Reinikka (1998) found that on average these schools received only 13 percent of the budgetary allocation for non-wage expenditures; the remaining amount—en route from the finance ministry to the facilities—either disappeared or was used for purposes unrelated to primary school education. If a researcher were to use such budgetary information on primary school expenditures from government accounts, she may find that there is very little, if any, impact of public primary education spending on education attainment of primary-schoolers. In reality, such a result reveals little about the true worth of a unit of spending on primary education spending. At the same time, it is difficult for the researcher to find out, over a period of time and across countries, what is the "true" amount of spending on public programs.

Yet another reason the link between public spending and outcomes could be broken is the displacement of private sector effort by public spending. This argument is eloquently made in Filmer, Hammer, and Pritchett (2000). Commenting on the weak links that several studies have found between public spending on health and health status, the authors argue, "…changes in the price or availability of government interventions may induce a private supply response that can mitigate any actual impact on health outcomes." Thus, if an increase in public spending on health crowds-out private sector provision

of such services then the likely impact of an additional unit of public spending on health status may be minimal.

Does governance affect development outcomes? There is now a large empirical literature on the relationship between a variety of governance indicators and development outcomes.[2] A majority of these studies show that improved governance leads to better development outcomes. These studies have analyzed the effects of corruption and institutions on, among other variables, economic growth, public investment, foreign direct investment, and social infrastructure. Kaufman et al (1999) show that governance indicators (that include voice and accountability, political stability and violence, government effectiveness, regulatory burden, rule of law and graft) have a strong *direct* negative impact on infant mortality. Gupta, Verhoeven, and Tiongson (1999) also find that countries with high corruption have high child and infant mortality rates.

In this section we have reviewed the research that links public spending with development outcomes. We have also provided information on the research that links governance with development outcomes. But each of these captures only a part of the full picture. The reality is that public spending, governance, and development outcomes are interlinked. We believe that governance[3] affects the relationship between public spending and outcomes; it is this impact that we seek to measure in our research. Our main experiment is to see if differences in the efficacy of public spending can be explained by the quality of governance.

3. Production of Development Outcomes

Suppose the development outcome of a public program p in an economy i is produced from the following model of production:

$$Outcome_i^p = e^{A_i} * \left(\frac{GDP_i}{N_i}\right)^a * \left(\frac{Pubex_i^p}{GDP_i}\right)^b \qquad where \;\; a > 0 \; ; \; b \geq 0 \tag{1}$$

where $Pubex^p_i$ is public spending on program p that produces $Outcome^p_i$ in country i, N_i is the country's population, GDP is gross domestic product, and A represents a set of country specific

[2] Kaufmann, Kraay, and Zoido-Lobaton (1999) provide a brief survey of this literature.

factors. The production function in equation (1) indicates that the development outcome of a public program *p* in a country: (a) improves with an increase in its income; (b) improves (or does not worsen) if an increased proportion of the country's resources are spent on that public program; and (c) depends on other country-specific factors. The outcomes could, for example, be indicators of health status (e.g., child mortality) or education attainment (e.g., proportion of children completing primary education) at any given point of time, which can be influenced, among other factors, by public spending.

Taking logs, equation (1) can be written in linear form as:

$$\ln\left(Outcome_i^{\,p}\right) = A_i + a\ \ln\left(\frac{GDP_i}{N_i}\right) + b\ \ln\left(\frac{Pubex_i^{\,p}}{GDP_i}\right) \qquad (2)$$

Given data the above model can be estimated to examine, among other things, the link between public spending on program *p* and the associated outcome of that program.

3.1 Modeling the efficacy of public spending: The governance factor

In estimating the relationship between public spending and a development outcome as specified in equation (2), a researcher typically takes the information on spending from public budget documents. But what if only a fraction of that spending is actually undertaken and the remainder disappears (as in the Ugandan example given above). To allow for such a possibility, let us suppose that only a fraction γ (.) of public resources are actually spent for productive purposes. Following Pritchett (1996), b, the coefficient on public spending on program *p* in equation (2) can be written as:

$$b = g(.) * b_p \quad (3)$$

where b_p is the productivity of public capital that is created from the spending on program *p*. Let us further assume that γ(.), which measures the efficacy of public spending, is a function of the state of governance, G_i , in each country *i*. Therefore,

$$g_i = f_{0,i} + f_{1,i}\ G_i \quad (4)$$

[3] In this paper we measure governance by two specific indicators: quality of bureaucracy and level of corruption.

G_i could indicate the level of corruption or the institutional capacity in country i. Substituting from equations (3) and (4), and rearranging terms, equation (2) can be written as:

$$\ln\left(Outcome_i^{\,p}\right) = A_i + a\ \ln\left(\frac{GDP_i}{N_i}\right) + b_p\ \left(f_{0,i} + f_{1,i}\ G_i\right)\ln\left(\frac{Pubex_i^{\,p}}{GDP_i}\right) \tag{5}$$

In our empirical work we estimate variants of the above equation.

4. Efficacy of Public Health Spending

Every country—rich or poor, developed or underdeveloped—undertakes public health spending with a single dominant objective: to improve the health of its citizens. Different countries adopt different approaches in meeting this objective. Some spend more public resources than others; some spend more on preventive than curative care; and some countries rely more on the private sector for service delivery. There is a wide variation in public health spending across countries: Governments spend from less than 1 to more than 8 percent of their GDP on public health related activities.

Our approach in this paper is to interact a public health spending variable with a governance indicator and create a measure of "efficacious" public spending on health. In turn, we examine the impact of this measure on health status. This analysis allows us to empirically examine whether public health spending is more effective in improving health status in countries with good governance.[4]

4.1 Empirical specification

Using the model outlined in Section 3, we estimate the following equation:

$$\begin{aligned}\ln\left(HS_i\right) = d_0 + d_1 \ln\left(PCGDP\right)_i + d_2 \ln\left(PHSGDP\right)_i + d_3\, G_i \\ + d_4 G_i * \ln\left(PHSGDP\right)_i + B\, X_i + e_i\end{aligned} \tag{6}$$

where the variables for country i are: *HS*—a measure of health status–Under-5 mortality (child) rate or infant mortality rate; *PCGDP*—per capita GDP measured in purchasing power parity adjusted dollars; *PHSGDP*—share of public health spending (defined as recurrent and capital spending from government [central and local] budgets, external borrowings and grants) in GDP; *G*—a measure of governance

(index of corruption or quality of bureaucracy); X—A vector of non-health related country specific factors; B—*a* vector of coefficients of X; and ε—an error term. In order to capture the direct effects that governance may have on health status, the variable G_i is included as an independent term in the equation.

4.2 Data and choice of variables

Our empirical analysis uses annual data for 1990 and 1997 (see Appendix A for more information on data including sources). These two years are chosen because we have, for them, the necessary information on a fairly decent sample of countries. Moreover, we wanted to compare our results with those of Filmer and Pritchett (1999), who have also used 1990 as the year for their cross-national study.

We study the impact of public health spending on child (under 5) and infant mortality. However, unlike previous researchers, we model the interaction between public spending and governance indicators in assessing this impact. Like Filmer and Pritchett (1999), the variable on public health spending that we use is available for a large cross-section of countries from the World Development Indicators that are put together by the World Bank. This variable measures total public spending on health; it is used because data on its composition across different health inputs are not available. We use two measures of governance—corruption and bureaucratic quality—to interact with public health spending. These indicators—measured on a scale of 0 to 6 (for corruption) and 1 to 6 (for bureaucratic quality) and available on a monthly basis—are put together by the U.S.-based Political Risk Services Group, which provides information on a regular basis for international businesses. The index of corruption measures corruption within the political system, which among other things reduces the effectiveness of government. The indicator of bureaucratic quality measures institutional strength and quality of the civil service. It assesses how much strength and expertise bureaucrats have. Other non-health related variables that we use in the regressions are standard in the literature; they include, among others, ethno-linguistic fractionalization, percentage of population that is Muslim, percentage of all females aged 15 and above that have attained primary education, percentage of population in urban

[4] This is similar to the approach used by Burnside and Dollar (2000) in asking the question if foreign aid has a stronger (positive) impact on growth in countries with good policies.

areas, and the Gini coefficient which is a measure of income inequality. We also include a demographic variable—the percentage of population aged under-5 for the child mortality regressions and under-1 for the infant mortality regressions, respectively.

4.3 Empirical results

Our health status regressions are done for two different samples. The sample used for the regressions with child (under 5) mortality as the dependent variable has a total of 148 observations over the two years (1990 and 1997) from 90 developed and developing countries. A larger sample, with 169 observations from 98 (developed and developing) countries, is used for the regressions with infant mortality as the dependent variable. In both sets of regressions, a dummy variable is included to differentiate between the two sets of observations corresponding to different years; this allows for independent trends in health status over time. From the two samples, we obtain the mean values of child and infant mortality (per 1,000 live births) as 59 and 42, respectively. The average share of public health spending in GDP for the two samples is nearly 3.3 percent, with a range of less than one-half to over eight. The mean values for the governance indicators—the corruption index and quality of bureaucracy—are 3.5 and 3.7, respectively. Finally, the average values of the purchasing-power-parity adjusted per capita GDP (in 1990 dollars) for the two samples are 9,298 and 8,920, respectively.

Table 1A. Summary Statistics on Public Health Spending, Governance and Outcomes

(Data from 90 countries over two years, 1990 and 1997)

Variables	*Observations*	*Mean*	*Std. Dev.*	*Min*	*Max*
Under-5 mortality rate	148	57.7	60.5	5	260
Public health spending (share in GDP)	148	3.32	2.13	.18	8.25
Per capita GDP (in PPP adjusted 1990$)	148	9,298	8,812	547	38,136
Index of corruption (least corrupt = 6)	148	3.5	1.5	0	6
Quality of bureaucracy (highest = 6)	148	3.7	1.5	1	6

Note: 1. Countries in the sample are: Argentina, Australia, Austria, Bahamas, Bangladesh*, Belgium, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Cameroon, Canada, Chile, China, Colombia, Democratic Republic of Congo, Costa Rica, Cote d'Ivoire, Denmark, Ecuador*, Egypt, El Salvador, Finland, France, Gabon*, Germany*, Ghana, Greece, Guatemala, Guinea, Guinea-Bissau*, Guyana*, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, South Korea, Kuwait, Lebanon, Luxembourg, Madagascar, Malawi, Malaysia, Mexico, Morocco, Mozambique, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Saudi Arabia, Senegal, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Kingdom, Uruguay, Venezuela, Yemen.

2. Countries marked with * in (a) have only one observation.

Table 1B. Summary Statistics on Public Spending, Governance and Outcomes
(Data from 98 countries over two years, 1990 and 1997)

Variables	*Observations*	*Mean*	*Std. Dev.*	*Min*	*Max*
Infant Mortality Rate	169	42.3	37.6	3.7	150
Public health spending (share in GDP)	169	3.26	2.10	.18	8.25
Per capita GDP (in PPP adjusted 1990$)	169	8,920	8,877	420	38,135
Index of Corruption (least corrupt = 6)	169	3.5	1.4	0	6
Quality of Bureaucracy (highest = 6)	169	3.6	1.5	1	6

Note: In addition to the countries listed in the above sample, the other countries are: Angola, Brunei, Dominican Republic, Gambia, Mali, Mongolia, United States, and Zambia.

4.3.1 OLS regressions: Factors affecting health status

Table 2 contains the OLS estimates of our model given in equation (6). Equation (2.1) presents the results from estimating a simple version of equation (6)—one that does not include the governance variable. It indicates that a 1 percentage increase in per capita GDP at the margin is associated with a .44 percent reduction in child mortality, i.e., the estimated elasticity of mortality is –.44. At the same time, a one percent increase in the share of public health spending in GDP is linked with a .19 percent reduction in child mortality. These two and other non-health related variables explain 92 percent of the variation in cross-national child mortality rates.[5]

[5] When estimated in a rather parsimonious form—with only two regressors: per capita GDP and public health spending—the model explains 88 percent of the variation in cross-national child mortality rates. Moreover, both variables are statistically significant and have the right signs.

Table 2. OLS Regressions: Factors affecting health status
(White heteroskedasticity-corrected *t*-statistics in parentheses)

Dependent variables →	*Under-5 mortality (natural log)*			*Infant mortality (natural log)*		
Independent variables ↓	*Eq. (2.1)*	*Eq. (2.2)*	*Eq. (2.3)*	*Eq. (2.4)*	*Eq. (2.5)*	*Eq. (2.6)*
GDP per capita in PPP adjusted 1990$ (ln)	–0.44	–0.37	–0.33	–0.47	–0.39	–0.35
	(–4.94)	(–4.35)	(–3.55)	(–5.82)	(–5.30)	(–4.16)
Public health spending (ln of share of GDP)	–0.19	0.08	0.15	–0.19	0.09	0.18
	(–2.45)	(0.68)	(1.47)	(–3.02)	(0.99)	(2.25)
Index of corruption (least corrupt = 6)		–0.04			–0.03	
		(–1.03)			(–0.91)	
Quality of bureaucracy (highest = 6)			0.03			0.05
			(0.79)			(1.56)
Index of corruption **x** public health spending (ln of share of GDP)		–0.07			–0.08	
		(–2.36)			(–2.92)	
Quality of bureaucracy **x** public health spending (ln of share of GDP)			–0.10			–0.12
			(–3.77)			(–4.61)
Female education	–0.01	–0.01	–0.01	–0.008	–0.008	–0.009
	(–3.57)	(–3.78)	(–4.22)	(–2.94)	(–3.20)	(–3.95)
Income inequality	0.009	0.007	0.006	0.01	0.007	0.007
	(2.14)	(1.61)	(1.51)	(2.41)	(1.70)	(1.84)
Predominantly Muslim	–0.0004	–0.002	–0.001	–0.0003	–0.001	–0.001
	(–0.26)	(–1.24)	(–0.76)	(–0.27)	(–1.19)	(–0.91)
Ethno-linguistic fractionalization	0.40	0.52	0.57	0.09	0.22	0.25
	(3.00)	(4.15)	(4.29)	(0.73)	(1.99)	(2.18)
Access to safe water	–0.002	–0.002	–0.003	–0.003	–0.003	–0.004
	(–0.55)	(–0.74)	(–0.93)	(–1.03)	(–1.16)	(–1.64)
Degree of urbanization	0.004	0.002	0.004	0.004	0.002	0.004
	(1.45)	(0.93)	(1.43)	(1.47)	(0.96)	(1.56)
Percentage of population aged under 5	0.04	0.04	0.04			
	(2.43)	(2.74)	(2.73)			
Percentage of population aged under 1				0.16	0.17	0.16
				(2.45)	(2.88)	(2.70)
Distance from the Equator	–0.15	0.24	0.23	–0.10	0.28	0.32
	(–0.51)	(0.78)	(0.73)	(–0.38)	(1.05)	(1.16)
Dummy for year 1997	0.05	–0.002	0.01	0.02	–0.02	–0.01
	(0.88)	(–0.03)	(0.03)	(0.41)	(–0.49)	(–0.17)
Constant	7.25	6.90	6.40	7.15	6.74	6.26
	(9.01)	(8.97)	(7.80)	(10.37)	(10.22)	(8.50)
R-squared	.92	.94	.93	.91	.93	.93
Number of observations	148	148	148	169	169	169

Earlier in this section we have discussed creating a measure of "efficacious" public spending on health. To do this, we interact public health spending with the index of corruption and include this as an additional regressor. To capture the direct effect of corruption on health status, we also include the index of corruption independently. This result is reported in equation (2.2).[6] The coefficient on the public

[6] One alternative to the standard OLS technique is to allow for serial correlation between two error terms corresponding to the same country. Since we have only two years of time series, there will be at most two error terms per country. Allowing

health spending is positive and statistically insignificant, but spending interacted with corruption has a significant coefficient of –.07 (*t*-statistics of 2.4). Among other regressors, income inequality and ethno-linguistic fractionalization are positively and significantly correlated with child mortality. In countries where more women have completed primary education, child mortality is lower. Countries with a higher percentage of population under-5 have higher child mortality rates. A similar result (see equation 2.3) is obtained when the spending variable is interacted with the quality of bureaucracy index: the coefficient on spending alone is positive and insignificant, but the interaction term has a significantly negative coefficient. The results on the infant mortality variable are very similar (equations 2.4 – 2.6) though the elasticity of infant mortality with respect to health spending is smaller than that of under-5 mortality. This is consistent with the theory that neo-natal deaths are caused by factors that are more genetically determined than deaths occurring later in life.

All in all, our results in Table 2 support two basic hypotheses: (1) rich countries have lower child and infant mortalities; and (2) the link between public health spending and child mortality is negative, but the efficacy of public spending in lowering child and infant mortalities is positively related with the level of governance. The first is a fairly consistent result in the literature. The second finding confirms what proponents of good governance have been arguing: Well-functioning public institutions are critical for translating public spending into effective services. In the next section we examine the case of treating public health spending as endogenous.

4.3.2 Two-stage least squares (2SLS) regressions

The OLS results presented in the previous sub-section are based on the assumption that public health spending is exogenously determined. As previous researchers have noted, it is possible that the two main variables in our analysis—public health spending and health status—are jointly determined. There also exists the possibility of reverse causation. For example, it is likely that when faced with poor and/or deteriorating health status of their citizens, governments would increase spending on health. Rich

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for this type of correlation, and re-running the regressions using the Generalized Least Squares method, our results are very similar to those obtained using OLS. We chose to report the latter because they are considerably more robust to different specifications and sets of independent variables.

countries, when providing debt relief to poor countries, often insist that such relief be spent on activities that would improve health and education outcomes.

To test the robustness of our results, we need to address the endogeneity problem. We do this by using instruments for public health spending (as well as for the interaction term) in a two-stage least squares regression. The instruments that we use are public health spending (expressed as a ratio of GDP) of a neighboring country; and (own) population. The process by which we choose the most appropriate neighbor is explained in Appendix A.

The 2SLS regressions are reported in Table 3. In our basic equation (3.1), which does not include the governance variable, we find that the public spending variable is statistically insignificant and has the wrong sign.[7] When we include the governance measures and interact them with the spending variable, our OLS results are confirmed. Equation (3.2) reports –.37 as the estimated elasticity of mortality with respect to income. Our measure of "efficacious" public spending—the interactive term—is of the right sign and is statistically significant, similar to the OLS result reported earlier. Results when public spending is interacted with the quality of bureaucracy index (equation 3.3) and when infant mortality is used as the dependent variable (equations 3.4 – 3.6) are similar. In the next sub-section, we look at the impact of public health spending on health status and examine how it changes under different levels of governance.

4.3.3 Impact of good governance in improving the efficacy of public health spending

Table 4 reports the net impact of public health spending on health status by combining the results obtained through different regressions reported in sub-sections 4.3.1 and 4.3.2. The first part of the table—Section A, which is based on regressions without the interactive (public spending with governance indicator) regressor—shows mixed results. It shows that when the OLS procedure is used, the impact of public health spending on under-5 mortality and infant mortality is negative, i.e., increasing public resources for health lowers these mortalities. On the other hand, when the 2SLS procedure is used to take into account the joint endogeneity problem, the impact of public health spending on both the mortalities is not significantly different from zero.

[7] This finding is also consistent with the results reported by Filmer and Pritchett (1999).

Table 3. 2SLS Regressions: Factors affecting health status
(White heteroskedasticity-corrected *t*-statistics in parentheses)

Dependent variables →	Under-5 mortality (natural log)			Infant mortality (natural log)		
Independent variables ↓	*Eq. (3.1)*	*Eq. (3.2)*	*Eq. (3.3)*	*Eq. (3.4)*	*Eq. (3.5)*	*Eq. (3.6)*
GDP per capita in PPP adjusted 1990$ (ln)	–0.53	–0.37	–0.32	–0.47	–0.37	–0.36
	(–3.98)	(–4.7)	(–3.47)	(–5.41)	(–4.93)	(–4.64)
Public health spending (ln of share of GDP)	0.16	–1.04	–0.19	–0.16	–0.13	–0.05
	(0.42)	(–1.50)	(–0.75)	(–0.62)	(–0.37)	(–0.23)
Index of corruption (least corrupt = 6)		0.15			0.03	
		(1.32)			(0.48)	
Quality of bureaucracy (highest = 6)			0.03			0.05
			(0.69)			(1.02)
Index of corruption **x** public health spending (ln of share of GDP)		–0.10			–0.10	
		(–3.07)			(–3.20)	
Quality of Bureaucracy **x** Public health spending (ln of share of GDP)			–0.07			–0.05
			(–1.95)			(–2.82)
Female education	–0.01	–0.01	–0.01	–0.008	–0.008	–0.01
	(–3.06)	(–2.92)	(–4.33)	(–2.97)	(–3.08)	(–3.51)
Income inequality	0.008	0.01	0.008	0.01	0.008	0.008
	(1.65)	(1.80)	(2.10)	(2.23)	(1.99)	(2.31)
Predominantly Muslim	0.001	–0.003	–0.001	–0.0003	–0.002	–0.001
	(0.37)	(–1.57)	(–1.08)	(–0.18)	(–1.51)	(–1.11)
Ethno-linguistic fractionalization	0.56	–0.01	0.40	0.10	0.15	0.18
	(2.75)	(–0.03)	(2.11)	(0.76)	(0.89)	(1.20)
Access to safe water	–0.006	0.01	0.0006	–0.003	0.0005	–0.002
	(–1.09)	(1.31)	(0.17)	(–0.75)	(0.10)	(–0.48)
Degree of urbanization	0.005	0.001	0.003	0.004	0.002	0.004
	(1.54)	(0.39)	(1.45)	(1.50)	(1.04)	(1.64)
Percentage of population aged under 5	0.03	0.07	0.04			
	(1.72)	(2.37)	(2.69)			
Percentage of population aged under 1				0.16	0.21	0.18
				(2.40)	(2.88)	(2.74)
Distance from the Equator	–0.53	1.21	0.35	–0.14	0.69	0.45
	(–1.01)	(1.81)	(1.03)	(–0.28)	(1.44)	(1.30)
Dummy for year 1997	0.009	0.18	0.06	0.02	0.06	0.009
	(0.13)	(1.28)	(0.85)	(0.38)	(0.28)	(0.15)
Constant	8.08	4.08	6.16	7.20	–3.94	6.18
	(6.86)	(2.19)	(7.78)	(8.80)	(–1.37)	(9.62)
R^2 of first-stage regressions						
Public health spending		.71	.71		.64	.65
Public health spending *x* (corruption or bureaucracy)		.88	.87		.86	.85
Other statistics						
R-squared	.90	.93	.92	.91	.91	.92
Number of Observations	148	148	148	169	169	169

Note: Instruments: Neighbor's public health spending, population, neighbor's public health spending *x* index of corruption, Neighbor's public health spending *x* index of bureaucracy.

Table 4. The Impact of Public Health Spending on Health Status

A. Results from regressions without the governance interaction term

Impact on ®	Under-5 mortality	Infant mortality
OLS (Table 2)	–.19**	–.19**
2SLS (Table 3)	.16	–.16

B. Results from regressions with the governance interaction term, i.e., $d_2 + d_4 * G_i$

Impact on ®	Under-5 mortality						Infant mortality					
	Corruption index			*Quality of bureaucracy*			*Corruption index*			*Quality of bureaucracy*		
Evaluated at ®	*2.0*[B]	*3.5*[M]	*5.0*[U]	*2.2*[B]	*3.7*[M]	*5.2*[U]	*2.1*[B]	*3.5*[M]	*4.9*[U]	*2.1*[B]	*3.6*[M]	*5.1*[U]
OLS (Table 2)	–0.06	–.16**	–.26**	–.07	–.22**	–.37**	–.07	–.17**	–.27**	–.06	–.23**	–.41**
2SLS (Table 3)	–1.24	–1.40*	–1.56**	–.35	–.45**	–.56**	–.34	–.49	–1.66*	–.24	–.38**	–.52**

Note: 1. Evaluated at: [M] The sample mean; [B] One standard deviation below the mean; and [U] One standard deviation above the mean.

2. Based on a 't' test for functions of parameters: [*] Significantly lower than 0 at the 10-percent level; [**] Significantly lower than 0 at the 5-percent level.

Our main finding, however, emerges from the bottom half of the table: Section B reports the total impact of public health spending on under-5 and infant mortalities when the model includes the interactive regressor. The net impact from the different regressions reported in the sub-sections 4.3.1 and 4.3.2 is calculated as follows:

$$\frac{\%\ \Delta\ in\ mortality}{\%\ \Delta\ in\ public\ \ health\ spending} = d_2 + d_4\ G_i$$

where d_i are the coefficient estimates of equation (6) and G_i is the governance indicator—corruption index or quality of bureaucracy. In Table 4, this elasticity of mortality with respect to public health spending is calculated at different levels of governance, using the estimates of the coefficients d_i from the regressions previously reported (in Tables 2 and 3). Each time, a *t*-test is used to evaluate if the estimated elasticity is significantly different from zero (see Maddala 1992, for more information on this procedure). For example, Section B shows that the elasticity of under-5 mortality, obtained from the OLS regression (2.2), is –.16 (significant at the 5-percent level), when evaluated at 3.5, which is the sample, mean of the corruption index. When evaluated at 5.0 (one standard deviation above the mean value), which indicates that corruption is lower, the elasticity is –.26 and is significant at the 5-percent level. Finally, it is not significantly different from zero when the corruption index is 2.0—one standard

deviation below the mean value. The elasticities are consistently negative and increasing in absolute size when evaluated at a good level of governance. There is a clear pattern that in countries with low levels of governance (i.e., countries which are rated as very corrupt or are rated to have very ineffective bureaucracy), public health spending at the margin will be inefficacious. Moreover, these findings are consistent along all dimensions, i.e., method of estimation (OLS or 2SLS), governance indicator (corruption index or quality of bureaucracy), and health status (under-5 mortality or infant mortality).

5. Measuring the Efficacy of Public Education Spending

As discussed in Section 2, past research findings on the link between public education spending and measurable outcomes provide mixed evidence. In studying this relationship, our aim is to examine how is it affected when we move from a state of low quality to high quality governance.

5.1 Choosing a measure of education outcome

One important difference between the health and education sectors is that it is difficult to find educational outcome measures that are consistent across countries. In education there is no equivalent to the child and infant mortality indicators used in the health sector. Data on enrolment rates are widely available, but they do not reflect quality differences across countries. Moreover, enrolment numbers, especially at the primary level, include repeaters as well as students that subsequently drop out of school. For example, Filmer and Pritchett (1999) report that in almost all countries in South America, enrolment in the first grade is nearly 100 percent, but due to high dropouts rates, a large proportion of those enrolled do not complete primary school education.

Educational *attainment* has been used by several researchers to measure outcomes (Barro and Lee 1996, 2000).[8] Attainment can be defined as the number or proportion of school-age children that enter *and complete* primary or secondary school, or a particular grade. This is a superior measure to enrolment because it excludes students that drop out of school prematurely and the number of repeaters does not affect it. There is another advantage of using educational attainment: it has a strong inverse

[8] Literacy rates are also measures that can be used for educational attainment. However, data on these are generally available only as stock rather than flow measures; for example, figures on the proportion of *all* adults that are literate are widely available (e.g., World Development Indicators 2000). But it is difficult to link such a measure with the available data

relationship with dropout rates, and the latter are, in turn, markedly affected by educational quality (Harbison and Hanushek 1992, Barro and Lee 1996). Holding other things constant, students who receive good education—as reflected by good instruction aided with textbooks and other instructional materials—are more likely to stay in school. Thus, one could argue that high attainment rates indirectly reflect high educational quality.

5.2 Empirical specification, data and choice of variables

We estimate a similar model to that which was used for the health sector regressions:

$$\ln(FPS_i) = l_0 + l_1 \ln(PCGDP)_i + l_2 \ln(PESGDP)_i + l_3 G_i + l_4 G_i * \ln(PESGDP)_i + B X_i + w_i \quad (7)$$

where the variables for country *i* are: *FPS* —proportion of those who fail to complete primary school education;[9] *PCGDP*—per capita GDP measured in purchasing power parity adjusted dollars; *PESGDP*—share of public primary education spending in GDP; *G*—a measure of governance (index of corruption or quality of bureaucracy); *X*—*a* vector of non-health related country specific factors; *B*—*a* vector of coefficients of *X*; and ω—an error term. In order to capture the direct effects that governance may have on education outcome, the variable G_i is also included as an independent term in the equation.

The measure of educational failure that we use is constructed as follows:

$$EF^{j,t} = 100 - Attain\,PS^{j,t} = 100 - Intake\,PS^{j,t} \; x \; EComp\,PS_{0,5}^{j,t}$$

$Attain\,PS^{j,t}$ is an estimate of the percentage of all children aged *j* – the official age of entry into primary school–at time *t* who actually enter Grade 1 and are expected to continue and complete Grade 5. This estimate reflects two factors: (1) $Intake\ PS^{j,t}$ which is the proportion of all children of primary-school entry age who actually start school at time *t*; and (2) $EComp\,PS_{0,5}^{j,t}$ which measures the proportion of $Intake\ PS^{j,t}$ who are expected to continue and finish Grade 5. The measure $EComp\,PS_{0,5}^{j,t}$ is calculated using data on completion rates for students in Grade 1 through 5 at time *t*

on annual education spending, which is a flow measure. Standardized test scores are available for very few countries, mostly developed.

[9] To be consistent with our mortality measures of the health sector, we use education non-attainment as our outcome measure.

(for more details, see Appendix A). The cutoff point for calculation of the completion rate is Grade 5 rather than the final grade in primary school, because the latter varies substantially across countries.[10]

There is ample anecdotal and empirical evidence that educational outcomes are affected by family factors such as parents' income, occupations and educational background (Psacharopoulos and Woodhull 1985, Hanushek 1995, Barro and Lee 1996). These are reflected in three of our right-hand side variables: per capita income, the Gini coefficient (an indicator of income distribution), and the overall level of adult literacy. One could argue that the adult literacy variable is endogenous as unobserved factors affecting it may also affect primary school attainment. This is not a major issue in our analysis as our primary interest is not in the coefficient of the adult literacy variable. We do check our results by performing each education regression twice: once with adult literacy as a right-hand side variable, and once without it. Primary education spending is one of the key regressors in our analysis, along with the same two governance variables as in the health regressions: the level of corruption and of bureaucratic quality. Other right-hand side variables include ethno-linguistic fractionalization, the proportion of Muslims in the population, the level of urbanization, the proportion of the population aged 6 to 12, and a dummy variable for East Asia. The first three are also included in the child and infant mortality regressions; they reflect racial, cultural and physical circumstances that may arguably affect education provision and demand. The proportion of the population aged between 6 and 12 is a demographic factor that has shown to be strongly related to educational outcomes (Mingat and Tan 1998). A dummy variable for the countries in the East Asia Region is included as there seems to be a strong emphasis on the importance of education in these countries, probably due to cultural reasons (Stevenson 1992, Barro and Lee 1996). Our sample includes three countries from this Region: China, Thailand and South Korea.

[10] In principle, a similar technique could be used to compute attainment at the secondary and tertiary levels. In practice, however, the data required for this are not available for a sufficiently large number of countries. We tried using secondary school enrolment as a proxy for secondary level attainment, a not indefensible procedure since secondary school dropout rates tend to be relatively low in many countries. The ensuing regressions did not, however, perform well. In this paper, we report only the results of regressions explaining variations in failure to attain five years of primary education.

5.3 Empirical results

Our education results are based on a sample that has 72 observations from 57 countries over the same two years as for the health regressions: 1990 and 1997. Summary statistics presented in Table 5 indicate that on average, 23.1 percent of students of official primary school entry age failed to complete five years of primary education. The average share of public education spending at the primary level in GDP is close to 1.5 percent, with a range of less than 0.5 to 4 percent. The mean values for the governance indicators–the corruption index and quality of bureaucracy —are 3.4 and 3.3, respectively. The average purchasing-power-parity adjusted value of per capita GDP for this sample is 6,983 measured in 1990 dollars—significantly less than in the two samples that we used for the health sector analysis.

Table 5. Summary Statistics on Public Education Spending, Governance and Outcomes
(Data from 57 countries over two years, 1990 and 1997)

Variables	*Observations*	*Mean*	*Std. Dev.*	*Min*	*Max*
Primary Education "Failure Rate"	72	23.1	23.0	0	77.9
Primary education spending (share in GDP)	72	1.5	0.8	0.4	4.4
Per capita GDP (in PPP adjusted 1990$)	72	6,983	6,323	420	26,549
Index of Corruption (least corrupt = 6)	72	3.4	1.3	0	6
Quality of Bureaucracy (highest = 6)	72	3.3	1.4	1	6

Note: 1. Countries in the sample are: Austria, Bahrain, Bangladesh*, Bolivia*, Botswana*, Brazil*, Bulgaria*, Burkina Faso*, Cameroon*, Chile*, China, Colombia, Democratic Republic of Congo*, Costa Rica, Cote d'Ivoire*, Ecuador*, El Salvador*, Finland*, France*, The Gambia*, Greece, Guatemala*, Haiti*, Hungary*, Ireland, Israel*, Italy, Jamaica*, South Korea*, Malawi, Mali*, Mexico, Morocco, Mozambique*, Namibia*, New Zealand*, Nicaragua, Niger*, Norway*, Pakistan*, Panama*, Paraguay*, Poland*, Romania*, Saudi Arabia*, Senegal*, Sudan*, Sweden*, Syria, Tanzania*, Thailand*, Togo*, Trinidad and Tobago*, Tunisia*, Uruguay, Venezuela, Zimbabwe*.

2. Countries marked with * in above have only one observation.

5.3.1 Regressions: Factors affecting education outcome

We begin with OLS estimation of equation (7). The results are reported in Table 6. The most important factor explaining the variation in failure to complete five years of primary school education appears to be per capita GDP. A percent increase in per capita GDP at the margin is associated with a reduction of over one percent in the failure rate. This finding is consistent across all equations. Of course, this is not unexpected: students in rich countries have higher levels of education attainment. Our

primary interest is, however, in the public education spending variable and its interaction with the governance indicators. When estimated without the interaction term—equation (6.1)—the coefficient on primary education spending has the correct sign, but is not significant. When the interaction term (with the corruption index) is included—equation (6.2)—the coefficient on the spending variable changes sign but continues to have a low *t*-value. More importantly, the interaction term has the correct sign and is highly significant. Among other variables, the dummy for East Asian countries is, as expected, highly significant; countries in the East Asia Region are known to have high primary school attainment. The income inequality variable has the right sign—that is counties with high inequality tend to have a higher failure rate—but has low significance. We find that including the adult literacy rate (equations 6.4 to 6.6) does not make much of a difference to the results; the explained variation in the failure rate is now around 68 percent.

It is quite possible that governments in countries with low primary education attainment react by increasing their primary education budget. Thus, as in the case of health regressions, our OLS estimates could be biased due to reverse causation. To tackle this problem, we estimate equation (7) using the 2SLS method, allowing public primary education spending and its interaction term with governance to be endogenous. As before, the instruments that we use are: the primary education spending of a neighboring country, and own population.

We present our 2SLS estimates in Table 7. Estimates of the coefficient on per capita GDP continue to support the hypothesis that rich countries have low rates of primary school failure. Once again this finding is consistent across all equations reported in the table. When compared with the OLS results from equation (6.1), the coefficient on primary education spending in equation (7.1) is higher in (absolute) value. Moreover, as before, it has the correct sign and is statistically significant. When spending is interacted with the corruption index—equation (7.2)—the interaction term has the correct (negative) sign and is significant at the 5-percent level. Among other variables, the East Asia dummy continues to be highly significant; and income inequality continues to have the right sign, but it now has low significance. Compared with the OLS results, there is not much of a drop in explained variation in failure rates across all equations.

Table 6. OLS Regressions: Factors affecting education outcomes

(White heteroskedasticity-corrected *t*-statistics in parentheses)

Dependent variable →	Failure rate (natural log)					
Independent variables ↓	*Eq. (6.1)*	*Eq. (6.2)*	*Eq. (6.3)*	*Eq(6.4)*	*Eq. (6.5)*	*Eq. (6.6)*
GDP per capita in PPP adjusted 1990$ (ln)	–1.58	–1.51	–1.17	–1.61	–1.50	–1.13
	(–4.95)	(–4.83)	(–3.17)	(–4.44)	(–4.21)	(–2.57)
Primary education spending (ln of share of GDP)	–0.35	1.14	0.96	–0.36	1.14	0.97
	(–1.32)	(1.74)	(1.48)	(–1.30)	(1.69)	(1.47)
East Asia dummy	–3.31	–3.59	–3.24	–3.34	–3.58	–3.21
	(–2.57)	(–2.62)	(–2.39)	(–2.55)	(–2.54)	(–2.28)
Adult illiteracy rate				–0.003	0.001	0.004
				(–0.28)	(0.10)	(0.29)
Index of corruption (least corrupt = 6)		–0.08			–0.08	
		(–0.59)			(–0.58)	
Quality of bureaucracy (highest = 6)			–0.16			–0.17
			(–0.90)			(–0.93)
Index of corruption **x** primary education spending (ln of share of GDP)		–0.43			–0.43	
		(–2.47)			(–2.44)	
Quality of bureaucracy **x** primary education spending (ln of share of GDP)			–0.38			–0.38
			(–2.12)			(–2.12)
Income inequality	0.03	0.03	0.03	0.03	0.03	0.03
	(1.50)	(1.34)	(1.30)	(1.48)	(1.33)	(1.27)
Predominantly Muslim	0.007	0.005	0.007	0.008	0.005	0.006
	(1.81)	(1.54)	(1.79)	(1.47)	(0.96)	(1.03)
Ethno-linguistic fractionalization	–1.14	–1.19	–0.55	–1.10	–1.20	–0.57
	(–1.77)	(–2.09)	(–0.87)	(–1.69)	(–2.13)	(–0.90)
Degree of urbanization	0.006	0.002	0.001	0.006	0.002	0.002
	(0.62)	(0.21)	(0.09)	(0.49)	(0.22)	(0.15)
Percentage of population aged 6 to 12	–0.05	–0.06	–0.05	–0.05	–0.07	–0.05
	(–0.77)	(–1.10)	(–0.71)	(–0.76)	(–1.14)	(–0.78)
Dummy for year 1997	0.11	0.004	–0.11	0.10	0.007	–0.11
	(0.39)	(0.01)	(–0.39)	(0.35)	(0.03)	(–0.37)
Constant	14.90	15.43	12.47	15.19	15.33	12.07
	(4.99)	(5.36)	(3.83)	(4.27)	(4.52)	(2.98)
R-squared	.66	.69	.68	.66	.69	.68
Number of observations	72	72	72	72	72	72

Table 7. 2SLS Regressions: Factors affecting education outcomes
(White heteroskedasticity-corrected *t*-statistics in parentheses)

Dependent variable →	Failure rate (natural log)					
Independent variables ↓	*Eq. (7.1)*	*Eq. (7.2)*	*Eq. (7.3)*	*Eq. (7.4)*	*Eq. (7.5)*	*Eq. (7.6)*
GDP per capita in PPP adjusted 1990$ (ln)	–1.79	–1.44	–1.12	–1.27	–1.42	–1.11
	(–2.31)	(–3.66)	(–2.39)	(–2.74)	(–3.72)	(–2.32)
Primary education spending (ln of share of GDP)	–1.13	2.38	3.07	–1.80	2.60	2.99
	(–2.62)	(1.61)	(1.51)	(–2.30)	(1.61)	(1.58)
East Asia dummy	–3.72	–3.73	–3.42	–3.82	–3.72	–3.41
	(–3.58)	(–4.83)	(–4.17)	(–3.73)	(–4.72)	(–4.06)
Adult illiteracy rate				–0.02	0.003	0.001
				(–1.03)	(0.16)	(0.07)
Index of Corruption (least corrupt = 6)		0.04			0.05	
		(0.29)			(0.35)	
Quality of Bureaucracy (highest = 6)			0.11			0.10
			(0.50)			(0.43)
Index of corruption **x** primary education spending (ln of share of GDP)		–0.89			–0.94	
		(–2.95)			(–2.94)	
Quality of bureaucracy **x** primary education spending (ln of share of GDP)			–1.11			–1.08
			(–2.67)			(–2.76)
Income inequality	0.03	0.02	0.02	0.03	0.02	0.02
	(1.36)	(0.98)	(1.08)	(1.36)	(0.93)	(1.08)
Predominantly Muslim	0.008	0.005	0.006	0.01	0.004	0.006
	(1.40)	(1.03)	(1.21)	(1.66)	(0.56)	(0.78)
Ethno-linguistic fractionalization	–0.08	–1.22	–0.51	0.07	–1.30	–0.52
	(–0.10)	(–1.26)	(–0.48)	(0.07)	(–1.23)	(–0.50)
Degree of urbanization	0.004	–0.001	–0.003	–0.0002	–0.001	–0.002
	(0.33)	(–0.10)	(–0.25)	(–0.01)	(–0.06)	(–0.21)
Percentage of population aged 6 to 12	–0.009	–0.05	–0.02	–0.003	–0.05	–0.02
	(–0.11)	(–0.65)	(–0.22)	(–0.04)	(–0.66)	(–0.24)
Dummy for year 1997	0.12	0.03	–0.15	0.07	0.04	–0.15
	(0.34)	(0.09)	(–0.42)	(0.19)	(0.11)	(–0.42)
Constant	10.59	14.71	11.21	12.14	14.57	11.3
	(2.25)	(3.68)	(2.72)	(2.40)	(3.76)	(2.69)
R^2 of first-stage regressions						
Primary education spending		.30	.32		.33	.36
Primary education spending *x* (corruption or bureaucracy)		.41	.50		.43	.53
Other statistics						
R-squared	.54	.66	.63	.55	.65	.64
Number of observations	72	72	72	72	72	72

Note: Instruments: Neighbor's primary education spending, population, neighbor's primary education spending *x* index of corruption, Neighbor's primary education spending *x* index of bureaucracy.

In Table 8 we present our overall results on the impact of primary education spending on the "failure" rate. Once again we find evidence in support of the hypothesis that in a country with good

governance, education spending is efficacious in lowering education failure rates. The elasticity of primary education failure with respect to public education spending is consistently negative and increasing in absolute size when evaluated at a good level of governance.

Table 8. The Impact of Primary Education Spending on Education Outcomes

A. The impact on primary education "Failure" rate (from regressions without the Governance interaction term):

	Regressions without adult illiteracy	Regressions with adult illiteracy
OLS (Table 6)	–.35	–.36
2SLS (Table 7)	–1.13**	–1.80**

B. The impact on primary education "Failure" rate (from regressions with the Governance interaction term, i.e., $l_2 + l_4 * G_i$)

Evaluated at ®	*Corruption index*			*Quality of bureaucracy*			*Corruption index*			*Quality of bureaucracy*		
	2.1^B	3.4^M	4.7^U	1.9^B	3.3^M	4.7^U	2.1^B	3.4^M	4.7^U	1.9^B	3.3^M	4.7^U
OLS (Table 6)	.23	–.33	–.89**	.24	–.30	–.83**	.24	–.33	–.89**	–.28	–.28	–.81**
2SLS (Table 7)	.52	–.64	–1.79**	.97	–.58	–2.13**	.62	–.60	–1.82**	.94	–.56	–2.07**

Note: 1. Evaluated at : ^{M} The sample mean; ^{B} One standard deviation below the mean; and ^{U} One standard deviation above the mean.

2. Based on a 't' test for functions of parameters: * Significantly lower than 0 at the 10-percent level; ** Significantly lower than 0 at the 5-percent level.

6. Conclusion

In this paper we have studied the links between public spending, governance, and outcomes. Our primary investigation was to examine the role of governance—measured by the level of corruption and the quality of bureaucracy—and ask how it affects the relationship between public spending and outcomes. Using data from a cross-section of countries over two years, we found that public health spending has a negative impact on both child and infant mortalities in countries that have good governance. As the level of corruption goes down (or the quality of bureaucracy goes up), public spending on health becomes more effective in lowering child and infant mortalities. Our findings also indicate that in countries rated as very corrupt or rated to have a very ineffective bureaucracy, public

health spending at the margin will be inefficacious. Linking public spending on primary education with failure to attain primary education, we found a similar result. Increasing public spending on primary education is likely to be more effective in increasing primary education attainment in a country with good governance.

These results have important implications for enhancing the development effectiveness of public spending. Simply increasing public spending on health and education is less likely to lead to better outcomes if countries have poor governance. These findings are particularly relevant for developing countries, where, on average, the state of governance is quite poor. Two of the seven International Development Goals are: (i) Achieving universal primary education in all countries by 2015; and (ii) lowering child mortality by three-fourths and infant mortality by two-thirds by 2015.[11] Increasing public spending on health and education is an easier option than improving governance, but as our findings suggest the easier option may not lead to achievement of these goals.

Appendix A.

This appendix provides details on the data used for this research.

I. Data on health and education variables

The data on child mortality, infant mortality, adult illiteracy, public health spending, and public primary-school education spending were obtained from the World Bank Database (various years). The data on the percentages of females aged 15 and above with primary education are from Barro and Lee (2000). The education attainment variable in the regressions was computed using data on primary school intake rates as well as rates of completion of Grade 5, as explained below. These data were taken from UNESCO (various years).

[11] The International Development Goals measure progress from 1990 and look to what can be achieved by 2015. They set targets for reductions in poverty, improvements in health and education, and protection of the environment, and have been adopted by the World Bank, the International Monetary Fund, and members of the Development Assistance Committee of the OECD. They were supported during the Millennium Declaration of the United Nations, adopted by the General Assembly in September 2000.

The expected completion rate measure $ECompR_{0,5}^{j,t}$ used to compute the "failure rate" in the education regressions (see Section 5.2) is taken from UNESCO data. UNESCO using the "Reconstructed Cohort Method" computes it. The method is explained in detail in Fredriksen (1991); it can be summarized by the following formula:

$$ECompPS_{0,5}^{j,t} = (Comp_{0,1}^{t-1}).(Comp_{1,2}^{t-1}).(Comp_{2,3}^{t-1}).(Comp_{3,4}^{t-1}).(Comp_{4,5}^{t-1})$$

where $Comp_{0,1}^{t-1}$ is the *actual* proportion of students entering and completing Grade 1 *only* between times t –1 and t; $Comp_{1,2}^{t-1}$ is the *actual* proportion of students entering and completing Grade 2 *only* between times t –1 and t; and so on. These one-year actual completion rates for each grade individually can be computed from data on enrolment and repetition rates for Grades 1 through 5, at times t –1 and t. Using the "Reconstructed Cohort Method" to compute expected five-year completion rates in this way is far less data-intensive than calculating actual five-year completion rates, which would require tracking of new students over five consecutive years (and more if there are repeaters). Data on the latter are available for only a few countries. Educational attainment data are also available, over five-year periods until 2000 for a wide range of countries, in Barro and Lee (1996, 2000). However, unlike the data from UNESCO, these are stock rather than flow measures; they provide information on the proportion of *all* adults that have completed primary education. These do not have a clear relationship between flow measures of education spending at different points in time.

II. Data on governance indicators

The indicators of corruption and quality of bureaucracy are taken from ratings made by experts at Political Risk Services (2001). This is not the only source of such ratings; however, it is the only one with wide country coverage, providing ratings for 140 countries. Researchers quite commonly use it.

III. Other variables

The World Bank (various years) is the source of our data on GDP per capita, safe water access, total population and the percentage of the latter living in urban areas. The data on the Gini coefficient come from the database compiled for the Dollar and Kraay (2001) paper; these were

obtained directly from the authors. Our data on ethno-linguistic fractionalization (a measure of ethnic diversity), the proportion of Muslims and the distance of each country from the Equator are from the well-cited paper by La Porta and others (1999). The distance from the Equator is computed by taking the absolute value of the latitude of each country from CIA (1996), and then scaling this to take values between 0 and 1.

IV. Choice of neighbors

In the 2SLS health (education) regressions, we use health (education) spending of a neighboring country as one of the instruments. In this sub-section, we explain how we choose a country's neighbor.

There were two underlying principles—besides geographical proximity—behind our selection process for the most appropriate neighbor N for a country X. First, X and N should at least be not too dissimilar in terms of size, language and per-capita income. Second, X is more likely to "look up" to a neighboring country, and to try to emulate its health and education spending patterns, if this neighbor is relatively well established and important. Guided by these principles, we put together the data on neighbor as follows:

- *Step 1*. All countries sharing a border with X were first identified. Among these, those without data on the appropriate type of spending (health or education) were discarded. Also, those in situations of serious conflict – such as the countries of Former Yugoslavia, as well as Liberia and the Democratic Republic of Congo (in 1997) – were discarded.
- *Step 2*. If there were less than 3 candidate neighbors remaining after enacting Step 1 (as was the case if X was an island country, for example), then additional countries were added to the list of candidates, with the aim of going into Step 3 with *at least* 3 candidates identified. These additions were based solely on the criterion of geographical proximity.
- *Step 3*. Countries with less than half the total population of X, if any, were then discarded from the list of candidates, unless this removed all countries from the list – in which case Step 3 was ignored.
- *Step 4*. Countries that were not in the same regional/language group (defined below), if any, were then dropped from the list of candidates, unless this removed all countries from the list – in which case Step 4 was ignored.
- *Step 5*. Countries that were not in the same income class (defined below), if any, were then dropped from the list of candidates, unless this removed all countries from the list – in which case Step 5 was ignored.
- *Step 6*. Countries that were in a lower income class (defined below), if any, were then dropped from the list of candidates, unless this removed all countries from the list – in which case Step 6 was ignored.
- *Step 7*. If there was now just one candidate remaining on the list, this was the chosen neighbor N. If there was now more than one candidate remaining on the list, the one with the highest total GDP

was the chosen neighbor N.

Regional/Language Groups.

For the above selection process, all countries were divided into the following regional/language groups. Group A—ex-Spanish colonies in South and Central America; Group B—Brazil; Group C—other countries in Central/South America not in Groups A or B; Group D—countries in North America; Group E—ex-English colonies in Sub-Saharan Africa; Group F—ex-French and ex-Belgian colonies in Sub-Saharan Africa; Group G—other Sub-Saharan African countries not in Groups E or F; Group H—Western European countries including Turkey; Group I—Eastern European (and ex-Soviet Bloc) countries; Group J—Former Soviet Union countries; Group K—Middle Eastern and Arab North African countries; Group L—countries of Asia and Oceania (including Australia and New Zealand).

Income Groups

The countries were also divided into the following three income classes for the selection process, with the classification following that used by the World Bank: High Income, Upper Middle Income, and all others.

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