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Corruption and the Provision of Health Care and Education Services

Sanjeev Gupta, Hamid Davoodi, and Erwin Tiongson

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Prepared by Sanjeev Gupta, Hamid Davoodi, and Erwin Tiongson[1]

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Abstract

Government intervention to correct market failures is often accompanied by government failures and corruption. This is no more evident than in social sectors that are characterized by significant market failures and government intervention. However, the impact of corruption on the public provision of social services has not been analyzed. This paper reviews the relevant theoretical models and users' perceptions of corruption in the public provision of social services. It then provides evidence that reducing corruption can result in significant social gains as measured by decreases in child and infant mortality rates, percent of low-birthweight babies, and primary school dropout rates.

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Authors' E-Mail Addresses: sgupta@imf.org; hdavoodi@imf.org; etiongson@imf.org

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I. INTRODUCTION

Social sectors in an economy are often characterized by market failures. To correct such failures, governments intervene through the public provision, financing, and regulation of services. There is recognition that corruption emerges as a by-product of government intervention (Acemoglu and Verdier, 2000); what is not well understood, however, is that corruption can adversely affect the provision of publicly provided social services. The theoretical literature identifies three channels through which this can happen. First, corruption can drive up the price and lower the level of government output and services (Shleifer and Vishny, 1993), including the provision and financing of health care and education services in many countries.[2] Second, corruption can reduce investment in human capital (Ehrlich and Lui, 1999). Finally, corruption can reduce government revenue (Shleifer and Vishny, 1993; Hindriks, Keen, and Muthoo, 1999),[3] which in turn can lower the quality of publicly provided services (Bearse, Glomm, and Janeba, 2000). The latter discourages some individuals from using these services and reduces their willingness to pay for them (through tax evasion), which shrinks the tax base and diminishes the government's ability to provide quality public services.[4] The lower quality also creates incentives for individuals to opt for privately provided services. However, in countries where private markets for health care and education services are limited, this can lead to congestion, increased delays in obtaining public services, rising opportunities for rent-seeking, and frequent use of discretionary power by government officials. Even in cases where private markets are well developed and extensive, the poor may lack the ability to pay for private services and outputs.

These predictions are consistent with a growing empirical literature on the economic consequences of corruption as well as results from surveys of users of public services. The existing empirical evidence, for example, shows that corruption reduces spending on operations and maintenance, such as medicine and textbooks (Tanzi and Davoodi, 1997). Higher corruption is associated with rising military spending (Gupta, de Mello, and Sharan, 2000), and lower spending on health care and education services (Mauro, 1998; Gupta, Davoodi, and Alonso-Terme, 1998). Corruption has also been found to lower tax revenues (Ul Haque and Sahay, 1996; Tanzi and Davoodi, 1997; Johnson, Kaufmann, and Zoido-Lobaton, 1999). The newly instituted surveys of users of public services further

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[2] Governments provide a wide range of services in social sectors, as measured by intermediate health care and education indicators (e.g., immunization and school enrollment) and outcomes (e.g., literacy and mortality)

[3] Government revenues are lower according to these two models because different government agencies act as independent rent-seeking, monopolist providers of complementary goods and services or because of corrupt and extortionist tax inspectors.

[4] Alesina (1999) discusses this "vicious cycle" in developing countries and contrasts it with a "virtuous cycle" in developed countries.

confirm the adverse impact of corruption on social services. The surveys rely on users who come in contact with officials in charge of providing social services.

Although corruption shifts the composition of public spending away from social sectors, its impact on health care and education indicators through spending may not be significant. In the empirical literature, the link between public spending and indicators of service provision, such as enrollment rate and infant mortality rates, is weak (Hanushek, 1995; Jack, 1999; Gupta, Verhoeven, and Tiongson, 1999). The impact of corruption on indicators of provision of health care and education services can then be either direct or indirect, working through some of the channels discussed above. This paper shows that corruption, measured by corruption perception indices, adversely affects the indicators of provision of health care and education services. Despite the overwhelming evidence from surveys of users of public services and the theoretical literature on the adverse consequences of corruption for provision of health care and education services, no systematic investigation has yet been made of the relationship between corruption and provision of health care and education services. [5]

The rest of this paper is organized as follows. Section II illustrates, using a theoretical model introduced by Shleifer and Vishny (1993), how corruption can impact on the provision of social services. Section III summarizes findings from national service delivery surveys to bolster the predictions from theoretical models. Section IV describes the data and econometric results. Section V contains the conclusions and policy implications.

II. Theoretical Framework

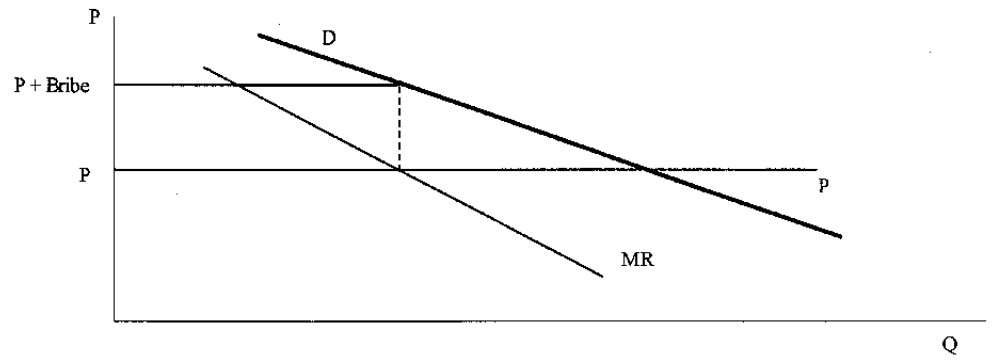
Among models of corruption, the one by Shleifer and Vishny (1993) provides the simplest framework for analyzing the causes and consequences of corruption as affecting the public provision of social services. In their framework, bribes are paid by consumers to obtain government services or output. Government officials are assumed to exercise monopoly power by determining the quantity of services or output provided, either by delaying or by simply withholding them. Two cases of corruption are considered, both of which have adverse consequences for the provision of services, and are relevant in many settings.

In the first case, an official overprices by providing a service or an output at a government-established charge plus a bribe. Marginal cost to the government agent is the official price and the agent determines the quantity supplied by equating marginal revenue and marginal cost as with a typical monopolist. The bribe constitutes a tax. The official retains the bribe and transfers the official charge to the treasury. Figure 1a illustrates this case as "corruption without theft." The result is that the bribe drives up the price and lowers the output. In these circumstances, some consumers would inevitably be crowded out of the

[5] Kaufmann, Kraay, and Zoido-Lobaton (1999a) test a simple association between two social indicators and various measures of governance.

market.[6] When services affected by corruption are critical for the population, such as basic health care and education services, the full impact of government spending would not be realized. If teachers accept bribes for providing government-funded books or for admitting students, it would be more difficult to achieve the objective of a literate population through universal school enrollment. In fact, it has been suggested that large irregular payments required for school entrance or for passing examinations help explain low enrollment rates (Cockroft, 1998). Similarly, the payment of bribes for gaining access to medical services could impact on health care indicators over time.

Figure 1a. Corruption without Theft



Source: Shleifer and Vishny (1993)

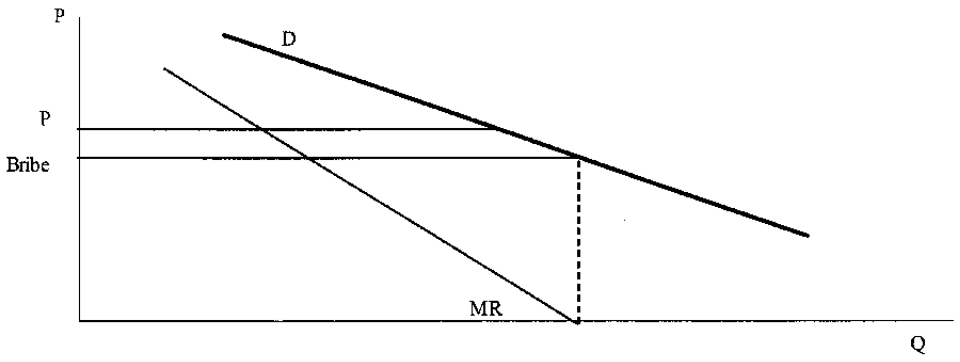
That government officials have the ability to limit the supply of public services has been highlighted by recent research (Kaufmann, 1997; Bardhan, 1997; Kaufmann and Wei, 1999)—a view that was propounded by Myrdal (1968) some 30 years ago.

In the second case, the official does not turn over to the treasury the government-imposed charge for the service or an output. This case has been referred to as "corruption with theft" (Figure 1b), as the government service or output is in a way stolen by the government official in charge of delivering it and a bribe is collected for providing the service and output to a consumer. In this case, the official still equates marginal revenue with marginal cost, but marginal cost to the official is now zero. Thus, the bribe a consumer pays may be lower than

[6] This is similar to Alam's (1989, 1990) model, where managers increase their illicit revenues by reducing output. The result is also consistent with studies of benefit incidence of public social spending, which point to significant leakages. Benefits from public spending disproportionately accrue to the rich; the poor simply do not utilize public services as intensively as the rich, despite the fact that the poor tend to have lower levels of health care and education achievements (Castro-Leal and others, 1999; Davoodi and Sachjapinan, forthcoming). Corruption, of course, is not the only reason for this leakage.

the official price. In a sense, the official "under-invoices" the cost of providing the service and output. Such a situation is attractive to the consumer and aligns his interest with that of the official, which makes corruption more difficult to detect. This creates a revenue loss for the treasury and the government official is able to exercise more discretion than in "corruption without theft." The corrupt official can choose to lower bribe level, thereby increasing the demand for a service or an output and raising revenue loss to the treasury. A smaller bribe also has the advantage of lowering the risk of detection.

Figure 1b. Corruption withTheft



Source: Shleifer and Vishny (1993)

The difference between the two cases is that revenue loss under the second case can be significantly higher. Although a lower bribe increases demand in the short run, it would restrict supply in the long run because of larger revenue losses.

Shleifer and Vishny's model offers policy prescriptions for anticorruption strategies. In corruption without theft, competition in the provision of government service or output could reduce possibilities for corruption. In corruption with theft, competition complemented with enhanced monitoring of government officials and better procurement policies would help curb corruption.

Although the above model has important policy implications, it overlooks that the government does not provide a single service or output. In an extension of their original model, Shleifer and Vishny (1993) present another model in which the government is still a monopolist but provides complementary services and output. The extended model recognizes that publicly provided health care and education services are complementary inputs to households' "production function" of health care and education services.[7] The government

[7] See, for example, Hanushek (1995) and Filmer, Hammer, and Pritchett (1998).

official can act as a joint monopolist and lower the bribe on a service or an output to expand demand for the complementary services and output. However, when different government agencies act as independent monopolists and do not consider the complementarity of services and outputs, the adverse impact of corruption is significant. In comparison with the joint monopolist model, a higher bribe is charged to the consumer, a lower output is supplied, and government revenue is even lower. A first-best anticorruption solution is to allow for many producers of complementary goods and services. In comparison with joint and independent monopolist cases, this results in the lowest price, highest output, and zero bribe.

In contrast, there exists a class of models that predict exactly the opposite result. According to these models, bribes provide a mechanism for overcoming an overly centralized and overly extended government bureaucracy, red tape, and delays (Leff, 1964; Lui, 1985). This interpretation of bribery and corruption, sometimes referred to as the "efficient-grease" hypothesis (Kaufmann and Wei, 1999), views the size of a bribe as a reflection of an individual's opportunity cost. Hence, the payment of a bribe is an efficient solution to the acquisition of a public service or output, with no adverse consequences. The next section shows that the efficient-grease hypothesis runs counter to findings of national service delivery surveys. In general, these surveys point toward the negative impact of corruption on the provision of services.[8]

III. National Service Delivery Surveys

In recent years, an increasing number of public service delivery surveys have been conducted in developing and transition economies by international organizations, such as the World Bank and CIET (Community Information, Empowerment, Transparency) International, as well as by local agencies, such as the Public Affairs Center (PAC) in Bangalore, India.[9] These surveys are designed to elicit responses from users of social services, including their views on the impact of corruption on service delivery. Although most reports based on these surveys are still preliminary, they nevertheless confirm the pervasiveness of corruption and bribery in the public provision of health care and education services.

One major survey conducted worldwide by the World Bank for the 1997 *World Development Report* (WDR) examined perceptions of institutional uncertainty as viewed by the private sector.[10] This survey provides an internationally comparable dataset of indicators of perceived uncertainty about laws, policies, and regulations, the level and unpredictability of corruption, as well as the perceived quality and efficiency of government services and the quality of health care provision. This aspect of the WDR survey provides interesting insights for this study. Figure 2 illustrates the relationship between an index of corruption and its

[8] Kaufmann and Wei (1999) also report that the efficient-grease hypothesis is not supported by data.

[9] The CIET social audits are available via the Internet: http://www.ciet.org.

[10] Available via the Internet: http://www.unibas.ch/wwz/wifor/staff/bw/survey/index.html.

unpredictability, on one hand, and government service provision, on the other, for a group of 71 countries.[11]

The scatterplots suggest a strong correlation between corruption and service provision; that is, countries with less corruption and higher predictability of corruption tend to have better quality of health care and more efficient provision of public services. [12] The correlation coefficients range from –0.59 to –0.66 and are significant at the 1-percent level. This high correlation further suggests that corruption and the efficient-grease hypothesis are at odds with each other.

The above results are reinforced by a simple regression of child mortality rate on a constant, the index of corruption, and the indicator of quality of health care provision for a group of 62 countries.[13] The results confirm the association between corruption and health outcomes: countries with higher corruption tend to have higher child mortality.

These results can be used to quantify the interaction between corruption and quality of health care provision and child mortality rate. Using the estimated coefficients on the explanatory variables and the mean and standard deviation of each variable in the regression, four cells are constructed, each representing a different scenario for corruption and quality of health care and the associated value for child mortality.[14] The results are shown in Figure 3a. The difference between the two polar cases is considerable; countries with low corruption and high quality of health care provision tend to have 59 fewer child mortality per 1,000 live births than countries with high corruption and low quality of health care provision. The results are subjected to further scrutiny in the next section.

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[11] In the survey, corruption was defined as irregular payments made to officials, and corruption uncertainty as firms asked to pay more, in addition to irregular payments. Respondents were required to rate their responses from 1 (worst) to 6 (best). Respondents were also asked to rate the quality of health care services and efficiency of government services provided in their country, following the same scale. For ease of interpretation, this paper re-scales the corruption and uncertainty indices from 1 (best) to 6 (worst), with higher values of each index representing higher corruption and higher uncertainty.

[12] See Pradhan and Campos (1999) and Wei (1997) for the concepts of corruption unpredictability and corruption uncertainty, both of which are found to have adverse impact on development.

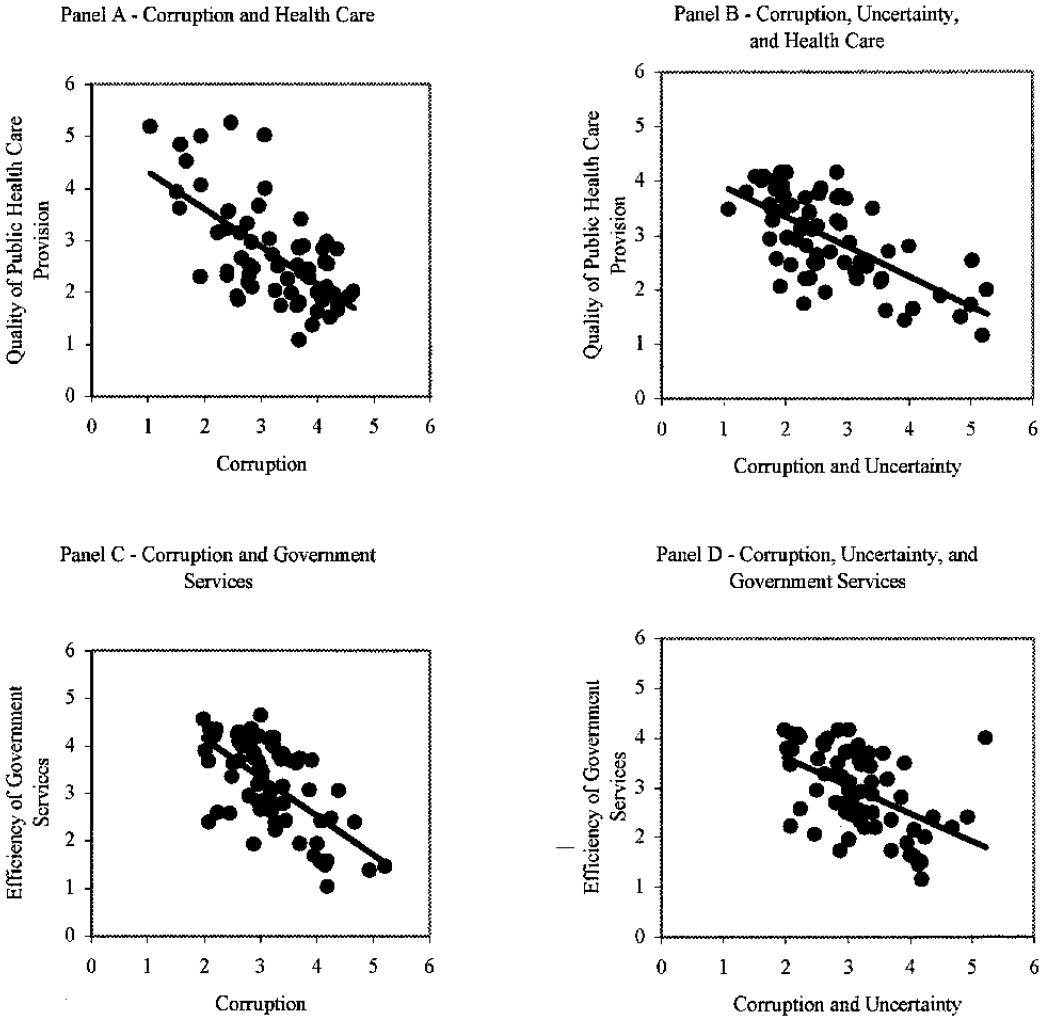
[13] The regression produces an adjusted R-squared of 0.13, with variations explained mostly by corruption and not by the quality of health care provision:

Child mortality	= 178.8	+22.9* (Corruption)	–9.1* (Quality),
	(5.50)	(1.75)	(–0.78)

where t–statistics are in parentheses. The regression does not control for other determinants of child mortality, hence the low R-squared, and does not address the endogeneity of corruption or reverse causality. These issues are discussed in Section IV of this paper.

[14] Each cell is calculated as one standard deviation around the mean; the results are the same when two standard deviations are used. Child mortality rates refer to under-age-5 mortality rates.

Figure 2. Corruption and the Provision of Government Services in 71 Countries



Sources: World Bank (1997).

Note: The indices used in the charts correspond to the following survey questions: For corruption: Are irregular payments commonly made to officials?; For corruption and uncertainty: Are firms asked to pay more—in addition to irregular payments—by other officials?; For quality of government services: How efficient are government services?; and for quality of public health care: How is the quality of public health care provision? In the survey, these are questions 14, 16, 25, and 22d, respectively. Respondents were required to rate their responses from 1 (worst) to 6 (best). For this paper, the corruption and uncertainty indices have been re-scaled from 1 (best) to 6 (worst).

Similarly, the student dropout rate is regressed on a constant, the corruption index and the indicator of efficiency of government services for a group of 53 countries.[15] The results shown in Figure 3b are consistent with theoretical predictions. Countries with higher level of corruption tend to have higher student dropout rate. The difference between the two polar cases is revealing: countries with low corruption and high efficiency of government services tend to have about 26 percentage points fewer student dropouts than countries with high corruption and low efficiency of government services.

Other surveys of national service delivery have solicited answers to a range of questions that were not covered in the WDR survey. The findings from these surveys can be summarized as follows.

First, *corruption can increase the cost of health care and education services.* Although primary health care and primary education are often provided by the government free of charge or at very low cost in the countries surveyed, service users often find themselves paying unofficial fees or illegal charges. The CIET social audits suggest that the percentage of students paying extra charges for education range from 10 percent to 86 percent.[16] A World Bank country study likewise finds that parents are asked to pay illegal stipends for enrolling their children in school (Langseth and Stapenhurst, 1997). A PAC survey reveals that as much as 38 percent of total hospital expenses borne by households are in the form of bribes, and some 17 percent of households claim to have made unofficial payments to public hospitals (Paul, 1998). One study reveals that even staff of a maternity hospital bribed to obtain medical services (Gopakumar, 1998). Another survey confirms that perception of corruption in the health sector is strongly correlated with input overpricing and unofficial payments (Gray-Molina, Perez de Rada, and Yanez, 1999).

Higher user costs also create a disincentive for using government facilities. Surveys suggest that that illegal payments for school entrance and other hidden costs help explain dropout rates and low school enrollment rates in developing countries (CIET, 1999; Cockroft, 1998).

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[15] The survey does not provide data on the quality of education service provision; the indicator of the efficiency of government services is used instead. The regression produces an adjusted R-squared of 0.29:

Dropout rate	= 78.05	+12.3* (Corruption)	–2.32* (Efficiency),
	(8.39)	(3.90)	(–0.52)

where t–statistics are in parentheses. Like the previous regression, the variation in the dependent variable is accounted for by variation in corruption rather than efficiency of government services, with the latter being statistically insignificant. Statistical inadequacy of this regression, as in the previous one, is addressed in Section IV of this paper.

[16] Not all informal charges are necessarily bribe payments.

Figure 3a. Corruption, Quality of Health Care, and Child Mortality in 62 Countries (Circa 1997)

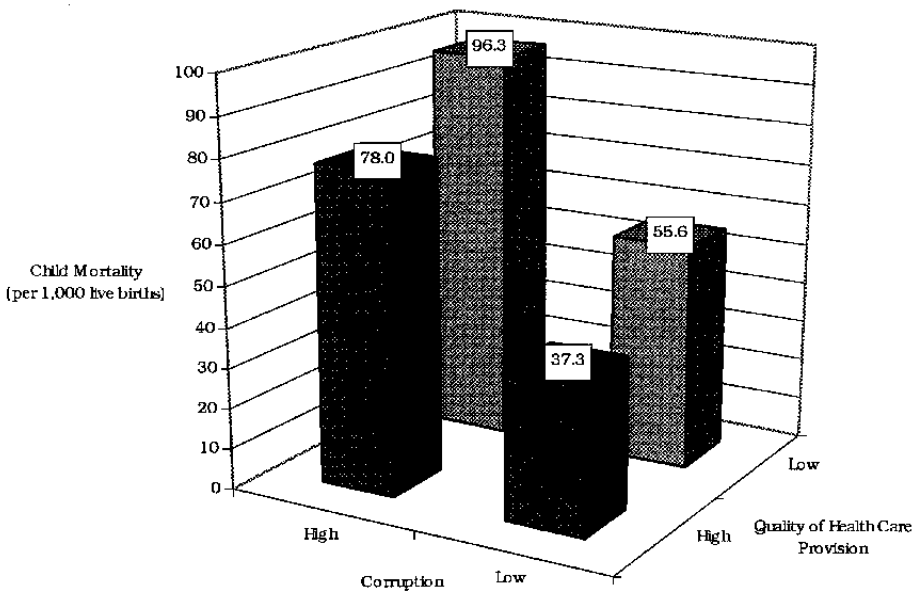
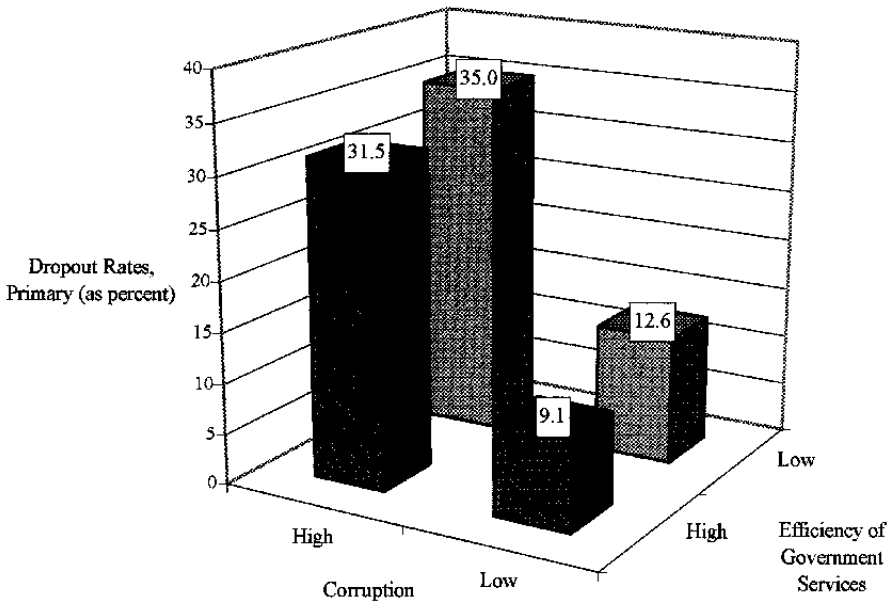


Figure 3b. Corruption, Efficiency, and Dropout Rates in 53 Countries (Circa 1997)



Sources: See text.

Second, *corruption may decrease the volume of publicly provided services.* Service delivery surveys show that theft of medicines and textbooks is a common form of leakage.[17] In one country, health staff reportedly have expropriated and sold drugs and medicine, depriving the poor of basic health services (Reinikka, 1999). In another country, despite significant public expenditures on textbooks, only 16 percent of children have actually received them. Similarly, education supplies have been lost to payoffs, under-deliveries, and overpricing (Chua, 1999).

Finally, *corruption may lower the quality of health care and education services.* In one country, bribes and payoffs in teacher recruitment and promotion have lowered the quality of public school teachers (Chua, 1999); in another, inadequate treatment and lack of drugs have been attributed to corruption (CIET, 1996). Officials may also create delays or bottlenecks in order to extract bribes. One survey confirms that bribes are indeed associated with slower service (Villegas, Morales, and Andersson, 1998).

The next section ascertains whether these service delivery surveys are consistent with data across a range of countries.

IV. Data and Estimation

The preceding sections suggest a framework for evaluating the relationship between corruption and social indicators:

$$Y_i = \alpha_i + \beta X_i + \gamma Z_i + \varepsilon_i \qquad (1)$$

where Y_i is a measure of aggregate education outcome or health status; X_i is an index of corruption perception in country i; and Z_i are control variables such as per capita income, public spending on health care and education services, average years of education, and other known determinants of health care and education indicators.

Although this framework addresses the adverse impact of corruption on health care and education indicators, the available data do not allow one to distinguish between the two cases of corruption discussed in Section II. The above regression should then be seen as a reduced-form specification.

The use of aggregate data to estimate the above equation has other limitations. The factors that affect health care and education indicators are often poorly captured by aggregate indicators, such as average years of education. However, there is evidence that cross-country analyses based on aggregate data are not inconsistent with findings of microlevel studies (Schultz, 1993 and 1998).

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[17] *The Economist* magazine (1994) reports on the theft of medical supplies.

The technique of Ordinary Least Squares (OLS) is used to estimate equation (1) for both cross-section and panel data covering 128 advanced and developing countries.[18] Panel data results may be less reliable because of the persistence of corruption over time in the sample countries, the limited annual data on social indicators, and the quality of reported social indicators that are often based on interpolations or estimates from demographic models. For these reasons, this paper relies largely on cross-sectional regressions.

Semilog regressions are used to estimate various specifications of equation (1). Except for corruption, all other variables are specified in logarithmic form. This is consistent with other studies suggesting a nonlinear relationship between social indicators and their standard explanatory variables.[19]

The corruption indices were drawn from various sources. The main index is from the Political Risk Services/International Country Risk Guide (PRS/ICRG) database. This corruption index has been re-scaled and ranges from 0 (least corrupt) to 10 (most corrupt).[20] Recent research by Kaufmann, Kraay, and Zoido-Lobaton (1999b) suggest the inadequacy of existing individual indices of corruption, due to high variance among the surveys that underlie these indices. These authors combine related measures of governance into aggregate indicators for what they consider to be six fundamental concepts of governance, including graft or corruption.[21] Their index of graft, with estimates ranging from about –2.5 (most corrupt) to 2.5 (least corrupt), is also used as an alternative measure of corruption. This was re-scaled and ranges from –2.5 (least corrupt) to 2.5 (most corrupt). This paper uses the PRS/ICRG index more extensively than the graft index because the graft index covers only the 1997–98 period, whereas the PRS/ICRG index covers the 1985–97 period—the same period as the health care and education indicators and the control variables.[22]

Indices of corruption constructed by Transparency International (TI), which are based on at least three surveys, are also used for testing the sensitivity of results.

At the outset, it needs to be recognized that the above indices of perception of corruption do not necessarily capture corruption in the health care and education sectors. For example, the PRS/ICRG index reflects the assessment of foreign investors about the degree of corruption

[18] Cross-sectional data are averages of each variable by country over the 1985–97 period. The actual number of observations varies depending on specifications. Descriptive statistics are provided in the appendix.

[19] See, for example, Pritchett and Summers (1996) on the nonlinear relationship between income and health.

[20] This procedure has been used by Tanzi and Davoodi (1997), and Gupta, Davoodi, and Alonso-Terme (1998).

[21] The methodology is described in detail in Kaufmann, Kraay, and Zoido-Lobaton (1999b).

[22] As noted later in the robustness tests, however, using the graft index in place of the PRS/ICRG index yields the same overall results.

in an economy. Investors are asked whether high government officials are likely to demand special payments (high-level corruption) and whether illegal payments are generally expected throughout lower levels of government especially those connected with import and export licenses, exchange controls, tax assessment, police protection, or loans (low-level corruption). However, these indices are likely to capture corruption at the service provision level to the extent they refer to corruption in the public sector as a whole.

This study uses health care and education indicators that are common to four sets of indicators endorsed at different international fora.[23] These include rates for immunization, births attended by health staff, child and infant mortality, enrollment and persistence to Grade 5, repeater, dropout, and illiteracy. Data on social indicators and the control variables are primarily drawn from the 1999 World Development Indicators, UNESCO, and Barro and Lee (1996).[24] A detailed list is provided in Appendix Table 1.

OLS regressions

Table 1 presents baseline regressions of indicators of health care and education services on a constant and the PRS/ICRG corruption index. The results show that better health care and education indicators are positively and significantly correlated with lower corruption. When per capita GDP, considered as a major determinant of corruption (Treisman, 2000), is added to the baseline regressions,[25] the corruption index remains significantly correlated with all measures of health outcomes, except for immunization rates (Table 2).[26] The coefficient estimates, however, are generally lower. Corruption ceases to be significantly correlated with indicators of education services when per capita income is added as a control variable, except for repeater rates and dropout rates at the primary level.

The overall results continue to hold when four other control variables are added. First, average years of education in the female population—a measure of maternal education—could have a positive impact on health outcomes (Schultz 1993, 1998) and on

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[23] The indicators have been endorsed by the OECD, the World Bank, and the UN; the Common Country Assessment (CCA) of the UN Development Assistance Framework; the UN/CCA Task Force on Basic Social Services; and by the UN Statistical Commission under the Minimum National Social Data Set (MNSDS).

[24] Other data are taken from Davoodi and Sachjapinan (forthcoming), and International Monetary Fund, *World Economic Outlook (1999)*.

[25] The link between income and social indicators is well documented. See, for example, Jack (1999) for a brief survey of the relevant health literature.

[26] In general, the estimated coefficient of per capita income in the mortality regressions is consistent with previous cross-country estimates. Wang and others (1999), for example, suggest that income elasticity for child mortality in 1990 was –0.71 in low-income and middle-income countries, which is close to the estimate of –0.73 obtained in this paper.

Table 1. Baseline Regressions, 1985-97: Cross-Sectional Analysis 1/

Dependent Variable	N	R^2	F Statistic	Constant	Corruption
Health Outcomes					
Child mortality (per 1,000 live births)	116	0.44	92.26***	5.75***	0.37***
				(28.01)	(12.26)
Infant mortality (per 1,000 live births)	117	0.48	107.77***	5.37***	0.35***
				(30.22)	(12.72)
Births attended by health staff (percent of total)	110	0.25	38.18***	3.42***	-0.13***
				(22.05)	(-6.06)
Immunization, DPT (percent of children under 12 months)	117	0.15	21.68***	3.92***	-0.06***
				(49.73)	(-5.61)
Low-birthweight babies (percent of births)	113	0.33	55.38***	3.02***	0.14***
				(23.34)	(7.20)
Education outcomes					
School enrollment, primary (percent net)	111	0.05	6.24**	4.34***	-0.03***
				(57.02)	(-3.30)
Repeater rates, primary (percent)	87	0.13	14.09***	3.17***	0.24***
				(9.51)	(3.47)
Dropout rates, primary (percent)	88	0.32	41.30***	4.70***	0.36***
				(16.32)	(7.02)
Persistence to grade 5, total (percent of cohort)	81	0.12	11.47***	4.13***	-0.04***
				(67.58)	(-4.30)
Illiteracy rates (percent of population age 15 and older)	86	0.08	8.53***	4.01***	0.23***
				(9.09)	(2.71)

Sources: World Bank (1999), Barro and Lee (1996) and Political Risk Services.
1/ Variables are means covering the period 1985-97. N denotes the number of countries. Except for corruption, all the variables are in logs. A low value of the corruption index means that a country is perceived to be less corrupt. White's heteroskedastic-consistent t-statistics are in parentheses. (***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 2. Corruption and Health Care and Education Services, 1985-97: Cross-Sectional Analysis 1/

Dependent Variable	N	R^2	F Statistic	Constant	Income	Corruption
Health outcomes						
Child mortality (per 1,000 live births)	116	0.82	254.42***	10.45***	-0.73***	0.13***
				(18.07)	(-9.11)	(4.30)
Infant mortality (per 1,000 live births)	117	0.81	255.43***	9.35***	-0.62***	0.14***
				(19.22)	(-9.17)	(5.14)
Births attended by health staff (percent of total)	110	0.48	50.52***	1.79***	0.25***	-0.05**
				(4.88)	(5.12)	(-2.01)
Immunization, DPT (percent of children under 12 months)	117	0.31	27.06***	3.07***	0.13***	-0.02
				(12.31)	(4.10)	(-1.40)
Low-birthweight babies (percent of births)	113	0.55	68.13***	4.55***	-0.24***	0.06***
				(17.93)	(-7.63)	(2.87)
Education outcomes						
School enrollment, primary (percent net)	111	0.24	18.01***	3.52***	0.13***	0.01
				(12.75)	(3.51)	(0.82)
Repeater rates, primary (percent)	87	0.22	12.98***	5.63***	-0.36***	0.15**
				(6.87)	(-3.49)	(2.16)
Drop-out rates, primary (percent)	88	0.44	35.78***	7.89***	-0.50***	0.20***
				(11.88)	(-5.15)	(3.39)
Persistence to grade 5, total (percent of cohort)	81	0.43	31.71***	3.14***	0.15***	-0.00
				(14.97)	(4.78)	(-0.30)
Illiteracy rates (percent of population age 15 and older) --	86	0.26	16.14***	7.46***	-0.50***	0.11
				(8.46)	(-4.27)	(1.34)

Sources: World Bank (1999), Barro and Lee (1996) and Political Risk Services.
1/ Variables are means covering the period 1985-97. N denotes the number of countries. Except for corruption, all the variables are in logs. A low value of the corruption index means that a country is perceived to be less corrupt. White's heteroskedastic-consistent t-statistics are in parentheses. (***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

student performance (Barro and Lee, 1997). Second, public expenditures on health care and education services are added, although evidence on their impact on social indicators is mixed.[27] Third, age-dependency ratio is meant to capture the constraints on public resources.[28] Finally, health status and education outcomes are expected to improve with increased urbanization.[29] For brevity, Table 3 reports the results of this exercise for child

[27] See, for example, Filmer and Pritchett (1999), Gupta, Verhoeven and Tiongson (1999) and Jack (1999) for health care, and Anand and Ravallion (1993), Noss (1991), Mingat and Tan (1998) for education.

[28] Dependency ratios have been used in regressions of education outcomes. See, for example, Tan and Mingat (1992). Behrman, Duryea, and Szekely (1999) suggest that dependency ratios change the relative share of public resources available for school-age children. This effect may hold for health as well.

[29] According to Schultz's (1993) survey of the literature, studies suggest that mortality is higher for rural, low-income households. Plank (1987) finds that access to education is typically better in urban areas.

mortality alone, but this holds for infant mortality and percent of low-birthweight babies as well.[30]

Some additional controls were also tried, which did not affect the statistical significance of corruption. These are access to safe water and access to sanitation,[31] which are found to be statistically significant. Physicians per 1,000 people, another measure of available health resources, is significant. Adding benefit incidence as a control variable shows that corruption remains significant at the 5 percent level.[32]

As regards regressions for education indicators, corruption is consistently correlated with dropout rates at conventional levels of significance when various control are added (Table 4).[33] However, this is not the case for the remaining education indicators. It is noteworthy that the presence of multicollinearity—in particular, the correlation between corruption and public spending—requires some caution in the interpretation of these results.[34]

Instrumental variable regressions

Corruption could be an endogenous variable, which would render the OLS technique inappropriate. First, both corruption and health or education indicators could be correlated with an unobserved, country-specific variable. The statistical relationship between corruption and health care or education may then be simply incidental. Second, the possibility of reverse causality cannot be ruled out as people with poor health status may be more willing to pay bribes to obtain services that otherwise would not be available; or worse education outcomes could create an environment conducive to corruption. The instrumental variable technique addresses both possibilities. The difficulty lies in finding appropriate instruments for corruption.

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[30] For lack of annual data from 1985–97, 1990 data on average years of education of adult females are used. The regressions also hold when 1990 data on average years of education of all adults are used.

[31] Shi (2000) finds that access to potable water and sewerage connection have a significant impact on child mortality.

[32] This follows Davoodi and Sachjapinan (forthcoming). To keep the sample size as large as possible, this paper restricts the controls to the strongest and consistent determinants of health outcomes, limiting the sample to 31 countries.

[33] These results also hold when pupil-teacher ratio is added as well.

[34] Corruption, for example, is correlated with public spending on education and health. The health regression results generally hold even when per capita health expenditures, including private spending, is used in place of public health spending.

For this study, the variables identified by Treisman (2000) are used as instruments. He finds that countries with lower corruption tend to be largely protestant, former British colonies, have high per capita income, a high ratio of imports to GDP, long exposure to democracy, and a unitary form of government.[35] These variables can be taken as potential instruments for the corruption index. In the current sample, corruption is found to be highly correlated with the share of protestants in the population, per capita income, and exposure to democracy.[36]

Table 3. Child Mortality and Corruption, 1985-97: Cross-Sectional Analysis 1/

	OLS							2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	5.75***	10.45***	10.42***	10.21***	9.37***	9.31***	8.65***	8.97***
	(28.01)	(18.07)	(17.90)	(21.55)	(24.46)	(22.71)	(16.69)	(21.00)
Corruption (PRS/ICRG)	0.37***	0.13***	0.12***	0.08***	0.07***	0.07***		0.10**
	(12.26)	(4.30)	(4.28)	(3.44)	(2.70)	(2.59)		(2.03)
Corruption (Graft)							0.20***	
							(3.95)	
Per capita income		-0.73***	-0.73***	-0.67***	-0.55***	-0.58***	-0.53***	-0.49***
		(-9.11)	(-8.98)	(-9.22)	(-9.75)	(-8.08)	(-6.24)	(-5.04)
Public health spending			-0.01	0.04	0.04	0.04	0.03	0.05
			(-0.30)	(0.87)	(0.90)	(0.86)	(0.80)	(0.95)
Average years of education, females, age 15 and older				-0.36***	-0.22***	-0.23***	-0.26***	-0.31**
				(-3.96)	(-2.84)	(-2.76)	(3.18)	(-1.96)
Dependency ratio					1.16***	1.13***	1.00***	0.98***
					(5.58)	(5.48)	(4.73)	(3.52)
Urbanization						0.07	0.04	0.04
						(0.15)	(0.30)	(0.28)
F statistic	92.26***	254.42***	168.27***	184.43***	195.54***	161.76***	169.36***	
Adjusted R-squared	0.44	0.82	0.81	0.89	0.91	0.91	0.92	
N	116	116	116	89	89	89	89	73
First-stage R-squared								0.69
Sargan's p-value								0.77

Sources: World Bank (1999), Barro and Lee (1996), Political Risk Services, Kaufmann and others (1999b) and Treisman (2000).
1/ Variables are means covering the period 1985-97. N denotes the number of countries. Except for corruption, all the variables are in logs. A low value of the corruption index means that a country is perceived to be less corrupt. White's heteroskedastic-consistent t-statistics are in parentheses. (***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively. The instruments us were (log of)1985 per capita income, democracy index, and percent protestants. See text.

[35] La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999) also find that countries that are less developed have higher catholic and Muslim populations, and countries with French or socialist laws tend to have inferior measures of government performance, including higher corruption.

[36] Further difficulties arise if per capita income is regarded as endogenous to health care and education indicators. Good health or better education could raise living standards, thus implying reverse causality. To address this concern, the initial value of per capita income (1985) is used as an instrument for per capita income averaged over the 1985–97 period.

Table 4. Dropout Rates and Corruption, 1985-97: Cross-Sectional Analysis 1/

	OLS							2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	4.70***	7.89***	8.06***	6.64***	5.16***	4.73***	3.25**	3.83**
	(16.32)	(11.88)	(11.32)	(4.97)	(3.98)	(3.44)	(1.99)	(2.52)
Corruption (PRS/ICRG)	0.36***	0.20***	0.18***	0.20***	0.14**	0.13**		0.36**
	(7.02)	(3.39)	(3.08)	(2.74)	(2.12)	(2.00)		(2.51)
Corruption (Graft)							0.50***	
							(2.72)	
Per capita income		-0.50***	-0.52***	-0.29***	-0.08***	-0.28	-0.15	-0.00
		(-5.15)	(-5.16)	(-1.42)	(-0.46)	(-1.28)	(-0.65)	(-0.02)
Public education spending			-0.07	-0.13	-0.23	-0.24	-0.31*	-0.08
			(-0.36)	(-0.66)	(-1.20)	(-1.20)	(1.65)	(-0.34)
Average years of education, females, age 15 and older				-0.17	0.17	0.05	0.00	0.17
				(-0.65)	(0.66)	(0.17)	(0.00)	(0.35)
Dependency ratio					2.50***	2.29***	1.95**	1.76*
					(3.49)	(3.07)	(2.53)	(1.92)
Urbanization						0.55	0.47	0.37
						(1.39)	(1.30)	(0.89)
F statistic	41.30***	35.78***	22.69***	10.95***	12.63***	11.16***	12.76***	
Adjusted R-squared	0.32	0.44	0.43	0.35	0.45	0.46	0.49	
N	88	88	86	72	72	72	72	59
First-stage R-squared								0.69
Sargan's P-value								0.17

Sources: World Bank (1999), Barro and Lee (1996), Political Risk Services, Kaufmann and others (1999) and Treisman (2000).

1/ Variables are means covering the period 1985-97. N denotes the number of countries. Except for corruption, all the variables are in logs. A low value of the corruption index means that a country is perceived to be less corrupt. White's heteroskedastic-consistent t-statistics are in parentheses. (***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively. The instruments used were (log of) 1985 per capita income, democracy index, and percent protestants. See text.

The results of 2SLS regressions are presented in Tables 3 and 4 (columns 8). The instruments used are the (log of) the initial value of per capita income, the share of protestants in the population, and exposure to democracy.[37] The specification test indicates that the instruments are correctly specified and the first-stage adjusted R-squared is generally high—about 0.69 for both regressions.

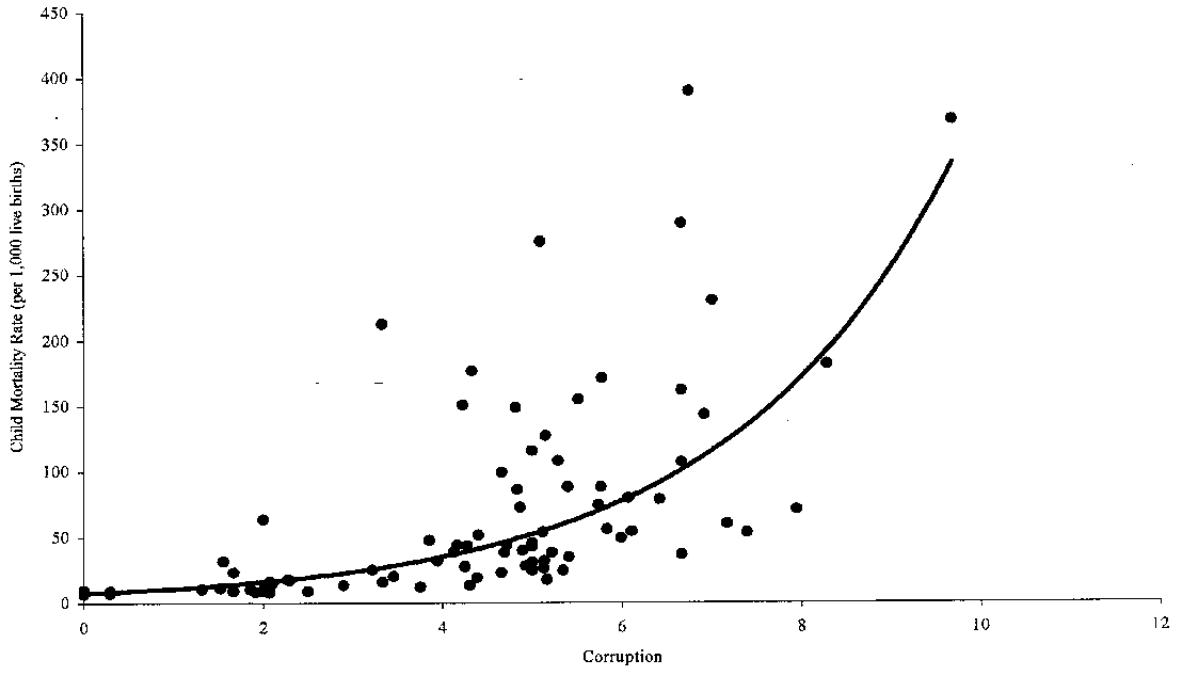
In general, the results in Tables 3 and 4 indicate a statistically significant relationship between corruption and both child mortality rates and dropout rates. The 2SLS regressions of infant mortality rates and percent of low-birthweight babies are not shown but the results hold for these regressions as well. Sargan's specification test also indicates that the

[37] The other control variables are assumed to act as their own instruments.

instruments are correctly specified for all 2SLS regressions. A partial scatterplot of the 2SLS regression in Table 3, column 8, is displayed in Figure 4.[38]

The results suggest that when corruption is reduced, the social gains, as measured by improvement in health care and education indicators, are immense. Figure 5 illustrates these gains, using the estimated coefficients and the mean of each variable in the 2SLS regressions.[39] The polar cases of corruption are based on its standard deviation.

Figure 4. Corruption and Child Mortality



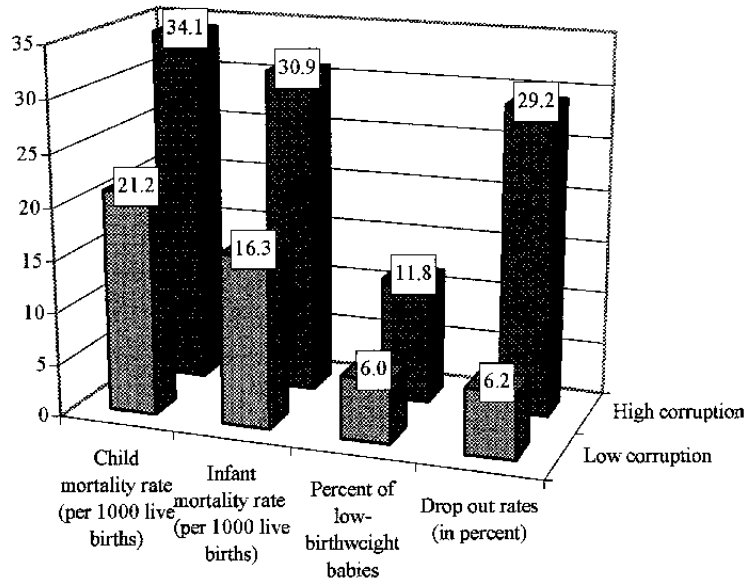
Source: Table 3.

Although the gains are not quite as dramatic as those suggested by the simple regression in Section III, they remain considerable. Infant mortality rates in countries with high corruption, for example, could be almost twice as high as in countries with low corruption, holding other factors constant; dropout rates could be five times as high.

[38] Removal of apparent outliers in Figure 4, for example, those associated with child mortality rates well above 200, in fact strengthens the relationship.

[39] The relative rankings based on the OLS regression (columns 6 in Tables 3 and 4) are the same as the 2SLS regression.

Figure 5. Corruption and Social Indicators



Source: See Tables 3 and 4.

Further robustness test

Estimating OLS regressions using the aggregate governance indicator for graft produced by Kaufmann, Kraay, and Zoido-Lobaton (1999) yields similar results.[40] (Tables 3 and 4, columns 7) The adjusted R-squared is somewhat higher at 0.79 but the basic results hold.

In addition, two other indices of corruption, the 1995–1998 TI index and the expanded 1997 corruption perception index constructed by Lambsdorff (1998)—are also significantly correlated with child and infant mortality rates, percent of low-birthweight babies, and dropout rates.[41] These results hold when income per capita, public spending on health or education, average years of education in the female population, dependency ratio, and urbanization are employed as control variables.[42] The coefficient estimates are broadly similar to those in regressions based on the PRS/ICRG index.

[40] This is not surprising, considering the high degree of correlation between the PRS/ICRG index and the graft indicator.

[41] These indices are both scaled from 0 (most corrupt) to 10 (least corrupt).

[42] The TI corruption index is also significantly correlated with immunization and persistence rates, controlling for all these variables. These results are available from authors upon request.

Previous regressions treated corruption as a continuous variable. Kaufmann, Kraay, and Zoido-Lobaton (1999) note the imprecision of existing continuous measures of corruption. Given this uncertainty, findings of these authors imply that corruption indices should be used to classify countries into three groups: the most corrupt, the least corrupt, and those in-between.

Table 5 reports the results of regressions with a two-way (high and low) and a three-way (high, medium, and low) classification of corruption scores. Dummy variables are used to define each classification.[43] For brevity, the table omits the coefficient estimates of the control variables in the regression model. In general, the results suggest that relative to countries with low corruption, countries with high and medium corruption have worse health care and education outcomes. The difference between high and medium corruption, however, is generally not significant, suggesting that a two-way classification may better characterize the data.[44]

Alternatively, the importance of corruption could also be ascertained by splitting the countries into high and low corruption. Table 6 reports the results that use the graft index to group countries into low and high corruption.[45] In general, the impact of health or education spending on social indicators remains insignificant. There is some evidence that corruption reduces the effectiveness of public education spending, as such spending is significant in reducing dropout rates in countries with low corruption but not in countries with high corruption. Meanwhile, the income elasticity of child mortality, infant mortality, and percent of low-birthweight babies in countries with low corruption is about twice the elasticity in high-corruption countries, suggesting that income is more effective in improving social indicators in countries with low corruption. Dependency ratios, however, pose a greater resource constraint in countries with low corruption, whereas female education is a bigger factor in reducing child and infant mortality in countries with high corruption. The finding on dependency ratios imply that as more resources are allocated toward old-age than younger population, social indicators for the latter worsen. The finding on female education is equally important because it shows that social gains from increasing females' access to education can be significant, particularly in countries with high corruption.

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[43] In the two-way classification case, the high corruption dummy takes a value of one when corruption scores are above the mean (or median) and zero otherwise. In the three-way classification case, a high corruption dummy takes a value of one when corruption scores are greater than one standard deviation above the mean and zero otherwise. The medium corruption is defined as one when corruption scores lie within one standard deviation around the mean and zero otherwise. The low corruption dummy takes a value of one when corruption scores are less than one standard deviation below the mean.

[44] When high corruption is used as benchmark, the dummy for low corruption is significant but medium corruption is not.

[45] A country is classified under high corruption if its corruption score is higher than the median graft score; otherwise, it is classified under low corruption. The results hold when the mean is used in place of the median.

Table 5. Cross-Sectional Analysis with Dummy Variables, 1985-97 1/

Corruption Classification	Dependent Variable: Child Mortality	Dependent Variable: Infant Mortality	Dependent Variable: Low Birthweight	Dependent Variable: Drop out	Dependent Variable: Child Mortality	Dependent Variable: Infant Mortality	Dependent Variable: Low Birthweight	Dependent Variable: Drop out
	(Coefficient estimates)							
	PRS/ICRG Corruption Index				Graft Index			
Two-way								
High (mean)	0.25**	0.29***	0.25***	0.08	0.42***	0.48***	0.26***	0.93***
	(2.54)	(2.99)	(3.57)	(0.33)	(3.19)	(3.71)	(2.82)	(2.83)
High (median)	0.30***	0.30***	0.29***	0.49**	0.24**	0.25**	0.08	0.56*
	(3.31)	(3.37)	(4.16)	(2.13)	(2.12)	(2.30)	(1.03)	(1.90)
Three-way								
High	0.34**	0.43***	0.35**	0.81*	0.33***	0.46***	0.33**	1.04*
	(1.96)	(2.62)	(2.34)	(1.81)	(2.39)	(3.31)	(2.59)	(1.81)
Medium	0.33***	0.41***	0.29***	0.52	0.38***	0.49***	0.30***	1.02**
	(3.17)	(3.75)	(3.31)	(1.37)	(3.81)	(4.63)	(3.25)	(2.26)
N	89	89	87	72	89	89	87	72

Sources: Political Risk Services and Kaufmann and others (1999b).
1/ These regressions, following previous regressions, control for log of income, sectoral spending, average years of female schooling, dependency ratio, urbanization.White's heteroskedastic-consistent t-statistics are in parentheses. (***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively. See text for classification of corruption dummies.

To further address the problem of imprecision in existing corruption indices, it has been argued that weighting an index by the inverse of its standard deviation could give more accurate results (Treisman, 2000). This gives more weight to corruption rankings in which there is less uncertainty or more agreement among the different surveys on which they are based. Table 7 presents the results of regressions of social indicators on the graft index divided by its standard deviation, along with the same control variables as in Tables 5 and 6. The results indicate that variance-weighted corruption is significantly related to child mortality, infant mortality, percent of low-birthweight babies, and dropout rates.

Table 6. Social Indicators and Low and High Graft, 1985-97: Cross-Sectional Analysis 1/

	Child Mortality		Infant Mortality		Low Birthweight		Dropout	
	Low Graft	High Graft	Low Graft	High Graft	Low Graft	High Graft	Low Graft	High Graft
Constant	9.98***	8.23***	9.98***	6.95***	5.96***	3.65***	2.91	4.74**
	(8.91)	(16.69)	(8.91)	(16.35)	(9.42)	(5.35)	(1.56)	(2.40)
Per capita income	-0.70***	-0.41***	-0.70***	-0.29***	-0.35***	0.14	-0.19	-0.13
	(-4.38)	(-4.36)	(-4.38)	(-3.62)	(-3.87)	(1.22)	(-0.53)	(-0.40)
Public health or education spending	0.04	-0.01	0.04	-0.02	0.02	0.03	-0.40*	-0.31
	(0.73)	(-0.09)	(0.73)	(-0.39)	(0.42)	(0.47)	(-1.79)	(-1.10)
Average years of education, females, age 15 and older	-0.28	-0.25**	-0.28	-0.21**	0.09	-0.08	-0.68	0.42
	(-1.62)	(-2.56)	(-1.62)	(-2.67)	(0.73)	(-0.90)	(-1.42)	(1.14)
Dependency ratio	1.15***	0.91***	1.15***	0.66**	-0.13	0.37	2.29*	1.96**
	(3.01)	(3.35)	(3.01)	(2.61)	(-0.39)	(1.10)	(2.06)	(2.46)
Urbanization	0.07	-0.06	0.07	-0.09	-0.24	-0.57***	0.89	-0.03
	(0.22)	(-0.51)	(0.22)	(-0.84)	(-1.31)	(-2.81)	(0.98)	(-0.08)
Adjusted R-squared	0.87	0.84	0.87	0.81	0.61	0.35	0.37	0.14
F statistic	60.65***	46.48***	60.65***	37.34***	14.64***	5.57***	4.54***	2.32*
N	45	44	45	44	44	43	31	41

Sources: World Bank (1999), Barro and Lee (1996), Political Risk Services, and Kaufmann and others (1999b).
1/ Variables are means covering the period 1985-97. N denotes the number of countries. Except for corruption, all the variables are in logs. A low value of the corruption index means that a country is perceived to be less corrupt. White's heteroskedastic-consistent t-statistics are in parentheses.
(***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Panel data regressions

Panel data regressions generally yield weaker results. Controlling for per capita income, public spending on health, dependency ratio, and urbanization rate, corruption remains significantly correlated with child mortality rates in both fixed effects and random effects regressions, and with percent of low-birthweight babies, in the random effects regression.[46]

Data limitations preclude the application of panel data techniques to education outcomes. For instance, there are relatively few observations for dropout rates for the 1985–97 period. In addition, the baseline regressions are not significant for either fixed effects or random effects.

V. Conclusions and Policy Implications

This paper provides a cross-country analysis of the relationship between corruption perception indices and indicators of provision of health care and education services. The empirical analysis shows that a high level of corruption has adverse consequences for a country's child and infant mortality rates, percent of low-birthweight babies in total births, and dropout rates in primary schools. In particular, child mortality rates in countries with

[46] Average years of education in the female population was dropped as a control variable, due to lack of annual data. These results are in Appendix Table 2. These results hold when the regressions also control for physicians per 1,000 and, for a much smaller sample, safe water and sanitation.

Table 7. Social Indicators and Variance-Weighted Corruption, 1985-97: Cross-Sectional Analysis 1/

	Child Mortality	Infant Mortality	Low Birthweight	Dropout
Constant	8.56***	7.46***	4.23***	2.94*
	(16.47)	(15.28)	(7.94)	(1.85)
Graft/standard deviation of graft	0.05***	0.06***	0.03***	0.12***
	(-4.28)	(-5.67)	(-2.72)	(-3.30)
Per capita income	-0.52***	-0.43***	-0.03	-0.09
	(-6.16)	(-5.35)	(-0.37)	(-0.41)
Public health or education spending	0.04	0.04	0.03	-0.35**
	(0.80)	(0.92)	(0.70)	(-2.06)
Average years of education, females, age 15 and older	-0.30***	-0.26***	-0.06	-0.08
	(-3.51)	(-3.14)	(-0.85)	(-0.25)
Dependency ratio	0.96***	0.74***	0.12	1.92**
	(4.37)	(3.58)	(0.50)	(2.51)
Urbanization	0.05	0.04	-0.41***	0.47
	(0.37)	(0.35)	(-2.90)	(1.34)
Adjusted R-squared	0.93	0.92	0.62	0.56
F statistic	176.49***	157.06***	21.79***	13.86***
N	89	89	87	72

Sources: World Bank (1999), Barro and Lee (1996), Political Risk Sevices, and Kaufmann and others (1999b).
1/ Variables are means covering the period 1985-97. N denotes the number of countries. Except for corruption, all the variables are in logs. A low value of the graft index means that a country is perceived to be less corrupt. White's heteroskedastic-consistent t-statistics are in parentheses. (***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

high corruption are about one-third higher than in countries with low corruption; infant mortality rates and percent of low-birthweight babies are almost twice as high, and dropout rates are five times as high. The results are consistent with predictions stemming from theoretical models and service delivery surveys.

The results have four important policy implications in light of the dominant role played by governments in the provision of health care and education services. First, improvements in indicators of health care and education services do not necessarily require higher public spending. It is equally, if not more, important to institute transparent procurement procedures and enhance financial accountability of public spending. Second, it is likely that a reduced level of corruption in the provision of services would help improve their quality. This, in turn, would induce individuals to use these services more intensely and pay official charges for their provision.[47] Third, conditions that facilitate private sector entry into the provision of public services would help curb the monopoly power of government service providers and limit their ability to charge bribes. Finally, participation of the poor in the decisions that

[47] It is, however, possible that the supply of basic public services is constrained in some countries, and would need to be expanded.

influence the allocation of public resources would mitigate corruption possibilities.[48] Empowerment of the poor would thus limit the monopoly power exercised by the government officials responsible for the provision of public services and outputs.

[48] This participatory principle underlies the preparation of recently introduced poverty reduction strategy papers for the Highly Indebted Poor Countries (HIPCs). It is envisioned that all stakeholders in the economy will participate in the process leading to the preparation of antipoverty programs, including for health and education, that are consistent with the overall macroeconomic framework.

Appendix Table 8. Descriptive Statistics: Country Averages, 1985-97 1/

Variable	Data Source	Mean	Std. Dev.	Minimum	Maximum	Observations
PRS/ICRG corruption index 1/	PRS/ICRG database	5.7	2.0	0.3	10.0	128
Graft governance indicators 1/	Kaufmann, Kraay, Lobaton, 1999	0.1	0.9	-1.6	2.1	128
Mortality rate, under-5 (per 1,000 live births)	WDI database, 1999	66.5	70.1	5.5	320.0	116
Mortality rate, infant (per 1,000 live births)	WDI database, 1999	46.0	40.6	4.5	183.5	117
Births attended by health staff (percent of total)	WDI database, 1999	72.2	27.6	7.7	100.0	110
Immunization, DPT (percent of children under 12 months)	WDI database, 1999	74.4	18.6	18.3	99.5	117
Low-birthweight babies (percent of births)	WDI database, 1999	10.6	6.2	3.2	46.0	113
School enrollment, primary (percent gross)	WDI database, 1999	95.6	20.4	27.8	133.8	111
Repeater rate, primary (percent)	UNESCO database, 1998	9.6	9.6	0.0	41.4	97
Dropout rate, primary (percent)	Barro and Lee, 1996	22.4	23.7	0.0	92.0	105
Persistence to grade 5, total (percent of cohort)	WDI database, 1999	82.0	17.3	32.9	100.0	81
Illiteracy rate, total (15 yrs old+)	WDI database, 1999	26.7	22.5	0.4	87.8	86
Per capita income (PPP)	WEO database, 1999	7212.6	6804.5	141.4	28212.5	118
Public spending on health (percent of GDP)	National authorities; IMF staff estimates	2.3	1.8	0.1	8.4	117
Public spending on education (percent of GDP)	National authorities; IMF staff estimates	3.5	1.7	0.2	8.7	116
Average years of education, female (15 yrs old+)	Barro and Lee, 1996	5.3	2.8	0.5	11.5	91
Average years of education, all, (15 yrs old+)	Barro and Lee, 1996	5.8	2.7	0.7	11.7	91
Health expenditure per capita, PPP (current international $)	WDI database, 1999	583.8	671.0	11.3	3462.9	93
Age dependency ratio (dependents to working-age population)	WDI database, 1999	0.7	0.2	0.4	1.1	117
Urban population (percent of total)	WDI database, 1999	55.0	24.1	11.5	100.0	117
Democracy dummy	Treisman, 2000	0.2	0.4	0.0	1.0	89
Protestants (percent of population)	Treisman, 2000	15.4	24.2	0.0	97.8	89
Benefit incidence (ratio of q1 to q5)	Davoodi and Sachjapinan, 2000	1.5	1.9	0.1	9.6	31
Pupil-teacher ratio, primary	WDI database, 1999	28.4	12.5	6.1	66.0	110
Physicians per 1,000 people	WDI database, 1999	1.2	1.1	0.0	3.9	115

Source: As indicated.
1/ The corruption indices retain their original scaling from worst to best.

Appendix Table 9. Health Indicators and Corruption, 1985-97: Panel Data Analysis 1/

Dependent Variable	Child Mortality		Infant Mortality		Low Birthweight Babies	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Corruption (PRS/ICRG)	0.02**	0.04***	-0.00	0.00	0.03	0.07***
	(2.08)	(4.63)	(-1.10)	(0.70)	(0.94)	(4.91)
Per capita income	-0.58***	-0.56***	-0.70***	-0.64***	-0.14	-0.02
	(-7.14)	(-12.13)	(-14.47)	(-20.57)	(-0.95)	(-0.43)
Public health spending	-0.26	-0.03	-0.02	-0.03*	-0.06	-0.02
	(-0.79)	(-1.46)	(-0.98)	(-1.80)	(-0.47)	(0.76)
Dependency ratio	0.16	0.95***	0.05	0.67***	0.67	0.22
	(0.59)	(6.35)	(0.34)	(5.58)	(0.64)	(1.47)
Urbanization	0.04	-0.10	0.31*	0.06	-0.01	-0.41
	(0.18)	(-1.01)	(1.83)	(0.84)	(-0.04)	(-4.54)
Adjusted R-squared	0.99	0.68	0.99	0.78	0.65	0.13
N	204	204	468	468	229	229

Source: World Bank (1999), Barro and Lee (1996), and Political Risk Services.
1/ Except for corruption, all the variables are in logs. A low value of the corruption index means that a country is perceived to be less corrupt. White's heteroskedastic-consistent t-statistics are in parentheses. (***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

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