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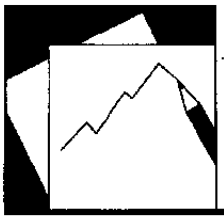

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The Impact of Ethnic Heterogeneity on the Quantity and Quality of Public Spending

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The Impact of Ethnic Heterogeneity on the Quantity and Quality of Public Spending

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Abstract

The paper investigates empirically the impact of ethnic heterogeneity on the amount of public spending on health and education and the quality, or "technical efficiency" of spending. While it finds partial evidence for the claim that more heterogeneous societies spend less on public goods, it suggests that heterogeneity significantly affects the efficiency of public expenditure outcomes in terms of social indicators. The results suggest that the impact of heterogeneity on public expenditure outcomes is not just a public choice problem, but also an issue of "technical efficiency."

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I. Introduction

Empirical research into the impact of heterogeneity on government output has focussed mainly on its impact on policy choices. As regards the provision of public goods, research has focussed on the impact of heterogeneity on the amount of spending. This paper investigates empirically the impact of heterogeneity on both the amount and quality ("technical efficiency") of government spending on health and education, whereby the efficiency of spending is assessed with reference to social indicators. The paper tests the Alesina and Spolaore (1995) model that more heterogeneous societies spend less on pure public goods using a cross-country database and concentrating on health and education. It finds that the results found by Alesina, Baqir, and Easterly (1997) (hereafter referred to as ABE) in an application of that model to a sample of U.S. regions and cities—more heterogeneous societies spend less on pure public goods—can be replicated in a cross-country study for the health sector, but not for the education sector. At the same time, in line with previous studies on the link between spending and social indicators (Flug, Spilimbergo, and Wachtenheim,1998; and Filmer, Hammer, and Pritchett, 1998), the paper shows it is difficult to find empirical evidence of an impact of public spending on education and health on social indicators. On the other hand, it finds that heterogeneity strongly affects the efficiency of public expenditure outcomes for both health and education. Heterogeneity is associated with worse health and education indicators, controlling for government expenditure on health and education, and other relevant variables.

Those results suggest that the impact of heterogeneity on public expenditure outcomes is not just a public choice problem, in that heterogeneity affects policy choices, but also an issue of "technical efficiency." The emphasis of International Finance Institutions (IFIs) and donors on increasing health and education spending in LDCs would seem justified, particularly in heterogeneous countries where the government by itself might choose to spend less on such public goods. However, given the weak link between spending on health and education and social indicators, and given that ceteris paribus the quality of spending is often low in heterogeneous countries, the pressure for higher expenditure should be accompanied by mechanisms to improve the quality of spending.

II. Literature

Endogenous growth theory has given new impetus to research into the role of the government in economic development. In the 1990s, many cross-section growth analyses have been conducted that show the impact of different policy *choices* on growth. See for instance Barro (1991). Macroeconomic stability, openness to trade, the degree of microeconomic distortions (as proxied by the black market premium), central bank independence, education policy, and the "quality of government"—proxied by the rule of law, institutional quality, and democracy—have been linked to economic performance.

In recent years, the literature has moved from determining policy choices that impact on economic growth (or well being) to identifying fundamental characteristics of a country associated with those policy choices. Ethnic (and/or linguistic) heterogeneity is one of the fundamental ("exogenous") characteristics of a society whose impact on policy choices and the quality of government has been studied. The notion that governments in heterogeneous societies are less inclined to produce pure public goods is particularly appealing intuitively, and this notion is consistent with the observation that the U.S. society—relatively ethnically diverse—seems to choose to channel fewer resources via the government than the more homogeneous European societies. Alesina and Spolaore (1995), develop a model in which preferences vary across different groups. With individuals' utility derived from public goods lower in ethnically heterogeneous societies, such societies choose fewer public goods. ABE present (a slightly adjusted version of) the Alesina and Spolaore model and apply it to the U.S. context. They find that spending on pure public goods—education, roads, libraries, sewers and trash pick up—in U.S. cities, metro areas, and counties is inversely related to the city's (area's/county's) ethnic fragmentation, even after controlling for other socioeconomic and demographic determinants. Alesina and Perotti (1995), present a model in which polarized societies have bigger problems implementing fiscal consolidation—arguably also a public good. Interestingly, in a recent paper, Annett (2000) finds empirical support for the idea that heterogeneity is associated with higher government spending. In his model, greater heterogeneity leads to political stability, and this in turn leads to higher government consumption as the government attempts to placate the opposition. In interpreting and comparing these results with the ones of Easterly and Levine, it should be noted that Annett studies total (non-defense) government consumption, whereas ABE look at spending on public goods.

Easterly and Levine (1997) argue that ethnic heterogeneity leads to social and political divisions that divert attention from sound policy making: "polarized societies will be both more prone to competitive rent-seeking by the different groups and have difficulty agreeing on public goods like infrastructure, education and good policies."[2] Greater ethnic heterogeneity therefore harms development since it leads to poorer policy choices. In a cross-country study, Easterly and Levine show that most of the policy variables that have been shown to affect growth—financial depth/repression, black market premium, the fiscal surplus, schooling, infrastructure[3]—are associated with ethnic heterogeneity, or ethno-linguistic fractionalization (ELF).[4] They note that the "Africa dummy" often found in cross-

[2]See this very interesting study also for further references.

[3]Proxied by the number of telephones per worker.

[4]The indicator used here to measure ethnic fragmentation has become popular in empirical studies. It was developed in the 1960s by a team of Soviet scientists. It indicates the probability that two randomly drawn persons from a given country will not belong to the same ethno-linguistic group. According to this measure, the most ethnically diverse countries are found mainly in Africa, with Tanzania, Uganda, and Zaire being on top. The least fractionalized countries are Korea, Haiti, and Japan. European countries are also found among the least fractionalized.

country growth regressions can partly be explained by the impact on policy of ethnic heterogeneity. Sachs and Warner (1997), investigate whether ethnic heterogeneity can explain the quality of policies (proxied by variables such as openness, government savings, and institutional quality). They find that ethnic heterogeneity is significantly correlated with openness and institutional quality, although not with government savings.[5] Sachs and Warner confirm the Easterly and Levine thesis that the effect from heterogeneity on growth runs via policies. When they control for policies in their growth regression, heterogeneity has no direct effect on growth (i.e., other than via policies).

The studies referred to so far mainly analyzed the effects of heterogeneity on (the quality of) policy choices. The quality ("technical efficiency") of government output for given policy choices was not under investigation (although several studies did look at the effect on "institutional quality"). In the case of macro-oriented growth regression studies, the focus on policy choices seems appropriate. On the other hand, in the area of public expenditure, quality—in terms of the impact of spending on social indicators—is as important as quantity. Recent research has shown that the efficiency of government spending varies considerably across countries and that there is large scope for improvement of spending efficiency.

One would expect spending on health and education to improve social indicators in these areas. This is the motivation behind the emphasis among policymakers and IFIs on reallocation of public spending towards health and education. In fact, the empirical evidence on whether health and education spending have a positive impact on social indicators is mixed. For education, most empirical studies find little, insignificant, or no effects of public spending on social indicators (see Flug, Spilimbergo, and Wachtenheim, 1998). For health, most studies find no effect at all (see Filmer, Hammer, and Pritchett, 1998). These results, together with more anecdotal evidence, have led to more attention on the efficiency of spending in terms of the impact on social indicators. Gupta, Honjo, and Verhoeven (1997), assess the efficiency of government expenditure on education and health in African countries, in relation to each other and compared with countries in Asia and Western Hemisphere. They show that African countries are less efficient in the provision of public goods than countries in Asia and Western Hemisphere, but also that African countries have become more efficient in the period 1984-95. Gupta, Verhoeven, and Tiongson (1999), show that intrasectoral allocation within health and education could improve the efficiency of public health and education spending. Shifting spending towards primary and secondary education, and primary health care, has a favorable effect on social indicators.

[5]To confuse matters, Warner and Sachs also note that ELF itself might be caused by poor economic and geographical conditions: linguistic diversity is high in mountainous, or otherwise difficult to access regions.

In a recent study on the "quality of government,"[5] La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999), (hereafter referred to as LPLSSV), investigate the impact of heterogeneity (and other fundamentals of society) on the efficiency of the government. However, of the proxies for government efficiency used by them—a measure of bureaucratic delay (red tape), tax compliance,[6] corruption, and the average wage in government (as a ratio of per capita GNP)—only the first two relate to "technical efficiency." And, these two proxies do not relate to the efficiency of government spending (and they are not necessarily correlated with spending efficiency).

III. THIS STUDY

The main innovation of this paper is the emphasis on the impact of heterogeneity on the quality, or "technical efficiency," of government spending. In heterogeneous societies, those working in the public health and education systems may identify themselves less with the typical "consumer" of the systems than in homogeneous societies and, indeed, they may be less likely to identify themselves with the formal objectives of the systems. The public health and education systems are more likely to be subject to patronage and competitive rent-seeking behavior. Such behavior diverts attention from the actual task of providing public goods, just as such behavior diverts attention from sound policy making (as argued by Easterly and Levine, 1997). As a result, public expenditure is likely to be less efficient in heterogeneous societies. The empirical results presented below suggest indeed that heterogeneity affects the "technical efficiency" of government spending on health and education. An example (in line with the results below) would be that in two equally developed countries, in terms of per capita GDP and formal level of schooling (number of years of schooling), which spend a similar share of GDP on public education and health, the schooling system in the less heterogeneous country is better able to reduce illiteracy, while the health system is more effective in reducing infant mortality, even if the two countries are equally effective in immunization.

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[5]They define the quality of the government by the aspects of a government whose effect on economic growth has been shown to be robust in previous studies—interference with the private sector, government efficiency, output of public goods, and size of the government. They find that the quality of government thus defined is influenced by fundamentals of a society such as heterogeneity, dominant religion, and inherited legal system.

[6]Data on bureaucratic delays and tax compliance is obtained from survey data.

IV. Model and Results

The determinants of two types of variables are estimated:

- **Public spending on health and education.**[7] The general specification can be written as follows.[8]

$$PUBSPEND = a * SCALE + b * TGDP + c * FUND + \epsilon, \qquad (1)$$

Where *PUBSPEND* is the level of public spending on health or education (as a share of GDP), *SCALE* is a vector of scaling variables (GDP per capita and schooling), *TGDP* is the tax/GDP ratio, which measures the availability of public resources, and *FUND* is a vector of fundamental characteristics of the society—including heterogeneity—that are expected to affect choices.

- **Social indicators in health and education.**[9] The general specification can be written as follows.

$$SOCIND = d * SCALE + e * PUBSPEND + f * FUND + \epsilon, \qquad (2)$$

Where *SOCIND* denotes (a vector of) social indicators in health and education. Note that *SCALE* and *FUND* appear in both equations.

Data from the Easterly and Levine database[10] was combined with data from the World Bank World Development Indicators. Data for the 1980s was collected for 160 countries, including industrialized countries, but excluding most transition economies. Data limitations meant that the number of observations in the various regressions ranges from 54 to 79. Annex I describes the data sources. Table 1 shows the correlation between the different variables.

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[7]Previous studies like ABE and LPLSSV have concentrated on this effect of heterogeneity (LPLSSV actually regress several indicators of public good output—as a share of GDP—on the fundamentals of a society, not controlling for tax revenues).

[8]At any time, the variables used in the regressions are the variables themselves, not the fitted values.

[9]In the case of health indicators, immunization is included as an additional control variable because of its significant additional explanatory power.

[10]This database is available on the internet: www.worldbank.org/html/prdmg/grthweb/ddeale.htm

Table 1. Correlation Matrix

	Africa Dummy	GDP Per Capita	Schooling	Tax/GDP	Life Expectancy	Public Health Spending	Immunization	Infant Mortality	Illiteracy	Corruption	Public Education Spending	Homogeneity
Africa dummy	1.00											
GDP per capita	-0.68 ***	1.00										
Schooling	-0.67 ***	0.73 ***	1.00									
Tax/GDP ratio	0.00	0.36 **	0.23	1.00								
Life expectancy	-0.81 ***	0.84 ***	0.78 ***	0.31 *	1.00							
Public health spending	-0.33 *	0.47 ***	0.43 **	0.45 **	0.53 ***	1.00						
Immunization	-0.32 *	0.53 ***	0.48 ***	0.59 ***	0.61 ***	0.52 ***	1.00					
Infant mortality	0.64 ***	-0.81 ***	-0.80	-0.43 **	-0.93 ***	-0.52 ***	-0.69 ***	1.00				
Illiteracy	0.67	-0.77	-0.89	-0.35	-0.87	-0.48	-0.56	0.90	1.00			
Corruption	-0.16	0.55 ***	0.25	0.30 *	0.46 **	0.40 **	0.55 ***	-0.51 ***	-0.31 *	1.00		
Public education spending	0.23	0.09	0.02	0.74	0.06	0.22	0.40	-0.20	-0.15	0.25	1.00	
Homogeneity	-0.63 ***	0.65 ***	0.42 **	0.22	0.69 ***	0.55 ***	0.40 **	-0.61 ***	0.59 ***	0.24	-0.03	1.00

Number of observations is 44 (no mission values for any of these variables).

* Significant at 5 percent
** Significant at 1 percent
*** Significant at .05 percent

The *scaling variables* included in the regressions are:

- **Per capita GDP.** With education and health assumed to be (at least) normal goods, one would expect a rise in per capita income to lead to higher health and education spending. In fact, education and health are often found to be superior goods. Then, the share of GDP devoted to public education and health expenditure should increase with a rise in per capita GDP.

- **Schooling attainment.** The average number of years of schooling is often used to measure the level of education of a country. As such, it would be a social indicator, and could be seen as an output of the education process. However, the level of schooling attainment can also be seen as a *determinant* of public sector output and attainment of social indicators—for instance, a better educated society puts more emphasis on public health expenditure. Therefore, schooling is used as a scaling variable in the health regressions, next to GDP per capita. Schooling is not included as a scaling variable in the regression for education *spending*, as the reverse causality—impact of spending on schooling—should be expected to dominate. However, a caveat with schooling attainment is that a certain number of years of education will have different results as to the actual skills attained, depending on the quality of the schooling system. Therefore, illiteracy is used as the final social indicator in the education area , and schooling is seen as an intermediate variable (and thus included as a determinant in the illiteracy regression).

The *availability of public resources*, as a determinant of spending, is proxied by:

- **Tax/GDP ratio.** Public spending is constrained by the availability of public resources. The level of taxation is partly a choice variable. However, the total amount of tax revenues is likely to be affected by exogenous factors such as the presence of an easily taxable group or sector such as a large mineral industry. Hence, the tax/GDP ratio is included as a control variable in the determination of spending on public goods.[11]

[11] It would be useful to "endogenize" the tax/GDP ratio, modeling the "willingness to pay" as a function of fundamental characteristics. Heterogeneity has two opposite effects on the tax/GDP ratio. A more heterogeneous society is less likely to pay taxes in order to provide pure public goods (in line with the Alesina and Spoloare model). On the other hand, in heterogeneous societies, the government is more likely to tax—preferably the parts of society not represented in government—in order to pursue patronage and transfer public resources to favored groups. These effects offset each other and, a priori, the net effect of heterogeneity on the tax/GDP ratio is ambiguous. Here, no significant effect of heterogeneity on the tax/GDP ratio was found, controlling for economic development (GDP per capita). This would suggest that the two effects are indeed offsetting.

The *fundamentals* of society included here are:

- **Homogeneity.** As discussed above, homogeneity is expected to affect both the level and quality of spending. Homogeneity is defined as (1-ELF), with ELF the measure of ethnic-linguistic heterogeneity developed in the 1960s in the Soviet Union (see footnote 3). Although the main results are based on this measure of ethnic heterogeneity, a sensitivity analysis is performed by doing all regressions using a heterogeneity measure constructed by Muller (1964).[12]

- **Corruption.**[13] Corruption is likely to impact on the quality of government spending. On the one hand, one would expect heterogeneous societies to be more prone to corruption. Empirically, the two variables exhibit some correlation (a coefficient of 0.24 (see Table 1)), but it is not significant. Corruption is clearly also fed by exogenous factors. For instance, Leite and Weidmann (1999), show the impact of the availability of natural resources on corruption. Consequently, here corruption is included as a proxy/control variable for exogenous factors other than heterogeneity.

- **Africa dummy.** A dummy variable for Sub-Saharan African countries is included in line with many of the other studies in this field.

The *social indicators* used to assess the quality, or "technical efficiency" of spending are:

- **Immunization against DPT.** Immunization rates are among the best quantifiable direct public health output indicators. Data is available for immunization against DPT and measles. The two are highly correlated, and here we include only the first one. Immunization is not a goal in itself. It could be seen as a government output instead of a social indicator (comparable to schooling in the area of education). Here, infant mortality and life expectancy are seen as final social indicators for the health sector and below, immunization, besides being estimated, is also used as a control variable in the regression for infant mortality and life expectancy.

- **Infant mortality,** expressed as the number per 1,000 live births.

- **Life expectancy,** in number of years.

- **Illiteracy.** Illiteracy is a more final social indicator than schooling, and less subject to measurement errors and problems with cross-country comparability. As shown in Table 1, the correlation between schooling and illiteracy is high (-0.89) but not perfect.

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[12]Easterly and Levine (1997), provide a useful discussion on measurements of heterogeneity. They compare the Soviet measure with other measures of ethnic heterogeneity developed subsequently, and conclude that the Soviet measure is the most comprehensive and is still the most widely used measurement in social sciences.

[13]Note that a higher value of the CORRUPT variable indicates less corruption.

Annex II presents in a more detailed manner the specification of the regression equations, indicating which effects are included and excluded in light of the above discussion.

A. Health

Public health spending

Regression I in Table 2 summarizes the results. Both schooling attainment and per capita GDP are included as scaling variables. The effect of schooling dominates, and the effect of per capita GDP is not significant. A higher tax/GDP ratio is associated with higher public health spending, confirming the idea that the availability of resources does matter.[14]

Heterogeneity is significant with the expected sign: a more homogeneous society tends to channel more resources to public health spending, controlling for the level of development and education, the availability of tax resources (and other control variables). The size of the coefficient would suggest that a reduction in heterogeneity of 10 percentage points[15] would be associated with an increase in public spending on health of 0.14 percent of GDP. The highly significant effect of corruption[16] (corruption is associated with lower public spending on health) suggests that there are fundamentals other than heterogeneity that have an effect on the composition of public spending. In Regression II, corruption is excluded. The exclusion of corruption does not significantly affect the other coefficients, except for the coefficients of per capita GDP and schooling. The coefficient of per capita GDP now becomes significant, whereas the one of schooling loses its significance. The Africa dummy is not significant in either of the regressions.

Efficiency of health spending

As discussed above, immunization can arguably be seen as both a policy measure and a public expenditure outcome. Immunization against DPT is regressed on the same set of variables, including public health spending, but excluding the tax/GDP ratio Again, schooling attainment is found to be a better regressor than per capita GDP. This is interesting but not unreasonable. In countries with an unequal distribution of income, or "island industries" based on natural resource wealth, a relatively high per capita GDP could coincide with bad social indicators. On the other hand, some developing countries with a low GDP per capita have made impressive progress with the improvement of social indicators. It is notable that the level of public health spending is not found to be associated with immunization. But, this is consistent with the earlier literature discussed in Section II.

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[14]The size of the coefficient indicates that public health expenditure, as a share of GDP, would increase by 0.05 percentage point for a 1 percentage point increase in the tax/GDP ratio.

[15]As an illustration, the difference in heterogeneity between the OECD and non-OECD countries included here is 22 percentage points.

[16]Note that a higher number for the corruption variable implies less corruption.

The effect of heterogeneity was not found to be significant at the 5 percent significance level, despite the significant (negative) pairwise correlation between heterogeneity and immunization. On the other hand, the results suggest that corruption has a significantly negative effect on immunization.

The results of a regression of infant mortality on the above-mentioned variables, including immunization, are summarized in equation IV. Again, schooling attainment is highly significant. Remarkably, public health spending has no effect on infant mortality (actually, the sign is wrong). A higher rate of immunization is strongly associated with lower infant mortality. Heterogeneity is highly significant. The coefficient would suggest that a reduction in heterogeneity of 10 percentage points would be associated with a 2.4 point reduction in the infant mortality rate. Corruption is not significant and the African dummy is just significant. The interesting result is that, controlling for the level of development (per capita GDP), and schooling, public spending on health, immunization effort, and other characteristics of the society, heterogeneity has a highly significant negative effect on infant mortality.

The regression of life expectancy (regression V), shows similar effects for all determinants but the Africa dummy (which is highly significant in the regression for life expectancy) and GDP per capita (which is now also significant). Again, heterogeneity is highly significant, with the coefficient suggesting that a reduction in heterogeneity of 10 percentage points is associated with an increase in life expectancy of half a year. The fit of this equation is particularly good—more than 90 percent of the variation in life expectancy across countries is explained by the determinants.

As shown, immunization has a highly significant effect on both infant mortality and life expectancy, while no significant effect of heterogeneity on immunization was found (despite the significant pairwise correlation). This could be interpreted as weakening the case that heterogeneity is an important determinant of the efficiency of public health expenditure outcomes. However, immunization is included here only because of its strong independent explanatory power. Excluding immunization in the regressions for infant mortality and life expectancy does not affect the results with respect to the other variables, except for the fact that the Africa dummy loses its significance in the regression for infant mortality.

A repetition of the regressions using the Muller measurement of heterogeneity leads to similar results. The effect of heterogeneity is stronger in all regressions except for the regression of immunization (these results are not reported in tabular format).

Table 2. Health: Public Spending, Output and Social Indicators

Regression Dependent Variable	I Public Health Spending 1/	II Public Health Spending 1/	III Immunization	IV Infant Mortality	V Life Expectancy
GDP per capita	-0.32 (-0.7)	0.72 (1.9)*	4.11 (0.9)	-6.95 (-1.3)	2.00 (1.8)*
Schooling	1.05 (1.8)*	0.87 (1.4)	15.46 (2.5)**	-34.46 (-4.5)**	4.66 (3.1)**
Tax/GDP ratio	0.04 (1.9)*	0.05 (2.4)*	... ...	... ...	... ...
Public health spending 1/	... ...	... ...	0.74 (0.6)	2.35 (1.6)	-0.17 (-0.6)
Immunization	... ...	... ...	... ...	-0.52 (-3.6)**	0.07 (2.6) **
Homogeneity	1.43 (1.9)*	1.30 (1.8)*	9.7 (1.2)	-23.82 (-2.4)**	5.35 (2.8)**
Corruption	0.71 (4.2)**	... ...	4.47 (2.2)*	-1.68 (-0.7)	0.60 (1.2)
Africa dummy	-0.01 (-0.1)	0.37 (0.6)	8.34 (1.3)	14.10 (1.8)*	-8.66 (-5.5)**
Constant	0.15 (0.1)	-5.22 (-2-2)*	-23.08 (-0.9)	205.56 (6.3)**	35.42 (5.3)**
R2	0.68	0.59	0.65	0.86	0.91
N	67	74	76	76	69

Notes:

1/ As percentage of GDP.

* = significant at 5 percent.

** = significant at 1 percent.

B. Education

Education spending

Table 3 summarizes the results. In regression I for the level of public spending on education, only the tax/GDP ratio was found to be significant.[17] That is, neither the scaling variable (per capita GDP) nor heterogeneity (nor the other control variables) were found to be significant.

Quality of education spending

Regression II of Table 3 shows the results of a regression of the level of schooling attainment on the same set of variables (including public spending on education). Not surprisingly, per capita GDP was highly significant. But, interestingly, again, the level of public spending on education was not significant. The finding that heterogeneity is associated with higher schooling attainment seems to be clearly inconsistent with the argument of this paper. However, as noted above, there are doubts about the appropriateness of viewing schooling as a social indicator, and as shown below, heterogeneity does have a significantly positive effect on illiteracy. Corruption is found not to be significant, while the Africa dummy is significant.

In this paper, illiteracy is viewed as the appropriate final social indicator for education. In Regression III for illiteracy, only schooling attainment and heterogeneity were found to be significant, although the coefficients of public education spending (and the Africa dummy), was almost significant. The coefficient of heterogeneity has the expected sign: illiteracy is higher in more heterogeneous societies, controlling for the level of GDP per capita, the level of schooling, public spending on education, and the other control variables (the 10 percentage point reduction in heterogeneity would be associated with a decrease in the illiteracy rate of 1.5 percentage points).[18]

A repetition of the regressions using the Muller measurement of heterogeneity leads to similar results. The effect of heterogeneity is then actually almost significant in the regression for public education spending (these results are not reported in tabular format).

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[17]The size of the coefficient indicates that public education expenditure, as a share of GNP, would increase by 0.11 percentage point for a 1 percentage point increase in the tax/GDP ratio.

[18]Data for illiteracy was not available for many OECD countries. Hence, both the size and the composition of the sample for the illiteracy regression is different than for the other regressions. This should be taken into account. However, this difference in sample does not seem to account for the difference in impact of heterogeneity between schooling and illiteracy. When the schooling regression is repeated for the same sample of countries as the illiteracy regression, the results are the same as in the original regression for schooling.

Table 3. Education: Public Spending, Output and Social Indicators

Regression Dependent Variable	I Public Education Spending	II Schooling	III Illiteracy
GDP per capita	0.18 (0.6)	0.35 (5.1)**	3.00 (1.0)
Schooling	... ...	... ...	-39.12 (-8.7)**
Tax/GDP ratio	0.11 (6.1)**	... ...	... ...
Public spending on education	... ...	-0.00 (-0.0)	-1.16 (-1.4)
Homogeneity	-0.35 (-0.5)	-0.26 (-1.7)*	-15.04 (-2.5)**
Corruption	0.14 (1.1)	0.04 (1.2)	-1.06 (-0.8)
Africa	0.64 (1.2)	-0.35 (-2.7)**	6.94 (1.5)
Constant	0.26 (0.1)	-1.07 (-2.3)**	73.39 (3.8)**
R2	0.52	0.73	0.85
N	79	79	54

Note:

* = significant at 5 percent.

** = significant at 1 percent.

V. SUMMARY OF RESULTS

The main empirical findings, in a cross-country regression analysis, are:

(1) Heterogeneity is associated with less public spending on health, although no significant association could be found between heterogeneity and public spending on education.

(2) Heterogeneity is associated with worse health and education indicators (infant mortality; life expectancy; and illiteracy, although not with schooling), even controlling for the level of development (and, if relevant, schooling or immunization), public spending and corruption. That is, heterogeneity impacts negatively on the quality (or "technical efficiency") of government spending.[19]

(3) The (usually assumed) positive effects of public health and education spending on social indicators are small or not significant, compared to the impact of the level of development (and/or schooling) and heterogeneity. Although not central to the argument here, this result is important because the strong impact of development on social indicators underlines the importance of economic growth as an objective of policy.

Additional results are that (i) corruption seems to impact on the allocation of public resources—governments in less corrupt societies devote more public resources to health and achieve higher immunization rates, ceteris paribus—but has no impact on the quality, or "technical efficiency," of government spending; and (ii) the Africa dummy is highly significant in the regression of life expectancy (and just significant in the regression of infant mortality), but not in any of the spending regression and neither in the illiteracy regression.

All in all, the results suggest that (i) there is mixed evidence for the impact of heterogeneity on the amount of government spending on health and education, and (ii) there is strong evidence for the impact of heterogeneity on the quality, or "technical efficiency," of public spending. The first result could be compared with results previously found by ABE for regions and cities in the United States, and is a public choice issue. The second result deserves more attention from researchers and policymakers. The recognition of the impact of fundamentals of a society on the quality of government spending implies that a discussion of the appropriate size and role of the government should refer to these fundamentals of a society.

What could be the lessons for policy making? The emphasis of IFIs and donors in favor of increased health and education spending in LDCs would seem justified in particular in heterogeneous countries where the government by itself might choose to spend less on such

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[19] It could be true that heterogeneity has an impact on social indicators other than via the amount and quality of government policies/spending. Although this possibility cannot be discarded in the absence of empirical evidence, it is likely that the impact runs at least partly via government policy. Note in this connection, Sachs and Warner's finding that, in their growth regressions, the effect of heterogeneity on growth runs only via policies.

public goods. However, given the weak link between spending on health and education and social indicators, and given that ceteris paribus the quality of spending is low in heterogeneous countries, the pressure for higher expenditure should be accompanied by mechanisms to ensure the quality of spending.

Data Sources

Variable	Description	Source
Homogeneity	1-ETHNIC, with ETHNIC being the Index of ethnolinguistic fractionalization, 1960	Easterly and Levine
GDP per capita	Log of real per capita GDP in 1980	Easterly and Levine
Schooling	Log of 1 plus average years of school attainment, average 1980-85	Easterly and Levine
Tax/GDP ratio	Tax revenue, as percent of GDP; 1980-89	World Development Indicators (xxxGBTAXTOTLG_1)
Public health spending	Public health spending, as percent of GDP; average 1990-93	World Development Indicators (xxxEXPDPRIM_1)
Public education spending	Public spending on education, total (percent of GNP, UNESCO); average of 1985 and 1990	World Development Indicators (xxxSEXDTOTLG_1)
Immunization	Immunization, DPT (percent of children under 12 months); average 1980-89	World Development Indicators (xxxSHIMMIDPT)
Corruption	Knack and Keefer measure of corruption (1980-89)	Easterly and Levine (from othervar.xls)
Africa dummy	Dummy for Sub-Saharan Africa	Easterly and Levine
Infant mortality	Mortality rate, infant (per 1,000 live births); average 1980-89	World Development Indicators (xxxSPDYNIMRTIN)
Life expectancy	Life expectancy, 1990	World Development Indicators (xxxSPDYNLEOOIN)
Illiteracy	Illiteracy rate, adult total (percent of people 15+), average 1989-90	World Development Indicators (xxxSEADTILITZS)

Specification Regression Equations

Public Spending

$$\begin{bmatrix} \text{Pub. Hlth. Sp.} \\ \text{Pub. Educ. Sp.} \end{bmatrix} = \begin{bmatrix} a11 & a12 \\ a21 & - \end{bmatrix} * \begin{bmatrix} \text{GDP p.c.} \\ \text{Schooling} \end{bmatrix} + \begin{bmatrix} b11 & b12 & b13 \\ b21 & b22 & b23 \end{bmatrix} * \begin{bmatrix} \text{Corruption} \\ \text{Heterogeneity} \\ \text{Africa dummy} \end{bmatrix}$$

Social Indicators

$$\begin{bmatrix} \text{Immunization} \\ \text{Infant mortality} \\ \text{Life expectancy} \\ \text{Schooling} \\ \text{Illiteracy} \end{bmatrix} = \begin{bmatrix} c11 & c12 \\ c21 & c22 \\ c31 & c32 \\ c41 & - \\ c51 & c52 \end{bmatrix} * \begin{bmatrix} \text{GDP p.c.} \\ \text{Schooling} \end{bmatrix} + \begin{bmatrix} d11 & - \\ d21 & - \\ d31 & - \\ - & d42 \\ - & d52 \end{bmatrix} * \begin{bmatrix} \text{Pub. Hlth. Sp.} \\ \text{Pub. Educ. Sp.} \end{bmatrix} + \begin{bmatrix} e11 & e12 & e13 \\ e21 & e22 & e23 \\ e31 & e32 & e33 \\ e41 & e42 & e43 \\ e51 & e52 & e53 \end{bmatrix} * \begin{bmatrix} \text{Corruption} \\ \text{Heterogeneity} \\ \text{Africa dummy} \end{bmatrix} + \begin{bmatrix} - \\ f21 \\ f31 \\ - \\ - \end{bmatrix} * \begin{bmatrix} \text{Immun.} \end{bmatrix}$$

Note: - indicates that the corresponding variable is not included in the regression, in light of the discussion in Section III.

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