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Why Do Some Oil-Rich Countries Perform Better Than Others?

Farrukh Iqbal
Youssouf Kiendrebeogo

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Abstract

Progress in child mortality reduction and education attainment varies widely among oil-rich countries. This paper investigates the causes of this variation using an empirical model that departs from the available literature in allowing for explicit measurement of the impact of initial levels of child mortality and education attainment. The results show that the following four variables are statistically significant and robust across various specifications: public spending on health and education, economic growth rates, caloric sufficiency, and initial levels of child mortality and education attainment. Further analysis was conducted to determine the economic significance of these factors by examining the contribution of each to the fitted growth rates (as a deviation from the sample mean) of child mortality and secondary school enrollment for 14 oil-rich developing countries. The analysis reveals some interesting patterns. First, initial conditions dominate the results for education attainment: the initial level of secondary school enrollment in 1980 is the dominant factor in explaining subsequent improvements in 10 of the 14 oil-rich developing countries for which calculations could be performed. Second, policy factors worked in different ways in different countries. A high degree of caloric sufficiency enabled countries in the Middle East and North Africa to reduce child mortality faster, while low levels of caloric sufficiency prevented African oil-rich countries, such as Angola and the Republic of Congo, from making progress. Third, levels of public spending were not economically critical for gains in school enrollment, although they were important in a few country cases for improvements in child mortality rates.

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Why Do Some Oil-Rich Countries Perform Better Than Others? *

Farrukh Iqbal and Youssouf Kiendrebeogo

The World Bank

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A. Introduction

Among the many oil-rich countries in the world, some have done far better in terms of improving the standards of living of their citizens than others. Why has this been so? This paper attempts to answer this question using long run changes in two aspects of the standard of living, the child mortality rate and the secondary education enrollment rate.[1]

Does performance with respect to these indicators vary among oil rich countries? Consider Figure 1 below that shows a fractional-polynomial regression of the change in child mortality rates (number of deaths among children under 5 years of age per 1,000 births) during 1970-2010 on the initial child mortality rates prevailing in each country *circa* 1970. To show the diversity in performance among oil rich countries, we have labeled all oil rich countries from the Middle East and North African (MENA) region as well as all oil rich countries from the Sub-Saharan Africa (SSA) region. All the MENA countries (except Iraq) are located above the regression line while all the SSA countries are below the line. In other words, all the MENA countries (save Iraq) achieved larger changes over time than predicted by their initial levels of child mortality while the SSA countries achieved smaller ones.

Figure 2 shows a similar, though less pronounced pattern, using changes in gross secondary school enrollment rates as an alternative measure of development performance. All MENA countries (except Iraq) are seen to have achieved gains that are higher than would have been predicted by their initial levels in 1970. Oman shows exceptionally good performance. Among the African countries, four (Angola, Gabon, Equatorial Guinea and the Republic of Congo) are below the fitted regression curve while one (Nigeria) is above the line.

Clearly, there is diversity in performance between these two groups of oil rich countries. One reason for this may lie simply in differences in wealth. Higher wealth among the MENA countries compared to the SSA ones (clearly true for the GCC group of MENA countries) may have provided the resources with which to improve health and education indicators at a faster rate. We will investigate this connection rigorously in this paper, in particular, by examining the effect of public spending on health and education outcomes. Meanwhile, the link between incomes and development performance

[1] We use these two measures because they are considered such important policy objectives that they were included in the Millennium Development Goals adopted by the international development community for the period 2000-2015 and have now been included as well among the Sustainable Development Goals for the next decade and a half. We do not use income per capita or growth of income per capita as measures of performance because, for oil rich counties, these are likely to be mechanically related to the amount of oil resources they possess and to exogenous changes in the price of oil over time.

can be checked in a preliminary fashion through Figure 3, which shows a scatter plot with the long run improvement (between 1970 and 2010) in child mortality rates on the Y-axis and the 2010 level of GDP per capita (measured in 2011 PPP dollars) on the X-axis.

Figure 1: Change in child mortality rates relative to initial levels

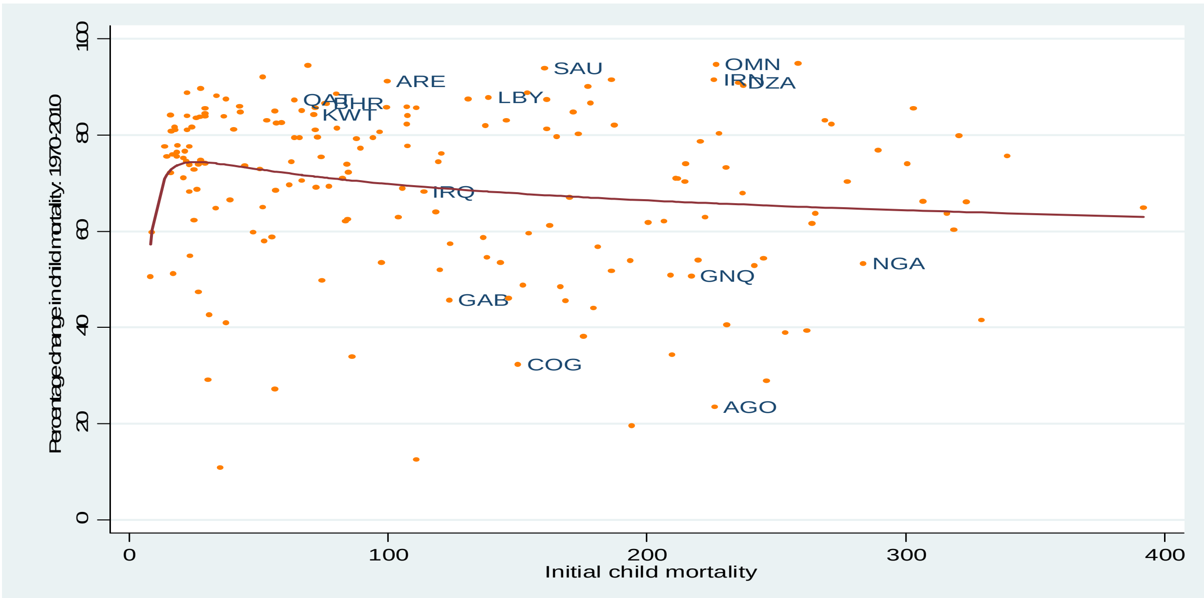
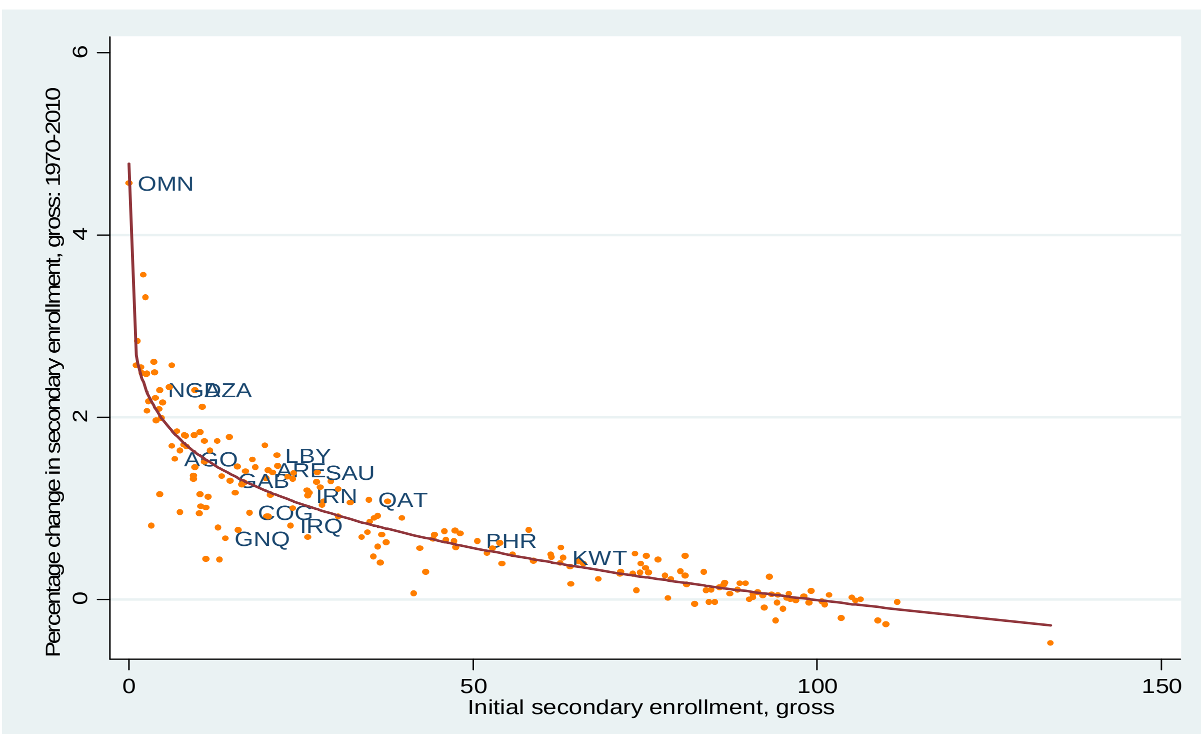


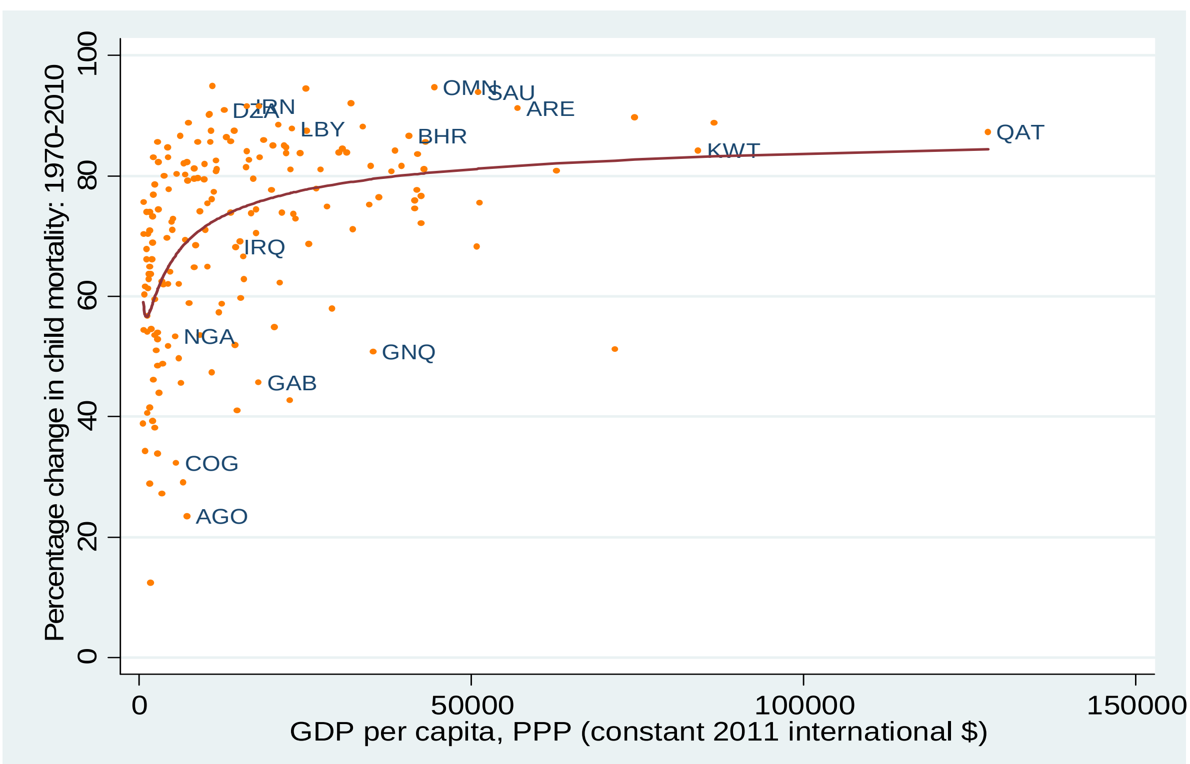
Figure 2: Change in gross secondary school enrollment rates relative to initial levels



The results show that, even after controlling for income per capita, the MENA countries have achieved better child mortality outcomes (all but Iraq are located above the bivariate regression curve) over the past 40 years or so than the African countries (all located below the regression curve). This suggests that differences in performance are due to more than just differences in income per capita. This should not be surprising since countries with similar levels of resources may make different budget allocations to different priorities and with different degrees of effectiveness.

The rest of this paper is organized as follows. We proceed in Section B to a literature survey that helps identify plausible determinants of progress over time in child mortality and school enrollment. In Section C, we develop the empirical strategy to assess the importance of these determinants of cross-country variations in human development outcomes. The results of our econometric analyses are reported in Section D together with robustness checks of the basic model. In Section E, we explore two extensions of the model that delve deeper into oil-wealth effects. In Section F, we report and discuss some country-specific results of the empirical model that answer the question in the title of the paper in a nuanced fashion. Concluding remarks follow in Section G.

Figure 3: Income per capita and change in child mortality over 1970-2010



B. Literature review

Two strands of literature have a bearing on our proposed investigation. The first consists of studies of the determinants of performance in the health and education area. The second consists of studies of policy and institutional characteristics of oil-rich countries often referred to as the "resource curse". We review these two strands below by first identifying the important determinants of health and education performance and then considering how "resource curse" aspects may accentuate or attenuate these determinants.

Public spending on health and education facilities and personnel is perhaps the most prominent policy tool used by governments to improve health and education indicators. This is especially the case with the MENA oil countries where the model of publicly financed delivery of health and education services was adopted early in their histories as independent nation-states, even to the extent of being considered a basic right of citizens in some countries (Kronfol, 2012). The public sector in resource rich countries tends to be generously endowed with revenues and thus one would expect public spending to be especially important to the supply of health and education facilities there. A number of studies have found public spending to be associated with improvements in health and education indicators (Gupta et al., 2002; Baldacci et al., 2008) in developing countries. However, others have found public spending to have a negligible effect (Filmer and Pritchett, 1999; McGuire, 2005) and have argued that this is likely because of leakages that affect public spending in countries with weak governance.

The *quality of governance* is important to health and education outcomes in several ways. In corrupt environments, public resources could be misappropriated and misspent. The lack of accountability mechanisms could affect the extent to which health and education personnel (doctors, nurses, teachers and school administrators) shirk from their duties. There is, by now, a fairly extensive literature showing that developing countries suffer from high levels of absenteeism among service providers (Chaudhury, et al., 2006). Where the rule of law is weak, it may be difficult to enforce corrective actions even when malfeasance is detected. The empirical literature tends to confirm a link between weak governance and poor outcomes from public spending (Rajkumar and Swaroop, 2008).

The "resource curse" literature notes the tendency for resource-rich countries to have especially weak governance arrangements. The availability of natural resources presents numerous opportunities for private gain through such means as getting exclusive licenses to exploit the resources or obtaining contracts to sell goods and services to governments. Such "rent-seeking" activities generate corruption. This connection between resource dependence and corruption has been empirically documented in many studies (see, for example, Mauro, 1995 and Bhattacharya and Hodler, 2010). The connection is even stronger in non-democracies where accountability mechanisms (or checks and balances) are less strong (Ross, 2001). If so, this would make the governance issue even more important for the MENA and African oil rich countries since many of them happen to be authoritarian and non-democratic in practice.

Private spending may also be an important determinant, especially in contexts where private clinics and schools are widely available. However, direct information on private spending on health and education is not available for most developing countries. Some studies use income per capita as a proxy for private spending and find a positive and significant role for it: see Filmer and Pritchett (1999) for the case of child mortality and Gupta et al., (2002) and Baldacci et al., (2008) for the case of education attainment. Indeed, Filmer and Pritchett (1999) argue that income levels are by far the predominant determinant of child mortality improvements. Other studies (see Iqbal and Kiendrebeogo, 2015) use the growth rate of income as a proxy, arguing that income per capita is unsuitable because it is often highly collinear with other included variables such as public spending.

In addition to direct spending on health and education, other targets of public spending may also be relevant to improving health and education indicators. For example, spending on infrastructure (such as water supply and sanitation) and social assistance (such as food subsidies) may have this effect.
The connection between clean water supply and child mortality rates is well documented, as is that between child nutrition and child mortality (Pelletier and Frongillo, 2003). Resource-rich countries generally tend to spend a lot on infrastructure (this can also be thought of as a way to distribute rents in discretionary ways) as well as to have generous social assistance arrangements. The latter is a particularly distinctive characteristic of MENA countries (including those without much by way of oil wealth) which have had generous food and fuel subsidies for many years (Iqbal, 2006). *Food sufficiency* is likely to be an important determinant of health and education outcomes for inter-related reasons. Adequacy of food among mothers is known to lead to higher baby weight and higher levels of milk production and thus breastfeeding, all of which lead in turn to improved chances for infant and child survival. Likewise, adequacy of food among children leads to reduced susceptibility to disease, again leading to better child survival rates. As far as education is concerned, better food intake is likely to lead to better health among children who are then less likely to miss days at school and drop out at lower ages.

Population density could be another important variable. For mortality, the link could go either way. Higher population densities could mean that a given health facility would cover more people and thus provide economies of scale to public spending. On the other hand, higher population densities have also been associated in many areas with higher probabilities of disease incidence and spread. Rising mortality accompanied urbanization in Europe and North America in the first half of the nineteenth century in many cities (Cutler et al., 2006). In the case of education, however, the link is more likely to be one-way: population density is likely to lead to greater productivity in public spending as each school covers more students.

C. Modeling Considerations

A typical empirical model linking an education or health indicator to its determinants takes the following general form:

(1) $M_i = f(Z_i)$

where the subscript i denotes country, *M* refers to the education or health indicator adopted as the dependent variable, and Z refers to a vector of socioeconomic variables such as those discussed in the literature survey above.

Our interest, however, is in explaining changes in the education or health measure over time. An empirical model for this may be written in the following general form:

(2) $LogM_{i(t+n)} - LogM_{it} = f(LogM_{it}, Z_{iavg})$

where the left hand side refers to the log-change in M over a n-year interval from year t to year $t+n$ and, on the right hand side, Mit refers to the initial value of M at time t; and the subscript avg refers to the average value of the independent variables over the n year interval.

This empirical model differs in three main respects from the conventional approach: (a) it defines the dependent variable as the growth rate of the indicator over time rather than its *level* at a point in time; (b) it introduces the initial level of the indicator as an independent variable and (c) it uses average values over past intervals for the independent variables rather than contemporary values. These three aspects are discussed further below.

Formulation of the dependent variable. Most studies use the level of education attainment or child mortality at a given point in time as the dependent variable. Some (see Wang, 2002 and Baldaccci et al., 2008) average the indicator over five-year periods to reduce measurement errors. Since our interest is in explaining changes over time, we define our dependent variable as the log-change in indicator levels between 1980 and 2014 for each country in our sample. This is analogous to what is done in the "empirics of growth" literature where the growth rate of income over time is the object of explanation rather than its level at any given point in time. This formulation is used in Goldin and Katz (1997) and Iqbal and Kiendrebeogo (2015) for education attainment and Pritchett and Summers (1996) and Iqbal and Kiendrebeogo (2014) for child mortality reduction. The log-change formulation is central to the Iqbal and Kiendrebeogo studies but somewhat incidental to the other studies where it is mixed in with level formulations.

Use of initial level of indicator as independent variable. Many empirical formulations of the well-known Solow (1956) growth model use as an independent variable the initial level of income for the year from which growth is being measured. This allows one to determine the presence of convergence, whereby countries with low initial per capita incomes tend to grow faster than those with higher initial incomes (Sala-i-Martin, 1996). Our formulation allows us to check for convergence over time in the levels of health and education outcomes as well.

That convergence very likely characterizes the pattern of change in health and education indicators may be seen from Figures 1 and 2. These show how the initial level of the relevant indicator is linked to subsequent changes in it. Figure 2 is especially notable in tracing out a hyperbolic arc showing that countries with low school enrollment rates in 1970 have much bigger increases in enrollment over the next 40 years than countries with high enrollment rates in 1970. Why is this the case? Consider, for example, a country with close to 100% enrollment. In this case, most of the children who are unenrolled are likely to be the difficult cases who may be living in remote locations or constrained by individual health or disability problems or influenced by family-specific beliefs or culture. Meanwhile, at the opposite extreme of very low enrollment rates, small investments in school buildings and teachers may elicit large gains in enrollment from the relatively large population with unmet educational demand. In such a case, one would expect convergence over time as countries with lower initial rates move faster and catch up with the ones with higher initial rates.

A similar "economies of scale" case can be made for child mortality improvements. One would expect that, all other things being equal, the application of public and private resources should have a bigger impact in countries that had high rates of child mortality to begin with since the resources would be applied to larger pools of potentially treatable cases. Roughly speaking, the same fixed cost (reflected in medical facilities and personnel) can be used to tackle a larger number of cases in high initial mortality environments than in low mortality environments.

Using past average values for independent variables. Using past average values for each independent variable is consistent with the idea that it takes time for spending to have an impact on health or education performance as facilities need to be built and personnel need to be trained. Furthermore, the same facilities and personnel, once in place, can continue to have impact over many years. Some studies (see Baldacci et al., 2008) have attempted to incorporate these aspects by using five-year averages for their measure of public spending. Taking averages over past values also serves to mitigate concerns about measurement errors and endogeneity. While measurement errors could be large with respect to data for any given year, by the law of large numbers, averaging over a large number of years reduces the scope for such errors. Lacking any theoretical or empirical guidance on the exact duration of the interval over which spending and other independent variables affect health and education indicators, we simply use the average value of these variables over the period for which data are available.

Based on the above considerations, we estimate two equations, one each for changes in child mortality and gross secondary school enrollment, which take the following general form:

Equation (3)

$$|LnY_{i2014} - LnY_{i1980}| = \alpha + \beta_0 LnY_{i1980} + \beta_1 LnPublicSpending_{iavg} + \beta_2 Undernourishment_{iavg} + \\ + \beta_3 Growth_{iavg} + \beta_4 PopulationDensity_{iavg} + \beta_5 CorruptionControl_i + \varepsilon_i$$

In this equation, Y is the outcome indicator for health (child mortality) or education (school enrollment and $|LnY_{i2014} - LnY_{i1980}|$ is the absolute log-change in Y in country i between 1980 and 2014. We use absolute values so that higher values of $|LnY_{2014} - LnY_{1980}|$ are interpreted as "good" development outcomes. $LnPublicSpending_{avg}$ is the log of average public spending per capita on health (in the child mortality regression) or on education (in the school enrollment case). Both measures are averaged over 1980-2014, the period for which relevant data are available. $Undernourishment_{avg}$ refers to the proportion of the population whose food intake is insufficient to maintain minimum dietary energy needs continuously (averaged over 1990-2014). $Growth_{avg}$ is the average annual growth rate of real GDP per capita over 1980-2014. Corruption control refers to the degree to which corruption is perceived to be well-controlled in the country and is also averaged over 1980-2014. ε_i is an error term. Additional information on the definition and sourcing of these variables is provided in the annex.

D. Regression Results

Basic model

Table 1 reports the results of estimating Equation 3 separately for child mortality and school enrollment. The initial levels of child mortality and school enrollment turn out to be very important in their respective regressions. They are statistically significant at the 1% level of confidence and they have the largest standardized coefficients among all independent variables by far.

Table 1: Determinants of changes in child mortality and school enrollment (Full sample)

Variable	Child mortality	School enrollment
Ln Initial child mortality	0.373***	
	(0.110)	
Ln Initial school enrollment		-0.771***
		(0.038)
Health spending per capita	0.144**	
	(0.063)	
Education spending per capita		0.070***
		(0.026)
GDP per capita growth	0.069**	0.054***
	(0.027)	(0.012)
Undernourishment	-0.013**	-0.013***
	(5.50e-03)	(2.30e-03)
Population density	5.00e-04*	1.00e-05
	(3.00e-04)	(1.00e-04)
Control of corruption	-0.062	0.013
	(0.103)	(0.037)
Constant	-0.958	3.238***
	(0.688)	(0.171)
Observations	79	78
Adjusted R-squared	0.226	0.885

Notes: Regressions are run on global samples including developing and high-income countries. The dependent variables are the absolute log changes in child mortality (reduction) and secondary school enrollment (increase) over the period 1980-2014. Asterisks denote significance levels as follows: *** p<0.01, ** p<0.05, * p<0.1.

The positive sign on initial child mortality shows that the higher is the initial child mortality in 1980, the greater is the reduction during 1980-2014. The negative sign on initial school enrollment shows that the is higher the initial level of secondary school enrollment in 1980, the smaller is the increase over time. Thus, in both cases, convergence is at work: countries with worse child mortality and education levels in 1980 improve these indicators at a faster rate over the next three decades than countries with better initial levels.

Among policy variables, public spending turns out to be important, both in statistical terms (significant at 1% level of confidence) and in economic terms (with high values for standardized coefficients). The greater the amount spent per capita on health and education, the better the development performance in terms of child mortality and school enrollment. For child mortality reduction, similar results have been found in some earlier work (see Gupta et al. 2002) but not in other investigations (see Filmer and Pritchett, 1999). For school enrollment, similar results are reported by Gupta et al. (2002) and by Baldacci et al. (2008) for developing countries.

Income growth is significant in both equations. The faster a country has grown, the better is its performance with respect to reducing child mortality and raising school enrollment.[2] This finding is consistent with Filmer and Pritchett (1999) for child mortality and Baldacci et al. (2008) and Goldin and Katz (1997) for education. However, as noted earlier, previous studies have used income per capita rather than growth as the relevant proxy while interpreting this as capturing the effect of private spending.

The food or caloric sufficiency variable is significant with a negative sign in both regressions: the higher the level of undernourishment the smaller the reduction in child mortality and the smaller the increase in school enrollment. Countries that were better able to ensure food adequacy clearly did better. Since this result holds even in the presence of an income growth variable, it suggests that policies directed towards food sufficiency (such as provision of subsidies relating to food items) have contributed independently to this effect.

Population density has a significant effect with a positive sign in the child morality equation. This suggests that areas with higher population density benefit from an economies of scale effect.[3] Such results have been observed before in some studies, using urbanization as an alternative measure of population density. Population density is not significant in the school enrollment regression.

The corruption variable is not significant in either the child mortality regression or the school enrollment regression. This is surprising because the literature suggests that corruption is an important issue in the delivery of public services in developing countries. Perhaps it is the nature of our sample that has produced this result: our sample contains higher income OECD countries as well where corruption is not a big issue in public service delivery. We check for this in the next section.

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[2] When we use average GDP per capita instead we also find that countries with higher levels of income per capita tend to experience faster reductions in child mortality and faster increases in school enrollment.

[3] Alternatively, using urbanization instead of population density provides very similar results but the coefficient on Health spending per capita is no longer statistically significant at conventional levels.

For the education regression, we can think of one other reason for the lack of significance. Let us assume that corruption results in a lack of books, equipment and qualified teachers and thus low quality education at public schools. A possible response would be for parents to move their children to better quality private schools. Of course, many families may not be able to afford this or such schools may not be available. But even if some pupils do switch from public to private schools, this has no impact on the measured enrollment rate used in our present analysis because this encompasses both public and private schools. We do not have information on enrollment rates for private schools separately. If we did, we would have been better placed to detect a governance effect on education.

Robustness checks

We employ two robustness checks. First, we run the basic model on a smaller sample of developing countries only. Second, we attempt a TSLS estimate of the basic model. Table 2 shows the results of regressions run on a sample of developing countries only. They suggest that our basic model is robust in the sense that none of the signs and significance levels change when the sample size is restricted to developing countries only. Four variables remain significant for both health and education performance: initial level of dependent variable; public spending; income growth and level of undernourishment. Furthermore, population density remains robust in the child mortality equation while corruption remains insignificant in both equations.

The second robustness check accounts for the possibility of an endogenous relationship between public spending per capita on health or education and the dependent variables as well as for possible errors in measurement arising from the fact that the empirical data originate in sources that do not necessarily define public spending in equivalent ways. Adopting a change rather than a level formulation for the dependent variable, and using past average values for the independent variables, help us mitigate these concerns somewhat since it is unlikely that the long run change in child mortality (or education measure) will affect, say, average public spending on health (or education). In addition, we employ a Two Stage Least Squares (TSLS) procedure in which the relevant public spending variables are entered in instrumented form. In each case, two instrument variables are used: the initial level (in 1980) of public spending and its rate of growth over 1980 and 2014. The results of the TSLS procedure (see Table 3) also suggest that our basic model is robust. The signs and significance levels do not change (in the second stage regression) from those in the basic model in either the child mortality or the secondary school enrollment regression.

Table 2: Determinants of changes in child mortality and school enrollment (Non-OECD sample)

Variable	Child mortality	School enrollment
Ln Initial child mortality	0.406***	
	(0.118)	
Ln Initial school enrollment		-0.756***
		(0.037)
Health spending per capita	0.179**	
	(0.074)	
Education spending per capita		0.063**
		(0.028)
GDP per capita growth	0.073***	0.058***
	(0.026)	(0.015)
Undernourishment	-0.012**	-0.012***
	(5.60e-03)	(2.20e-03)
Population density	7.00e-04**	9.00e-05
	(3.00e-04)	(1.30e-04)
Control of corruption	-0.118	0.065
	(0.139)	(0.049)
Constant	-1.328*	3.223***
	(0.755)	(0.178)
Observations	70	69
Adjusted R-squared	0.288	0.887

Notes: Regressions are run on a sample of developing countries. The dependent variables are the absolute log changes in child mortality (reduction) and secondary school enrollment (increase) over the period 1980-2014. Asterisks denote significance levels as follows: *** p<0.01, ** p<0.05, * p<0.1.

Other robustness checks include (i) using alternative measures of heath (infant mortality rate) and education (average years of schooling) outcomes, (ii) using alternative measures of health/education spending (measured as a ratio to GDP or as ratio to total spending), (iii) using alternative measures of nutrition (depth of the food deficit), and (iv) including additional controls such as a proxies for income inequality (Gini index), income poverty (poverty headcount and poverty gap) and (v) using panel specifications (yearly data, 5-year and 10-year non-overlapping periods). Our main results, available on request, are robust to all these sensitivity checks.

Table 3: Determinants of changes in child mortality and school enrollment (TSLS)

Variable	Child mortality		School enrollment	
	1st stage	2nd stage	1st stage	2nd stage
Ln Initial child mortality	-0.074	0.362***		
	(0.114)	(0.110)		
Ln Initial school enrollment			0.073	-0.777***
			(0.097)	(0.039)
Health spending per capita		0.130*		
		(0.071)		
Health spending per capita (initial)	0.339***			
	(0.133)			
Health spending per capita (change)	0.339**			
	(0.133)			
Education spending per capita				0.083**
				(0.034)
Education spending per capita (initial)			0.850***	
			(0.058)	
Education spending per capita (change)			0.304**	
			(0.131)	
GDP growth	0.022	0.067**	0.055	0.054***
	(0.034)	(0.026)	(0.035)	(0.012)
Undernourishment	-1.52e-03	-0.013**	1.05e-03	-0.012***
	(4.28e-03)	(5.56e-03)	(5.00e-03)	(2.03e-03)
Population density	-5.39e-05	5.26e-04*	3.28e-04	2.00e-05
	(4.08e-04)	(3.11e-04)	(3.88e-04)	(1.14e-04)
Control of corruption	0.204**	-0.053	0.154*	1.81e-03
	(0.087)	(0.107)	(0.090)	(0.043)
Constant	1.287	-0.843	0.478	3.182***
	(0.773)	(0.725)	(0.340)	(0.191)
Observations	79		78	
Adjusted R-squared	0.225		0.884	
First stage F-Stat (p-value)	0.000		0.000	
Kleibergen and Paap (2006) test (p-value)	0.000		0.000	
Hansen J overidentification test (p-value)	0.279		0.285	

Notes: Regressions are run on global samples including developing and high income countries. The dependent variables are the absolute log changes in child mortality (reduction) and secondary school enrollment (increase) over the period 1980-2014. Ln Public Spending per capita (on Health and education) are instrumented with their initial values and growth rates over 1980-2014.

E. Extensions

We now extend our basic model to get a better sense of its applicability to oil- rich countries. In the introductory section, we had noted the fact that oil-rich countries in the MENA region tended to perform much better than predicted by their initial conditions or their income (see Figures 1, 2 and 3). We explore whether there is a MENA-specific effect by adding a dummy for the MENA region to the basic model. We also check to see whether oil resources have any effect in addition to whatever is captured through public and private spending. So we add a dummy variable for oil resources which takes the value 1 if the country in question is in the top 25 countries ranked by level of oil production per capita and 0 otherwise. The MENA and oil dummies are introduced separately as well as in interaction with the public spending variable. The relevant results are reported for the child mortality case in Table 4 and the school enrollment case in Table 5.

Table 4: Determinants of changes in child mortality: MENA region and oil resource effects

Variable	(1)	(2)	(3)	(4)
Ln Initial child mortality	0.308**	0.374***	0.319***	0.379***
	(0.118)	(0.111)	(0.114)	(0.110)
Health spending to GDP ratio [1]	0.114*	0.139**	0.108	0.129*
	(0.065)	(0.069)	(0.065)	(0.069)
GDP PC growth	0.078***	0.072**	0.083***	0.077***
	(0.024)	(0.027)	(0.024)	(0.027)
Undernourishment	-0.010*	-0.013**	-0.010*	-0.013**
	(5.60e-03)	(5.40e-03)	(5.40e-03)	(5.40e-03)
Population density	6.00e-04*	5.00e-04*	6.00e-04*	5.00e-04*
	(3.00e-04)	(3.00e-04)	(3.00e-04)	(3.00e-04)
Control of corruption	-0.063	-0.054	-0.066	-0.043
	(0.097)	(0.110)	(0.096)	(0.107)
MENA dummy [2]	0.370***			
	(0.123)			
Oil-rich dummy [3]		0.048		
		(0.188)		
Interaction [1] and [2]			0.074***	
			(0.024)	
Interaction [1] and [3]				0.025
				(0.034)
Constant	-0.675	-0.955	-0.702	-0.951
	(0.719)	(0.691)	(0.709)	(0.685)
Observations	79	79	79	79
Adjusted R-squared	0.277	0.216	0.279	0.222

Notes: Regressions are run on global samples including developing and high-income countries. The dependent variables are the absolute log changes in child mortality (reduction) over 1980-2014.

Including a dummy for the MENA region has an effect in the child mortality regression but not in the school enrollment regression. In the child mortality regression, the dummy variable for MENA is positive and significant, both by itself and when interacted with the public spending on health variable. This suggests that the child mortality results for MENA are also affected by some unspecified variables that are being captured instead by the regional dummy.[4] And these variables appear to affect the impact on child mortality of public spending on health. However, the basic model remains robust in the presence of the MENA dummy.

Table 5: Determinants of changes in school enrollment: MENA region and oil resource effects

Variable	(1)	(2)	(3)	(4)
Ln Initial school enrollment	-0.776***	-0.770***	-0.595***	-0.597***
	(0.039)	(0.039)	(0.041)	(0.040)
Education spending to GDP ratio [1]	0.080***	0.066**	0.040***	0.039***
	(0.028)	(0.029)	(0.011)	(0.011)
GDP PC growth	0.051***	0.055***	0.045***	0.047***
	(0.013)	(0.013)	(0.012)	(0.012)
Undernourishment	-0.013***	-0.013***	-6.00e-03***	-5.70e-03***
	(2.30e-03)	(2.29e-03)	(2.20e-03)	(2.10e-03)
Population density	4.00e-06	1.40e-05		
	(1.18e-04)	(1.20e-04)		
Control of corruption	4.84e-03	0.017	0.083**	0.089**
	(0.037)	(0.039)	(0.037)	(0.037)
MENA dummy [2]	-0.090			
	(0.061)			
Oil-rich dummy [3]		0.024		
		(0.072)		
Interaction [1] and [2]			-4.10e-03	
			(0.013)	
Interaction [1] and [3]				0.010
				(0.012)
Constant	3.233***	3.247***	2.569***	2.570***
	(0.170)	(0.178)	(0.203)	(0.202)
Observations	78	78	109	109
Adjusted R-squared	0.885	0.883	0.790	0.791

Notes: Regressions are run on global samples including developing and high-income countries. The dependent variables are absolute log changes in secondary school enrollment (increase) over 1980-2014.

The oil resource dummy does not have an effect in either regression, not by itself and not in interaction with the public spending variable. This suggests that, once the other variables in the basic model have been included, whether or not a country is oil-rich does not matter. Most probably, the effect of oil resources is fully picked up by the public spending and income growth variables.

[4] When we use the Gulf Cooperation Council (GCC) countries instead, we get a stronger effect. The coefficient increases from 0.370 [s.e=0.123] to 0.554 [s.e.= 0.221]. But this stronger effect is unlikely to be related to oil resources, given that the coefficient on the Oil-rich dummy is statistically insignificant.

F. Country-Specific Discussion

Now that we have a sense of which independent variables are statistically significant we can turn to a discussion of their relative impacts at the country level. Tables 6 and 7 show the extent to which each robustly significant independent variable has contributed to the fitted absolute growth rate (as a deviation from the sample mean) of child mortality and school enrollment for all the hydrocarbon rich developing countries in our sample.[5] This allows us to assess which factors were most important in each country case.

Three broad patterns can be discerned from Table 6. First, initial levels of child mortality were the most important factor for seven countries but in a negative sense, namely, their initial levels of child mortality in 1980 were so low that they had a big momentum disadvantage relative to other countries. These countries are Kazakhstan, Trinidad and Tobago, Mexico, Kuwait, Malaysia, the República Bolivariana de Venezuela and the United Arab Emirates. By contrast, for Nigeria and Angola, initial levels of child mortality were so high that this became the biggest source of momentum for the country in reducing child mortality over the succeeding years.

Table 6: Contributions to gap between actual and predicted changes in child mortality levels

Country	Fitted rate of decline in CM	Initial mortality	Ln of Health spending PC, PPP	GDP Per Capita growth	Undernourishment	Population density
Algeria	1.074	0.466	0.487	-0.211	0.485	-0.153
Azerbaijan	1.046	0.083	0.449	0.373	0.178	-0.037
Iran, Islamic Rep.	0.733	0.103	0.463	-0.258	0.543	-0.117
Nigeria	0.527	0.917	-0.646	-0.143	0.385	0.013
Kazakhstan	0.493	-0.444	0.354	0.177	0.568	-0.163
Trinidad & Tobago	0.143	-1.145	0.856	-0.024	0.281	0.171
Mexico	0.127	-0.362	0.212	-0.173	0.550	-0.100
Indonesia	0.100	0.221	-0.607	0.372	0.127	-0.012
Kuwait	0.083	-1.254	1.712	-0.737	0.359	0.004
Malaysia	-0.016	-1.460	0.621	0.329	0.570	-0.076
Angola	-0.184	1.024	0.247	-0.377	-0.923	-0.154
Venezuela, RB	-0.546	-1.016	0.669	-0.365	0.300	-0.134
United Arab Emirates	-0.589	-1.285	1.046	-0.812	0.570	-0.109
Congo	-0.875	0.125	-0.097	-0.068	-0.677	-0.159

[5] Oil-rich countries are defined as belonging to the top 20 countries in the distribution of oil production per capita over 1980-2011. Only countries for which we have data are included in our sample.

Notes: Entries are expressed in percentage points. The fitted rate of decline in CM is expressed as a deviation from the sample mean. CM stands for child mortality. Only the statistically significant regressors are used.

If we slit the non-high-income OECD sample into quintiles of rate of decline in child mortality, it appears that four oil-rich countries (Algeria, Azerbaijan, the Islamic Republic of Iran, and Nigeria) are in the top quintile and three (the República Bolivariana de Venezuela, United Arab Emirates, and Republic of Congo) in the bottom quintile. These differences in rates of decline in child mortality illustrate the extent to which some oil-rich countries performed better than others. These differences are the results of conditional convergence, undernourishment, public spending on health and, to some extent, economic growth and population density.

Second, undernourishment or caloric sufficiency turns out to have played a surprisingly important role. In several countries, namely, the United Arab Emirates, Malaysia, Kazakhstan, the Islamic Republic of Iran, Mexico, and Algeria, the high degree of caloric sufficiency (low undernourishment) played the most significant role in reducing child mortality. In another two countries, namely, Angola and Republic of Congo, the relatively low degree of caloric sufficiency played the most significant role in preventing the reduction of child mortality.

Third, high levels of public spending on health were the most important determinant in Kuwait, the United Arab Emirates, Trinidad & Tobago, the República Bolivariana de Venezuela, Malaysia, and Algeria. In Indonesia, Nigeria, and the Republic of Congo, by contrast, public spending was so low that it became the most important factor in retarding the decline of child mortality. The above suggests that different factors contribute to different degrees in the fitted rate of decline in the child mortality rate (as a deviation from the sample mean) for the country in question.

Table 7: Contributions to gap between actual and predicted change in school enrollment

Country	Fitted rate of growth in CM	Initial school enrollment	Ln of Education spending PC, PPP	Undernourishment	GDP Per Capita growth
Nigeria	3.202	2.979	-0.259	0.489	-0.008
Angola	2.066	3.173	0.021	-1.106	-0.021
Algeria	0.845	-0.044	0.290	0.612	-0.012
Indonesia	0.188	0.143	-0.151	0.175	0.021
United Arab Emirates	-0.553	-1.581	0.358	0.716	-0.046
Mexico	-0.561	-1.443	0.201	0.690	-0.010
Malaysia	-0.562	-1.615	0.319	0.715	0.019
Iran, Islamic Rep.	-0.632	-1.484	0.184	0.683	-0.014
Venezuela, RB	-1.306	-1.980	0.308	0.386	-0.020

Trinidad & Tobago	-2.598	-3.251	0.292	0.362	-0.001
Kuwait	-2.687	-3.682	0.578	0.458	-0.041
Congo	-3.432	-2.638	0.015	-0.806	-0.004
Kazakhstan	-3.715	-4.443	0.005	0.713	0.010
Azerbaijan	-3.919	-4.371	0.193	0.237	0.021

Notes: Entries are expressed in percentage points. The fitted rate of growth in SE is expressed as a deviation from the sample mean. SE stands for school enrollment. Only the statistically significant regressors are used.

Turning now to the education case, we find a somewhat different pattern than in the case of child mortality (see Table 7). The biggest difference relates to the role of initial level of enrollment. In the education case, this is by far the biggest contributor to the gap than any other independent variable for the majority of oil rich countries (10 of the 14 countries in the table). In all but three cases, the role of this factor is negative: the initial level of school enrollment was so high for the countries in question in 1980 that it slowed down the rate of subsequent increase in enrollment. However, in the cases of Angola, Nigeria and Indonesia, the initial enrollment in 1980 was so low that it imparted great momentum to subsequent increases.

Initial enrollment was not important in explaining the gap between actual and predicted changes in the cases of Algeria and Indonesia. In the case of Algeria, public spending on education and undernourishment were the most important contributing factors whereas in the case of Indonesia, undernourishment was the single most important determinant in a positive direction. Once again, some oil-rich countries performed better than others. If we split the non-high-income OECD sample into quintiles of rate of growth in school enrollment, we find that two oil-rich countries (Nigeria, Angola) are in the top quintile and five (Trinidad and Tobago, Kuwait, Congo, Kazakhstan, and Azerbaijan) in the bottom quintile. The differences in fitted growth rates of school enrollment across oil-rich countries were mainly driven by conditional convergence and, to a lesser extent, public spending on education, undernourishment and economic growth.

G. Concluding Observations

We have attempted in this paper to identify the policy and institutional factors that best account for the differences in development performance, measured in terms of the decline in child mortality and the increase in school enrollments, among hydrocarbon rich countries. Modeling considerations introduce a legacy factor into our assessment. This factor is the initial level of child mortality and secondary school enrollment in 1980 in each country. Our regression analysis suggests that this legacy factor is a very important determinant in both cases and it operates in a way that confers a momentum in countries that have high child mortality rates and low school enrollment rates as initial conditions. Such countries benefit from a convergence process in which their subsequent improvement, *ceteris paribus*, is faster than in countries with relatively advantageous initial conditions, similar to what is found in growth regressions where countries with initially low incomes tend to grow faster than those with initially higher incomes.

When we examine the contribution of different factors to the gap between actual and predicted changes in child mortality and school enrollment we find initial conditions to be very important as well. Indeed, in the case of school enrollment, it is the dominant factor in 10 of the 14 oil rich countries for which calculations could be performed.

Another broad conclusion is that policy factors worked in different ways in different countries. The degree of undernourishment (reflecting food subsidy policy most likely) was a surprisingly common positive factor among many countries (especially those from the Middle East and North Africa) and a negative factor for African oil rich countries such as Angola and the Republic of Congo. This may be related to the fact that virtually all MENA countries have operated food subsidy programs for many years.

Surprisingly, levels of public spending were not found to be among the most important contributors to the gap between actual and predicted changes in school enrollment, although they were important in a few cases for child mortality changes.

References

Baldacci, E., Clements, B., Gupta, S., and Cui, Q., (2008), "Social Spending, Human Capital, and Growth in Developing Countries" *World Development*, 36:8, 1317-1341

Barro, R., 1991. "Economic Growth in a Cross-Section of Countries." *Quarterly Journal of Economics*, 106 (2): 407-443.

Bhattacharya, S. and Hodler, R., 2010. "Natural Resources, Democracy and Corruption." *European Economic Review*, 54(4): 608-21.

Chaudhury, N., Hammer, J., Kremer, M., Muralidharan, K. and Rogers, H., (2006). "Missing in Action: Teacher and Health Worker Absence in Developing Countries." *Journal of Economic Perspectives*, 20:1, 91-116

Filmer, D. and Pritchett, L. (1999), The Impact of Public Spending on Health: Does Money Matter? *Social Science and Medicine*, 49:10, 1309-1323.

Goldin, C. and Katz, L. (1997), Why the United States Led in Education: Lessons from Secondary School Expansion, 1910 to 1940, Working Paper 6144, National Bureau of Economic Research, Cambridge. Mass.

Gupta, S., Verhoeven, M., and Tiongson, E., 2002, "The Effectiveness of Government Spending on Education and Health Care in Developing and Transition Economies" European *Journal of Political Economy*, 18: 717-737.

Gupta, S., Verhoeven, M., and Tiongson, E.R (2003), "Public Spending on Health Care and the Poor." *Health Economics*, 12:8, 685-696.

Haber, S. and Menaldo, V., 2011, "Do Natural Resources Fuel Authoritarianism? A Reappraisal of the Resource Curse." *American Political Science Review*, 105:1,1-26.

Hodler, R. (2006). "The Curse of Natural Resources in Fractionalized Countries." *European Economic Review*, 50(6): 1367-86.

Iqbal, F., (2006), Sustaining Gains in Poverty Reduction and Human Development in the Middle East and North Africa, World Bank, Washington D.C.

Iqbal, F, and Kiendrebeogo, Y., 2016. "The Determinants of Child Mortality Reduction in the Middle East and North Africa." *Middle East Development Journal*, 8:2, 230-247.

Iqbal, F. and Kiendrebeogo, Y., 2015. "Public Spending and Education Attainment in the Middle East and North Africa." *Review of Middle East Economics and Finance*, 11:2, 99-118.

Kronfol, N. (2012), Historical Development of Health Systems in the Arab Countries: A Review. *Eastern Mediterranean Health Journal*, 18:11, 1151-1156.

Kristof, Nicholas, (2015). An Unsettling Complicity. New York Times, March 26.

Mauro, P. 1995. "Corruption and Growth." *Quarterly Journal of Economics*, 110(3): 681-712.

McGuire, J. (2006), Basic Health Care Provision and Under-5 Mortality: A Cross-National Study of Developing Countries. *World Development*, 34:3, 405-425.

Pelletier, D. and Frongillo, E., (2003). Changes in Child Survival are Strongly Associated with Changes in Malnutrition in Developing Countries. *Journal of Nutrition*, 133:1, 107-119.

Pritchett, L. and Summers, L., (1996). Wealthier is Healthier, *Journal of Human Resources*, 31:4, 841-68

Rajkumar, A. and Swaroop, V., (2008). "Public Spending and Outcomes: Does Governance Matter?" *Journal of Development Economics*, 86: 96-111

Ross, M. 2001. "Does Oil Hinder Democracy?" *World Politics*, 53(3): 325-61.

Ross, M. 2004. "What Do We Know About Natural Resources and Civil War?" *Journal of Peace Research*, 41(3): 337-56.

Ross, M. 2012. *The Oil Curse: How Petroleum Wealth Shapes the Development of Nations*. Princeton University Press: New Jersey.

Sala-i-Martin, X., (1996). The Classical Approach to Convergence Analysis. *Economic Journal*, 106:437, 1019-1036.

Solow, R., 1956. A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics,* LXX, 65-94.

Wang, L., (2002), Determinants of Child Mortality in LDCs: Empirical Findings from Demographic and Health Surveys. *Health Policy*, 65:277-299.

Annex: Variable definitions and sources

Variable	Definition	Source
Δ Ln Child mortality	Log change in Mortality rate, under-5 (per 1,000 live births) between 1980 and 2010	World Development Indicators, World Bank; http://data.worldbank.org/data-catalog/world-development-indicators
Ln Initial Child mortality	Log of Mortality rate, under-5 (per 1,000 live births) in 1980	World Development Indicators, World Bank; http://data.worldbank.org/data-catalog/world-development-indicators
Δ Ln school enrollment	Log change in school enrollment, secondary (% gross) between 1980 and 2010	World Development Indicators, World Bank; http://data.worldbank.org/data-catalog/world-development-indicators
Ln Initial school enrollment	Log of gross secondary school enrollment in 1980	World Development Indicators, World Bank; http://data.worldbank.org/data-catalog/world-development-indicators
Health spending PC, PPP	Public spending on health per capita per year (2005 PPP dollars)	World Development Indicators, World Bank; http://data.worldbank.org/data-catalog/world-development-indicators
Education spending PC, PPP	Public spending on education per capita per year (2005 PPP dollars)	SPEED Database, IFPRI; http://www.ifpri.org/blog/speed-public-expenditure-data-now-online
Population Density	Population per sq. km	World Development Indicators, World Bank; http://data.worldbank.org/data-catalog/world-development-indicators
Undernourishment	Prevalence of undernourishment (% of population)	World Development Indicators, World Bank; http://data.worldbank.org/data-catalog/world-development-indicators
Control of Corruption	Control of Corruption: Estimate of governance (ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance)	Worldwide Governance Indicators, World Bank; http://info.worldbank.org/governance/wgi/index.aspx#home
GDP per capita growth	GDP per capita growth (annual %)	World Development Indicators, World Bank; http://data.worldbank.org/data-catalog/world-development-indicators