"We Don't Need No Education":

The effects of education-specific foreign aid on school enrollment in low-income countries

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Abstract

The newly released Project-level Aid (PLAID)/AidData database comprises comprehensive, sector-specific data for nearly 1 million development projects, increasing our ability to perform critical evaluations of aid effectiveness in various sectors. Here, we use AidData to address the pertinent question of education aid effectiveness, as education is widely considered to be a critical input for both human development and poverty alleviation. Using a subset of the world's poorest nations, we empirically evaluate the effect of educational foreign aid on primary school enrollment rates over the period 1975-2005. While past literature suggests that aid has had positive effects on education, this new and more detailed database allows us to more clearly evaluate aid's impact in poor countries. Our robust findings indicate that education aid dollars may have no significant impact on education outcomes in less-developed nations.

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> *"Education is development. It creates choices and opportunities for people, reduces the twin burdens of poverty and disease, and gives a stronger voice in society. For nations it creates a dynamic workforce and well-informed citizens able to compete and cooperate globally – opening doors to economic and social* ***prosperity."***
>
> -Millennium Development Goals #2

Introduction

Education is widely considered to be a principal avenue to human development (Easterly 2001, Sen 2001). Often touted is the logic that education "contributes directly to economic growth through its effects on productivity, earnings, job mobility, entrepreneurial skills, and technological innovation." Such claims are often disputed, as the overall economic growth impact of education is difficult to quantify. However, following Amartya Sen's logic, we suggest that education also has intrinsic value for human development that cannot be overlooked (2001). Thus, regardless of whether the outcomes of education are economic or human growth, understanding the impact of foreign aid on education in developing countries becomes an especially critical question.

At the same time, the cry for increased aid effectiveness has become increasingly sharp throughout the world, and new data innovations allow for more robust looks at aid's effects. Furthermore, recent contributions to the aid literature suggest that sector-by-sector evaluations are necessary to obtain more accurate evaluations of aid effectiveness (Findley *et al* 2009). Most aid effectiveness literature has focused on broad questions of aggregate aid and its relationship with economic growth, usually with very inconclusive results (Burnside and Dollar 2000). A closer look at the effect of sector-specific aid on sector-specific outcomes may be the real key to

unraveling the mystery of aid's real impacts, allowing us to better identify causal chains and to reduce the likelihood of problematic intervening variables (Michaelowa 2007). So, by understanding the effect that aid monies directed toward primary education have on the measureable outcomes of primary education, we can understand whether aid of this type is accomplishing its intended purpose. The global aid policy environment also provides a unique case for study on this topic, as the 2000 Millennium Development Goals call for universal primary education by 2015 (UN 2010). Thus, we have a direct aid outcome to evaluate: is primary education aid increasing primary school enrollment? Even putting aside the implications of education aid for growth in general, it becomes imperative for us to understand whether donor aid is even accomplishing the short-term targets on which it is focused.

In pursuing this research, we have used a groundbreaking new resource for aid donation data. Recently renamed AidData, Project-Level Aid (PLAID) Database, a collaborative effort between Brigham Young University and the College of William and Mary, provides historical, detailed, sector-by-sector project descriptions and amounts for all of the world's major bilateral and multilateral donors over the past five decades. Previously, these data were only available from the OECD's Creditor Reporting Service Database, which collects data from major bilateral donors and some large multilaterals. Also, most previous development research relies solely on Official Development Assistance (ODA), but AidData includes both development loans and grants that represent both ODA and non-ODA. Thus, AidData has greatly expanded upon available aid data, providing us with the most comprehensive sector-specific data on education aid.

It remains in question whether more aid may translate into better education outcomes, and the debate on this connection is only beginning (Dreher *et al* 2008). The limited literature on

education aid effectiveness may be viewed in two camps – those who evaluate general economic outcomes of aid such as economic growth and those who look at educational outcomes as an outcome of interest or dependent variable. Theoretically, educational foreign aid must either positively impact a country's economy or improve certain educational outcomes to be considered effective. Those who look at economic outcomes most often use increases in gross domestic product (GDP) as a broad measure of effectiveness, suggesting that educational foreign aid should stimulate economic growth as it provides human capital (Asiedu and Nandwa 2007; Pritchett 2001). Since nearly all aid is intended to alleviate poverty – though direct or indirect mechanisms – by enhancing economic growth, such a question has logical foundations. However, these studies seldom find a positive correlation between education aid and growth.

Following new trends in sector-specific aid evaluations, most recent scholars have evaluated education aid's impact on specific measureable outcomes of education, assuming that a too-broad look at education's effect on GDP allows for excessive error potential. Most often, enrollment rates are considered as the dependent variable for these studies, both because they relate to the MDGs and because they have the best global availability. Initial studies by Michaelowa and Weber (2004, 2007) and Dreher *et al* (2008) found fairly tentative positive correlations between education aid and education outcomes, suggesting that aid does have some positive influences on school enrollments. However, their conclusions suggested that the relationships were not so significant substantively, and data availability issues make the findings somewhat tentative. Both sets of authors acknowledge the flaws of the OECD-CRS database of aid data and their potential effect on results. Furthermore, due to data availability, both studies looked at the effect of *all* education aid on primary school enrollment, instead of just the effect of primary school aid on enrollment. While secondary and tertiary education projects may be

expected to have some spillover effects on primary school enrollments, they may also introducing distorting noise into the models. Attempting to address this issue, Michaelowa and Weber (2008) looked at the effects of aid disaggregated by education level on education outcomes. Results here were largely inconclusive, though the most significant positive effects were recorded for secondary education levels. The effect of primary-only education aid was notably insignificant. Again, the fact that OECD/CRS data does not capture many large development projects funded by multilateral development banks constrained the analysis and results.

Theory and Case Selection

As a starting point we stipulate that the allocation of foreign aid to education is meant to support the local educational system by providing goods and services not efficiently delivered by the existing education system. Enrollment rates are an efficient method for assessing the delivery of services by a local education system. Low enrollment rates suggest that students and families either do not have the opportunity or the desire to enroll in primary school. Some low enrollment rates are such because of an inadequate supply in school buildings, classrooms, teachers, supplies, etc. Others are a result of schools whose poor quality fails to persuade parents that their children's time would be better spent at school than in other settings. Presumably, foreign aid to education should address both of these problems. Foreign aid projects are frequently intended to build new infrastructure for the education system. They also provide improved teacher training, better curricula and enhanced learning materials. If foreign aid is actually improving the accessibility and the quality of education in recipient countries, then we should expect enrollment rates to increase as a result of the programs.

However, foreign aid to education does not simply increase the supply of quality education in communities where an unmet demand exists. In many places, there may be a low demand for education. For example, in a setting with a low cultural value for education, most aid projects would likely be ineffective. Additionally, in a locale where children suffer from poor health, education aid projects are less likely to be effective. Perhaps the biggest factor in predicting the effectiveness of education aid is income. Impoverished families often face relatively high opportunity costs when enrolling their children in school. We also hold that the general infrastructure in a country matters, likely affecting construction, transportation, and other details that may influence school attendance. Where well-maintained roads and schools are available, the burden of attending school for a given student will be reduced. Previous research indicates that a nation's political climate or level of democracy may have a substantial impact on foreign aid allocation and effectiveness.

While the ability of foreign aid to improve education outcomes is important in all recipient countries, we limit our analysis to 109 low and low-middle income countries, as defined by the World Bank. This is primarily because data for primary enrollment rates frequently approaches 100 percent among high and upper-middle income countries, skewing the results of an evaluation of *changes* in enrollment rates. Primarily, though, we are interested in the way that foreign aid is used in countries where the need for improvement in education is most severe: in low-income nations.

Data

Our aid variables are taken from AidData 1.9, which was described previously. We define primary aid amounts as the nominal commitment amounts reported for each project that

was coded as having primary education as its major purpose. AidData coders assign each project a major purpose code that encompasses its overall purpose, and then add several activity descriptions to capture all of the project's aspects. The five-digit codes are extrapolated from the OECD-CRS codebook and represent a nearly comprehensive set of aid activities. Also, commitment values are given preference over disbursement values because of their broader availability. While it seems logical to look at aid that has actually been disbursed instead of money that has only been promised, the poor coverage of disbursement data biases our analysis toward using commitment values. Furthermore, there is no clear evidence of a major discrepancy between disbursement and commitment amounts in our database, potentially dampening this concern (Wilson 2009).

We then generated a variable for projects with any education purpose code *except* primary education (e.g. secondary, tertiary, combined or unspecified education projects), which we include in the database as a control variable to better isolate the effects of primary-only education aid. Following the same logic, we created a variable representing aggregate aid flows for all sectors except education. For each of these aid variables, we generated a series of lags from one to five years to help account for the time-lag between commitments and actual "on the ground" effects of aid. With such precautions, we believe that we can capture the plausible delays between aid disbursements and actual outcomes. Furthermore, we do not distinguish between whether aid is provided in a loan or grant form, as we assume here that grants and concessional loans will have roughly similar effects, negating the need for a distinction between them. All aid variables were measured in per capita terms to control for variance in population. The amounts reported were divided by the total population of the recipient country as reported in the World Development Indicators. Due to limited coverage of population figures, the population

figures were smoothed over a five year period, allowing us to calculate per capita figures for as many aid variables as possible. Skewness tests indicate highly skewed data for all aid variables, so all aid per capita measures are logged to improve the robustness of our model.

The existing aid effectiveness literature limits analyses to commitments or disbursements reported to the Creditor Reporting System (CRS) of the Organization of Economic Cooperation and Development (OECD). There are several significant limitations to these data. Disbursements have only been reported since 2002. Commitments have better coverage; however, the CRS only contains information from limited list of CRS donors and for a limited definition of development assistance. We believe that a more expansive picture of aid is necessary to determine the effectiveness of development finance for education outcomes in the main. AidData contains a much broader picture of foreign aid by including data from additional donors and including a more expansive definition of development finance.

Most of our control variable data comes from the 2009 World Development Indicators published by the World Bank (2009). Our adult literacy variable is defined as the percentage of persons over the age of 15 who are literate, as reported in the World Development Indicators. Though previous literature uses this data as a key control variable (Dreher 2008), we have chosen to exclude it from most of our models due to a high potential for collinearity between enrollment and literacy (a simple regression between enrollment and literacy yields an R-square value of .68, suggesting problematic collinearity). Rationally, enrollments have a high effect on literacy, creating this potential collinearity problem. Still, the variable has been included for reference in some regressions. Our measure for income is the Gross Domestic Product per capita (current US$) as reported in the World Development Indicators, as included both by Michaelowa and Weber (2004) and Dreher *et al* (2008). Following our own theoretical model, we also

decided to include a measure for child health, acting under the assumption that a country's child health level should have significant impacts on educational enrollment. We use the infant mortality rate per 1,000 births as reported in the World Development Indicators as our proxy measure for this phenomenon. Following previous literature, we also include a control for the percentage of the population in a country that is below the age of 15 (Dreher *et al* 2008, Michaelowa 2004). This measure is intended to control for the level of strain that the education system places on a society. Finally, much literature on education aid in particular and aid effectiveness in general includes measures for governance and democracy, largely following the findings of Burnside and Dollar that the quality of government institutions heavily influences aid outcomes (2000). Previous education and aid papers use the Freedom House index, government expenditures, and other proxy variables to account for government influence on education outcomes (Dreher *et al* 2008, Michaelowa & Weber 2004). However, we have decided instead to include the Polity 2 measure published in the 2008 edition of the Polity IV database as our proxy for government influence. This measure provides a scale for the level of democracy in a country from -10 to 10. Countries with a -10 score are highly authoritarian and countries with a 10 score are highly democratic. Following previous literature, countries with more democratic institutions should more effectively use education aid.

Our enrollment variables are taken from two sources. We take the net primary school enrollment levels reported in the World Development Indicators. The coverage for this measure is rather weak until the mid 1990s. To verify the robustness of our results we use a second measure, the dataset compiled by Robert Barro and Jong-Wha Lee (2000). This dataset was compiled through information reported by the United Nations as well as survey responses collected by the authors from government officials. Figures are available in these data for every

five year period from 1955 to 2000. Our enrollment measure is taken from the "first level total" enrollment measure reported for each country. Because the enrollment variables in this dataset are only reported every five years, we look at the sum of aid amounts committed in the previous five years. This variable allows us to see how much aid over the previous five years has affected enrollment rates.

Table 1

	WDI Net Primary enrollment	Barro and Lee First level total Enrollment	Primary education aid per capita (US$ nominal)	Other education aid per capita (US$ nominal)	All other aid per capita (US$ nominal)	Infant mortality (per 1,000 live births)	Proportion of population ages 0-14	Paved road network (100,000 km)	Literacy rate (over age 15)
Mean	81.75	36.26	0.48	2.28	32.94	80.24	40.62	1.08	67.91
Median	90.09	37	0	0.09	14.77	76.3	42.95	.24	70.68
Standard Deviation	18.18	19.37	2.73	16.74	77.99	45.89	7.35	3.40	24.77
minimum	26.41	.1	0	0	0	6.99	13.86	.00	9.39
Maximum	99.94	86.8	86.64	688.65	2096.58	252.1	51.79	33.65	99.75
n	664	547	3883	3883	3883	4393	4570	1874	1061

Methods and Results

To empirically evaluate the relationship between education aid and primary enrollment rates, we estimate four models: Panel-data and mixed effects models with WDI data, and panel-data/mixed effects models with Barro and Lee data. The relationship between education aid and primary school enrollment for each dependent variable set may be seen here:

Figure 1

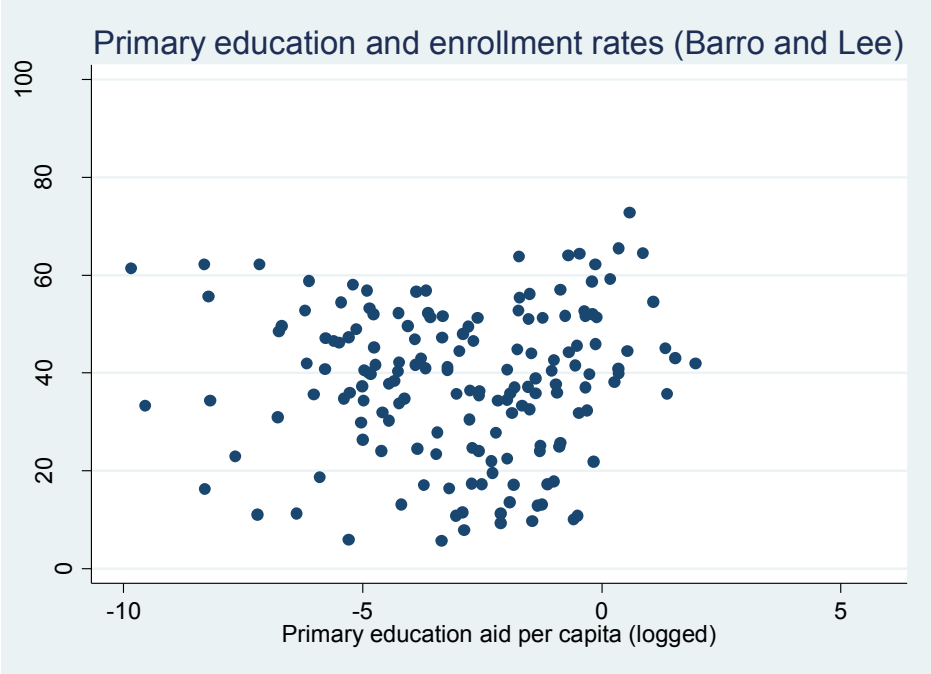
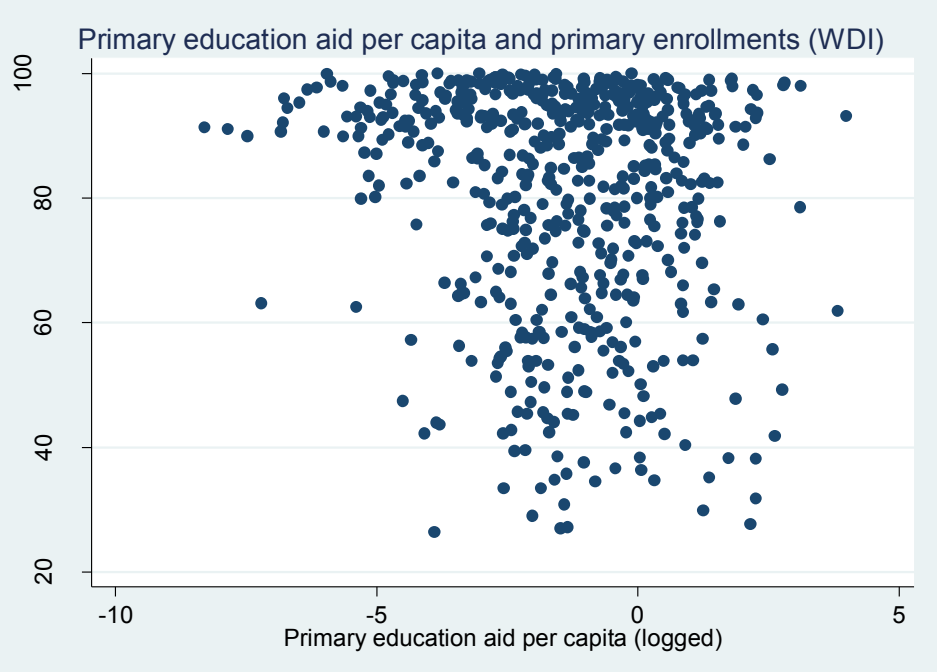


Figure 2



A look at the above tables suggests that a linear method for estimating these effects is less than desirable, especially when using the more prevalent WDI data. Thus, the effect of primary-education aid on primary enrollment rates was initially estimated using a panel-data OLS model, then with a latent-growth or hierarchical model. Though panel-data has previously been used in evaluating the relationship between aid and education, we feel that a latent-growth curve model better captures the nature of the change in enrollment rates over time, making our results more robust. Panel data regression analysis, while allowing for different initial intercepts for the model of each country, assumes that each country in the sample experiences growth at the same rate, or slope. However, the reality is that not only do countries in the sample begin with vastly different levels of enrollment, they also experience change at very different rates. Thus, a standard regression model that assumes these constants may impair our ability to make inferences about the relationship tested.

Therefore, we use a latent-growth model to allow the intercepts and slopes to vary across time periods and countries, better modeling the supposed actual behavior of enrollment-rate growth. An often used example for latent-growth curves is the human growth curve (Wilson 2009). Humans generally follow the same general trajectory over their life-cycle, but certain factors may influence both the 'starting point' of the growth curve and its rates of growth for each human. For example, nutrition or genetic proclivity may severely impact individual beginning points on the growth curve or rates of growth. In the same way, the several countries in our dataset start from very different enrollment positions and experience varying rates of growth.

As was described earlier, we have estimated the models for two sets of dependent-variable data, the WDI dataset and the more detailed dataset compiled by Barro and Lee. Due to

the year limitations of Barro and Lee, we felt it appropriate to include both sets of dependent variables, allowing us to compare across dependent variables to better understand the relationship between aid and education. To increase the validity of our findings, we also performed a fixed-effects regression with literacy, instead of enrollment, as the dependent variable, allowing us to evaluate the effect of education aid on an alternate measure of education outcomes. In addition to including the logged and lagged amounts of both non-primary education aid and non-education aid as control variables in the model, we have provided a theoretically sound set of controls to better highlight the effect of primary education aid on primary enrollment rates, as was explained above. Two that deserve more explanation here are adult literacy and infant mortality. Adult literacy is included to account for the large effect that parental education likely has on education enrollment rates. While this control is potentially very descriptive, there are also significant collinearity issues between the literacy and enrollment data (.65 R square). Considering this limitation, we have estimated the models both with and without adult literacy as a control variable. Additionally, we include infant mortality as a proxy measure for the level of health in a country. We theorize that countries with more health problems, represented by infant mortality rates, may also suffer from lower enrollment rates, due to the obvious connection between poor child health and poor school attendance. Previous literature has neglected to account for such effects, which we feel may be a critical explanatory factor for enrollment rates.

TABLE 2: Fixed-Effects Regression

Dependent Variable: WDI Primary School Enrollment Rates

Variable	1	2	3	4	5	6	7
primary education aid (1 year lag)	0.507	0.510*	0.537*	0.538*	0.538*	0.508*	0.222
	(0.312)	(0.283)	(0.285)	(0.285)	(0.285	(0.287)	(0.328)
primary education aid (2 year lag)	-0.127	0.00532	-0.0052	0.0129	0.0129	-0.042	-0.798**
	(0.301)	(0.274)	(0.275)	(0.276)	(0.276	(0.279)	(0.33)
primary education aid (3 year lag)	0.0541	0.183	0.242	0.265	0.265	0.231	0.357
	(0.286)	(0.26)	(0.267)	(0.269)	(0.269	(0.27)	(0.346)
primary education aid (4 year lag)	-0.0255	0.114	0.124	0.14	0.14	0.147	0.286
	(0.266)	(0.243)	(0.243)	(0.244)	(0.244	(0.243)	(0.309)
primary education aid (5 year lag)	0.171	0.142	0.124	0.123	0.123	0.0616	-0.0719
	(0.243)	(0.221)	(0.222)	(0.222)	(0.222	(0.226)	(0.24)
other education aid (1 year lag)	0.308	0.29	0.298	0.299	0.299	0.303	0.233
	(0.293)	(0.266)	(0.266)	(0.266)	(0.266	(0.266)	(0.265)
other education aid (2 year lag)	-0.335	-0.162	-0.151	-0.135	-0.135	-0.0809	0.0795
	(0.275)	(0.252)	(0.252)	(0.254)	(0.254	(0.255)	(0.306)
other education aid (3 year lag)	0.147	0.322	0.313	0.332	0.332	0.387	-0.137
	(0.271)	(0.249)	(0.249)	(0.251)	(0.251	(0.251)	(0.396)
other education aid (4 year lag)	-0.171	0.14	0.114	0.136	0.136	0.188	-0.115
	(0.287)	(0.268)	(0.269)	(0.271)	(0.271	(0.271)	(0.372)
other education aid (5 year lag)	-0.348	-0.0168	-0.0299	-0.0133	-0.0133	0.00742	-0.381
	(0.304)	(0.283)	(0.284)	(0.285)	(0.285	(0.287)	(0.317)
all other aid (1 year lag)	0.0241	0.00762	0.07	0.071	0.071	0.15	-0.261
	(0.528)	(0.479)	(0.483)	(0.484)	(0.484	(0.497)	(0.485)
all other aid (2 year lag)	0.212	0.176	0.187	0.162	0.162	0.357	0.118
	(0.596)	(0.541)	(0.541)	(0.543)	(0.543	(0.553)	(0.598)
all other aid (3 year lag)	-0.0393	0.404	0.364	0.319	0.319	0.2	-0.112
	(0.635)	(0.583)	(0.584)	(0.588)	(0.588	(0.592)	(0.547)
all other aid (4 year lag)	-0.541	0.338	0.348	0.292	0.292	0.158	0.577
	(0.695)	(0.653)	(0.653)	(0.658)	(0.658	(0.662)	(0.711)
all other aid (5 year lag)	-0.568	0.157	0.144	0.104	0.104	0.00165	-0.0407
	(0.618)	(0.578)	(0.578)	(0.582)	(0.582	(0.583)	(0.674)
Adult Literacy							-0.0489
							(0.209)
GDP per capita		-0.0389***	-0.0402***	-0.0389***	-0.0389***	-0.0375***	-0.0146
		(0.00749)	(0.00762)	(0.00782)	(0.00782	(0.00789)	(0.0116)
Infant mortality			0.0962	0.1	0.1	0.0962	0.0979
			(0.0974)	(0.0977)	(0.0977	(0.1)	(0.162)
Child population				0.465	0.465	0.488	1.293
				(0.602)	(0.602	(0.607)	(0.909)
Polity IV							-0.461***
							(0.177)
Constant	87.31***	124.7***	121.0***	102.9***	102.9***	100.0***	29.4
	(4.69)	(8.375)	(9.183)	(25.15)	(25.15	(25.48)	(43.96)
n	207	207	207	207	207	202	123
R-squared	0.363	0.479	0.483	0.486	0.486	0.503	0.653
Number of countries	61	61	61	61	61	59	45

Table 3: Fixed Effects Regression

Dependent Variable: Barro and Lee Enrollment Rates

Variables	1	2	3	4	5
Primary education aid (5 previous years)	0.306	0.221	0.203	0.141	0.458
	(0.252)	(0.247)	(0.251)	(0.229)	(0.963)
Other education aid (5 previous years)	-0.705	-0.668	-0.722*	-0.458	-0.842
	(0.428)	(0.416)	(0.436)	(0.402)	(1.707)
All other aid (5 previous years)	-1.523	-1.833*	-1.839*	-1.092	-2.764
	(0.947)	(0.927)	(0.93)	(0.862)	(4.453)
GDP per capita		-0.00515***	-0.00498***	-0.00057	0.0141
		(0.00174)	(0.0018)	(0.00185)	(0.00917)
Infant Mortality			-0.0213	-0.0157	-0.0161
			(0.0493)	(0.0451)	(0.121)
Child Population				1.406***	3.432**
				(0.273)	(1.054)
Adult Literacy					0.733*
					(0.363)
Constant	45.71***	53.07***	54.20***	-17.38	-150.8**
	(4.357)	(4.911)	(5.578)	(14.1)	(49.5)
n	206	206	206	205	64
R-squared	0.107	0.163	0.165	0.307	0.876
Number of countries	67	67	67	66	47

All aid variables measured per capita and logged. * Significant at the 10 percent level **Significant at the 5 percent level ***Significant at the 1 percent level

Overall, the initial fixed-effects OLS estimates using both dependent variables give little indication of a positive relationship between aid and education enrollment. Interestingly, primary education aid at the one-year lag level shows 10% significance in most of the regressions using WDI enrollment data. Two issues call into question the validity of this result: First, that significance is only at the weak 10% level, and second, that this is occurring at the one-year lag level, when aid commitments have surely not 'hit the ground' in the evaluated countries. Thus, this result is likely not indicative of a significant positive impact of aid on education. In each model, the inclusion of the potentially collinear adult literacy variable, which shows indications of significance, drastically distorts the results of the model, likely due to its high level of

collinearity with enrollment rates. We recommend that its inclusion here is likely not appropriate. GDP per capita, as may be expected, shows significant explanatory power in many of the regressions. These initial panel-data models do have fairly reasonable sample sizes for the available data; however, they suffer from somewhat low R-square values, suggesting that a significant portion of the variance in primary enrollment rates remains unexplained. Considering the limitations of using panel-data for this analysis, we move to our estimation of a latent-growth curvilinear model on these variables.

Table 4: Latent Growth Model					
Dependent Variable: WDI Primary School Enrollment Rates					
	1	**2**	**3**	**4**	**5**
Primary education aid (1-year lag)	0.1590	0.1780	0.0919	0.1510	0.1690
std. error	0.1870	0.1870	0.1900	0.1910	0.2130
Primary education aid (1-year lag)	-0.2810	-0.2940	-0.2880	-0.2360	-0.720***
std. error	0.1930	0.1930	0.1930	0.1940	0.2180
Primary education aid (1-year lag)	0.0595	0.0522	-0.0193	0.0392	0.0612
std. error	0.1900	0.1920	0.1940	0.1950	0.2230
Primary education aid (1-year lag)	-0.0335	-0.0366	-0.0108	0.0176	0.3260
std. error	0.1810	0.1830	0.1860	0.1850	0.2260
Primary education aid (1-year lag)	0.0263	0.0330	0.0285	0.0491	0.0332
std. error	0.1530	0.1540	0.1570	0.1560	0.1860
Other education aid (1-year lag)	0.0956	0.0910	0.1030	0.0894	0.2760
std. error	0.1700	0.1700	0.1700	0.1690	0.1710
Other education aid (1-year lag)	-0.0670	-0.0779	-0.1530	-0.1570	-0.0240
std. error	0.1710	0.1730	0.1750	0.1730	0.1940
Other education aid (1-year lag)	0.1050	0.0860	0.1040	0.0804	0.2380
std. error	0.1740	0.1760	0.1750	0.1740	0.1920
Other education aid (1-year lag)	-0.0527	-0.0823	-0.0731	-0.0989	0.365*
std. error	0.1720	0.1740	0.1760	0.1750	0.2110
Other education aid (1-year lag)	-0.2530	-0.2690	-0.2590	-0.2800	0.2610
std. error	0.1990	0.2010	0.2050	0.2030	0.2180
All other aid (1-year lag)	0.3610	0.2990	0.2760	0.2510	-0.0872
std. error	0.3400	0.3430	0.3480	0.3450	0.3670
All other aid (1-year lag)	0.5090	0.4200	0.3800	0.3840	-0.3830
std. error	0.3680	0.3710	0.3730	0.3700	0.4220
All other aid (1-year lag)	0.2500	0.1550	0.4370	0.3470	0.0804
std. error	0.3690	0.3710	0.3750	0.3760	0.3700
All other aid (1-year lag)	0.709*	0.5770	0.5080	0.5230	-0.1630
std. error	0.4250	0.4320	0.4310	0.4280	0.4510
All other aid (1-year lag)	-0.2080	-0.3010	-0.3060	-0.3060	-0.6730
std. error	0.3760	0.3810	0.3870	0.3830	0.4400
GDP per capita		0.00517***	0.0018	0.0009	0.0018
std. error		0.0020	0.0020	0.0021	0.0016
Infant Mortality			-0.224***	-0.172***	-0.111**
std. error			0.0477	0.0556	0.0549
Under-15 population				-0.4300	0.1990
std. error				0.2660	0.2280
Adult Literacy					0.390***
std. error					0.0662
Time (year)	0.936***	0.800**	0.5530	0.4350	0.3290
std. error	0.3290	0.3490	0.3620	0.3640	0.3720
Constant	-1,798***	-1,529**	-1019.0000	-767.4000	-602.3000
std. error	660.3000	700.0000	726.7000	732.6000	748.9000
n	207	207	207	207	128
Number of countries	61	61	61	61	47
sd(year)	1.8230	1.9188	1.9686	1.9276	1.4359
std. error	-0.2757	0.2905	0.3017	0.3105	0.2972
sd(constant)	3663.3520	3852.9330	3948.9990	3867.2950	2879.1650
std. error	552.8651	582.4532	604.9164	622.6391	595.4789
corr(year, constant)	-0.9999	-0.9999	-0.9999	-0.9999	-0.9999
std. error	0.0000	0.0000	0.0000	0.0000	0.0000
sd(Residual)	2.0782	2.0618	2.1000	2.0814	1.7212
std. error	0.1591	0.1568	0.1637	0.1619	0.1811

All aid variables measured per capita and logged. * Significant at the 10 percent level **5 percent level ***1 percent level

Table 5: Latent Growth Model

Dependent Variable: Barro & Lee Enrollment Rates

	1	2	3
Primary education aid (sum of previous 5 years)	0.1340	0.1480	0.1210
Std. error	0.1620	0.1640	0.1650
Other education aid (sum of previous 5 years)	-0.481*	-0.470*	-0.595**
Std. error	0.2620	0.2630	0.2690
All other aid (sum of previous 5 years)	-0.0485	0.0775	-0.1380
Std. error	0.6130	0.6160	0.6300
Adult literacy %			
Std. error			
GDP per capita		0.00202*	0.0012
Std. error		0.0012	0.0013
Infant mortality rates			-0.112***
Std. error			0.0379
Time (year)	0.1060	0.0720	-0.0505
Std. error	0.0837	0.0879	0.0929
Constant	-173.1000	-108.6000	144.7000
Std. error	167.4000	175.5000	186.4000
n	206	206	206
Number of countries	67	67	67
sd(year)	0.5448	0.5683	0.5541
Std. error	0.0622	0.0665	0.0649
sd(constant)	1095.1940	1141.2140	1109.2050
Std. error	124.5663	132.8434	129.4690
corr(year, constant)	-0.9999	-0.9999	-0.9999
Std. error	0.0000	0.0000	0.0000
sd(Residual)	2.4633	2.4657	2.4568
Std. error	0.1851	0.1866	0.1861

All aid variables measured per capita and logged. * Significant at the 10 percent level **Significant at the 5 percent level ***Significant at the 1 percent level

The above analysis of education aid, lagged a number of years, on WDI and Barro & Lee enrollment rates indicates that there is little statistically significant relationship between aid and education. Only when questionable literacy controls are included does primary aid show any significance, and the sign is in a negative direction at only the two-year lag level, making for a very unreliable result. In both of the major models, primary education shows no signs of significance. There are weak indications of *negative* significance of other education with the

Barro and Lee data, which potentially suggests a relationship between high aid volume and low enrollment rates and is not necessarily indicative of aid having a direct negative effect on enrollment rates. However, we cannot rule out that this may actually be the case. Regarding our lags, it is very difficult to know when aid "hits the ground," and it is likely that two years is not a sufficient period for aid commitments to have an effect. Another possible explanation of this trend is that, as donors spend money on other areas, they choose not to devote those resources to primary education. In such a scenario, other types of aid could be seen as a rival to education aid. In other words, increased commitments to other sectors may indicate a lower prioritization of primary education among donors. However, it should be noted that the specific variable that yields a negative sign varies between the tables and the results are far from conclusive. Also, in these latent-growth models, infant mortality was significantly related to both enrollment measures in multiple regressions, suggesting, as we suspected, that general health may have important effects on primary-school enrollment. Further research into the relationship between health and education is warranted.

It is important to note that across the latent growth models there is a very high level of correlation – approaching 100% – between the intercepts and the time-series variable (corr(year, constant). In other words, rates of growth vary dramatically according to starting intercept position. This is as we may expect, since the countries in the sample start with very different enrollment rates and demonstrate highly variable rates of growth over the specified period. Thus, we have further evidence that latent-growth curve estimation is highly relevant for this type of analysis.

To further confirm our results, we estimated a simple panel-data regression with youth literacy rates as the dependent variable. Youth literacy is defined as the percentage of the

population between ages 15 and 24 that is reported as literate. Due to the very poor coverage of literacy rates, latent-growth estimations were not feasible for this variable.

Table 6: Panel Data Regression		
Dependent Variable: Youth Literacy, WDI		
	1	**2**
Primary education aid (1-year lag)	5.106	-2.205
std. error	5.026	6.041
Primary education aid (1-year lag)	-3.311	0.622
std. error	2.653	3.225
Primary education aid (1-year lag)	3.816	-0.463
std. error	2.503	3.334
Primary education aid (1-year lag)	6.201	0.342
std. error	4.02	4.837
Primary education aid (1-year lag)	1.879	-0.123
std. error	1.258	1.599
Other education aid (1-year lag)	-3.075	-0.573
std. error	1.7	2.058
Other education aid (1-year lag)	-5.15	0.873
std. error	4.269	5.039
Other education aid (1-year lag)	-7.28	-0.469
std. error	4.092	5.354
Other education aid (1-year lag)	0.0358	0.00651
std. error	0.701	0.534
Other education aid (1-year lag)	-6.94	-0.811
std. error	3.557	4.763
All other aid (1-year lag)	8.036	2.865
std. error	5.257	5.192
All other aid (1-year lag)	6.493	-0.318
std. error	3.67	5.173
All other aid (1-year lag)	-3.341	0.54
std. error	3.134	3.442
All other aid (1-year lag)	-0.635	2.531
std. error	2.195	2.625
All other aid (1-year lag)	-0.535	1.244
std. error	2.25	2.057
GDP per capita		-0.0286
std. error		0.0183
Constant	6.048	91.81
std. error	44.92	55.56
n	82	82
R-squared	0.96	0.988
Number of countries	56	56
All aid variables measured per capita and logged. * Significant at the 10 percent level **Significant at the 5 percent level ***Significant at the 1 percent level		

The sample size on this model is very low, making any robust conclusion from an analysis of literacy rates very difficult. Still, the above estimations show no significant relationship between education aid and enrollment rates at any lag year, just as we saw with enrollment rates as the dependent variable. This further builds our case that education aid is not meaningfully contributing to key education outcomes. Again, viewing the relationship between aid and education with two dependent variables and two enrollment datasets, the results suggest that primary education aid is not related to primary enrollment rates in a substantively or statistically significant way. There is no real evidence from any model that increased aid to primary education aid has improved enrollment rates as the Millennium Development Goal donors have promised. These findings were robust to panel data regressions and latent growth models and measures of education reported by Barro and Lee as well as measures from the World Development Indicators.

Conclusions and Implications

We depart from previous literature to suggest that education aid may not explain changes in education enrollment rates in developing countries. Our statistical findings indicate that there is little significant relationship between the two variables, suggesting that global commitment to increase primary school attendance through aid efforts may have proven largely ineffective overall, though it is likely that there may have been individual success stories for specific projects. The comprehensive data provided by AidData may account for these findings that appear to contradict previous analyses on the subject. While many may view it as unfortunate that our more detailed dataset suggests weaker correlations between aid and its intended results, the findings may provide an important contribution to the scholarly discussion on aid

effectiveness, particularly in the education sector. Initial results do suggest that levels of health in a country may be highly related with enrollment rates, warranting further exploration. We especially suggest that a look at the potential effect of health aid on education outcomes may be helpful.

Of course, these results raise the question: why is aid *not* working? Though relatively simple to say that there is no broad causal link between primary education aid and primary school enrollment, it is much harder to describe which factors may stop aid from causing the expected changes in outcomes. Does corruption stand in the way of aid dollars reaching their intended recipients? If this is the case, many intended impacts of education aid, such as teacher salaries or school construction, may never actually occur as intended. Alternatively, does a lack of sustained funding mean that a newly-built school remains understaffed and underutilized? Perhaps education projects are too often given to recipients for whom the demand to pursue education is minimal, meaning that aid dollars have little impact. Likely, some of the above explanations, and countless more, could explain this disconnect between aid and education improvement. These factors also likely vary across countries and years, making it even more difficult to account for this null finding. Still, further research into trends and programs may help us understand the factors that come between aid dollars and more children attending school.

We of course risk banality when we suggest that further research may most effectively focus on a narrower picture of education aid effectiveness. Field experiments on specific aspects of education and development may help ascertain which types of education projects are most effective, thereby making a more helpful contribution to the policy discussion on aid. Better evaluations of *who* gets education aid and *why* they receive it may help us understand the effects of aid donor policies on enrollment growth. Even though macro-level aid appears largely

ineffective, a more “bottom-up” perspective on aid donations, like those that critics of foreign aid and others suggest, may help us tease out the ways that developed nations may effectively contribute to educational growth and human development.

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