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DISCUSSION PAPER

Aid Effectiveness Reconsidered - Panel Data Evidence for the Education Sector -

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- Panel Data Evidence for the Education Sector -

ABSTRACT

Applying the general question of aid effectiveness to the sector of education, this paper reveals an overall positive effect of development assistance on primary enrolment. However, even the most optimistic estimates clearly show that at any realistic rate of growth, aid will never be able to move the world markedly closer towards the internationally agreed objective of education for all. Universal primary education requires increased efficiency of educational spending by donors and national governments alike. Moreover, the recipient countries' general political and institutional background matters. Under conditions of bad governance, the impact of aid on enrolment can actually turn negative.

Keywords: aid effectiveness, primary education, good governance

JEL-Classification: F350, O150, I220

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1 Introduction

In the late 1990s, the World Bank study on aid effectiveness (World Bank 1998) provoked a general debate, both among aid agencies and in academia, on the effectiveness and the efficiency of development assistance. Evidence available at micro level typically provides strong support for the effectiveness of aid. Donor agencies tend to carry out regular project evaluations and publish overall statistics in which the share of "successful" projects generally varies between 70 and 90% (see e.g. Michaelowa and Borrmann 2004).

At macro level, however, the available evidence leads to results which are less robust by far. Empirical investigations have often failed to find a significantly positive link between aid and economic development. Boone (1996) even provides convincing evidence for a negative rather than a positive relationship. The World Bank study as well as Burnside and Dollar's (2000) paper resuming the study's main arguments conclude that the missing link between aid and growth may be due to donors' insufficient attention to governance issues within recipient countries. In fact, their econometric results show a positive effect of aid on growth wherever good governance is prevailing. One major argument in this context is the fungibility of resources. In recipient countries with "bad governance" governments might substitute the aid funds for national public expenditure in the sectors towards which the aid flows are directed, and use the released national funds for unproductive expenditure such as, the purchase of arms or increased consumption. Hansen and Tarp (2001) contradict these results on econometric grounds and provide evidence for an overall positive effect of aid. At the same time, Easterly (2001, 2002, 2003) questions the effectiveness of aid altogether, independently of governance in the recipient countries, arguing, inter alia, on the basis of inefficiencies on the donor side.

It is the objective of this paper to evaluate the apparently contradictory evidence on aid effectiveness taking the education sector as an example. A sectoral approach avoids the extremely high complexity of macro level evaluations in which it is virtually impossible to acknowledge for all factors with potential impacts on the link between aid and economic development. At the same time, as opposed to micro level project assessments, sectoral analysis should be able to reveal the relevance of fungibility and the impact of good governance. Finally, sectoral data can be drawn from international statistics which appear to be more reliable than the micro level evaluation data generated by development agencies with the intention to use them as a marketing device for development services.

The advantage of the education sector is primarily that development objectives in this field have been set out very clearly and have been agreed upon among all international donors at various occasions. Declarations adopted at the "Education for all" international fora in Jomptien 1990 and Dakar as well as the "Millenium Development Goals" adopted both at the UN level and in the framework of the Development Assistance Committee (DAC) of the OECD donor countries (OECD/DAC 2001, p. 18), all call for universal primary education as a major priority of poverty alleviation and general development policy.

In this paper, the impact of aid for education on the development of primary enrolment rates will be assessed over time for about eighty low-income countries. Section 2 presents the data used for the econometric analysis, section 3 discusses the results under different empirical assumptions and based on two different data sets: a long-term structural panel (five-year averages, 1975-2000) and a short-term annual panel (1993-2000). Section 4 concludes.

2 Data and variable selection

In order to carry out the analysis outlined above, information is required on primary education outcomes as well as on aid allocated to education in the different recipient countries. Moreover, various control variables related to the recipient countries' national education expenditure, specificities of the local education systems, the overall level of economic development, and some indicators of governance, need to be introduced.

In particular, reliable data on development cooperation are crucial for the assessment of aid effectiveness. Generally, this type of information can be drawn from the International Development Statistics (IDS) compiled by the DAC secretariat (OECD/DAC 2004). Typically, aid data are provided either in terms of commitments or in terms of disbursements. As commitments do not always translate into actual flows of resources and as, even if they do, the delay does not always follow a systematic pattern, the aid data used should be preferably based on disbursements. However, information on disbursements by sector of development assistance is available only from 1990 onwards. Similarly, for technical cooperation which, according to the DAC statisticians, is more accurate in terms of the sectoral break up, data are available only since 1992. For this reason, both of these series can be used only for an analysis of the impact of aid within the 1990s. In order to increase the number of observations, the panel based on this dataset uses annual observations, even though one-year steps may not be sufficient to show the impact of structural variables with little variation over time.

In order to assess long-term developments and the impact of structural variables, the only alternative is to use the data on aid commitments which are available throughout the 1970s, 80s and 90s. Unfortunately, until recently, donor reporting to this database (Creditor Reporting System, CRS) has remained incomplete, a fact that becomes most obvious when the total amount reported to the CRS database is compared to the total amount published in general DAC statistics. However, under the assumption that the sectoral share as provided in the CRS data is correct, an approximation of the true commitment data can be derived using the correct total from DAC statistics. This transformation is equivalent to a simple expansion of the sectoral information available from CRS:

$$(1) \quad EDUCAID = EDUCAID_{CRS} + \left(\frac{EDUCAID_{CRS}}{TOTALODA_{CRS}} \right) \cdot (TOTALODA_{DAC} - TOTALODA_{CRS})$$

$$\Leftrightarrow \qquad EDUCAID = EDUCAID_{CRS} \left(\frac{TOTALODA_{DAC}}{TOTALODA_{CRS}} \right)$$

where EDUCAID = aid for education; TOTALODA = total official development assistance. The subscripts denote the respective sources (DAC versus CRS databank).

All other variables can be directly drawn from international databases. Progress towards universal primary education can be measured in terms of the development of gross primary enrolment rates. They have been given preference over other more accurate indicators such as net enrolment rates or attainment levels since they have the advantage of being available for almost all developing countries even for the 1970s.

In order to characterize the national education systems in recipient countries, information on national education expenditure in percent of GNP (EXPEDUC), the student-teacher ratio in primary education (RATIO_ST), and the share of children and youths aged 0-14 as a percentage of overall population (POPY) are selected as potentially relevant variables. GDP per capita (GDPcap) is added as a variable controlling for the recipient countries' general income level. Information on each of these variables is available from the World Development Indicators (WDI, see World Bank 2003a).

Finally, four variables are introduced to assess the impact of good governance. Following Burnside and Dollar (2000, p. 851), relevant policies considered are the budget surplus in percent of GDP (BUDGET), the rate of inflation (INFL), and openness (OPEN) calculated as the sum of exports and imports as a percentage of GDP.

Based on these three variables, Burnside and Dollar create a policy index using weights specifically derived for growth regressions. As these weights are not applicable to education, this paper does not recur to the index but considers each variable separately. Again, all necessary data is provided by the WDI database.

As the above variables merely refer to economic aspects of good governance, they are complemented by the Freedom House index of political rights and civil liberties (FREE) which covers the broader political and institutional environment. This index is based on the evaluation of: free elections, the real power of elected political representatives, the de facto power of the opposition, the right to organize in groups, freedom of domination by the military or other powerful groups, and self determination rights of minority groups (political rights), as well as freedom of expression and belief, association and organizational rights, rule of law and human rights, and personal autonomy and economic rights (civil liberties). The index is measured on a one-to-seven scale, with one representing the highest degree of freedom and seven the lowest (Freedom House 2003). Alternative indices such as the recent World Bank governance indicators computed by Kaufmann, Kraay and Mastruzzi (2003) have also been considered, but have been finally rejected due to the limited length of available time series.[1]

Countries were included in the sample if they belonged (i) to the group of low- or lower middle income countries as defined by the World Bank (2003a) as well as (ii) to the group of developing countries (Part I of DAC aid recipients) according to DAC statistics. The latter condition excludes several lower middle income countries, particularly in Eastern Europe. This selection is based on the idea that countries above a certain development threshold have generally reached universal primary education so that they are of no interest for the analysis in this paper. Overall, 80 low- and lower middle income countries are covered by the following econometric analysis.

3 Econometric results

As the non-availability of long-term data on disbursements and technical cooperation limits the structural analysis to the use of the less reliable commitment data, the long-term "structural" panel analysis is presented first, and checked for robustness later on the basis of the annual panel for the 1990s.

1 For the data, see World Bank (2003b).

3.1 Initial results for the structural panel

The basic idea of the structural panel is that educational outcomes such as enrolment will tend to react on long-term developments of resource availability, the education system and the policy environment rather than on short-term variation of any of these variables. From this perspective, annual data create unnecessary noise which can be avoided if the data are smoothed over several years. For the purpose of this study, available information on all variables was simply averaged over the five-year periods 1970-1975 until 1996-2000.

Initial results are presented in Table 1. Each regression was carried out three times using:

EDUCAID: absolute aid (in constant 2001 US$)

EDUCAIDn: EDUCAID divided by the population of the recipient country, and

EDUCAIDg: EDUCAID divided by GDP · 100,

whereby (ii) and (iii) take into account that the effect of aid allocated to a particular country may depend upon the size of the recipient.

Across all three variations of the aid variable, both fixed effects (FE) and random effects (RE) estimates provide some evidence for a positive impact of educational aid on primary enrolment. Only in the case of EDUCAIDn, the coefficients are marginally below the significance level of 10%. Certain differences in the value of coefficients exist between the fixed effects and the random effects model, but in case of the variables EDUCAID and EDUCAIDg, these differences remain moderate. By and large, the initial results therefore seem to indicate a relatively robust effect of educational aid on primary enrolment.

Table 1: Panel I (structural panel) – initial results

Model	FE	RE	Arellano-Bond	FE	RE	Arellano-Bond	FE	RE	Arellano-Bond
EDUCAID	0.068***	0.074***	-0.005						
EDUCAIDn				0.035(*)	0.021(*)	-0.016			
EDUCAIDg							0.140*	0.149*	-0.020
EXPEDUC	3.439***	3.234***	-0.015	3.578***	3.289***	-0.002	3.278***	2.939***	0.166
RATIO_ST	0.638***	0.274**	0.766***	0.674***	0.266**	0.762***	0.508***	0.062	0.769***
POPY	-0.955***	-0.582**	-0.657	-0.864***	-0.480**	-0.673	-0.503	-0.258	-0.752
GDPcap	0.003(*)	0.003***	0.005*	0.004*	0.004***	0.005*	0.004	0.003***	0.004
BUDGET	0.121	0.098	-0.092	0.141	0.116	-0.112	0.096	0.137	-0.090
INFL	-0.000	0.000	-0.001	-0.000	0.000	-0.001	-0.000	0.000	-0.001
OPEN	-0.018	0.010	-0.100	-0.000	0.025	-0.098	-0.003	0.012	-0.081
FREE	-1.860**	-2.015**	-0.869	-1.794**	-1.938**	-0.949	-2.053**	-1.793**	-0.899
GPE(-1)			0.384***			0.388***			0.392***
N	277	277	149	277	277	149	249	249	137
countries	80	80	60	80	80	60	75	75	58
R^2(within)	0.26	0.23		0.23	0.20		0.19	0.15	
R^2(between)	0.04	0.17		0.05	0.17		0.06	0.20	
Wald stat.		$\chi^2(9)=71.2$	$\chi^2(10)=38.8$		$\chi^2(9)=61.3$	$\chi^2(10)=39.1$		$\chi^2(9)=48.9$	$\chi^2(10)=27.6$
Sargan (overidentification)			$\chi^2(9)=11.4$			$\chi^2(9)=11.1$			$\chi^2(9)=9.7$
A-Bo (AC1)			z = -2.76			z = -2.73			z = -2.78

Notes: ***, **, and * denote significance at the levels of 1%, 5% and 10% respectively. (*) notifies that the coefficient just fails to be significant at the 10% level. For an overview of variable definitions and sources, see Annex.

However, looking more closely at coefficients, the impact of aid, though positive, appears to be extremely modest. The coefficient estimates of 0.068 and 0.074 on EDUCAID imply that a one-million increase in aid funds allocated to education will raise primary enrolment rates by only about 0.07%! Comparing the effectiveness of aid resources with the impact of national resources in the regression using EDUCAIDg reveals that the latter are about 30 times more efficient. Generally, the effect of national education expenditure EXPEDUC appears to be strongly significant and robust across all fixed and random effects regressions and clearly more relevant than the effect of aid. Other authors found similar results on the basis of country-case studies and suggest that this may be due to general deficiencies in the management of aid resources, their missing focus on the relevant objective, and the overpricing of goods purchased by aid resources, often in the donor, rather than in the recipient country (see e.g. Mercer et al. 2002).

The other two explanatory variables characterizing the recipient countries' education system also show the expected effect. The student-teacher ratio (RATIO_ST) is strongly and positively related to primary enrolment. This reflects the fact that enrolment is eased if higher student numbers are accepted per teacher. Conversely, a higher share of children within the population (POPY) tends to reduce the enrolment rates.

It may be noted that for these two variables, fixed and random effects coefficient estimates differ quite considerably, so that the random effects estimation might not be consistent. Looking at fixed effects regressions, the coefficients imply that increasing the student-teacher ratio (on average) by 10 students increases gross enrolment rates by at least 5%. At the same time, a 1% higher share of the population under 15 years of age goes hand in hand with an almost 1%-reduced enrolment rate. This confirms the relevance of structural variables of the education system.[2]

The control variable for the general income level also shows the expected positive coefficients. The effect remains moderate, however, as educational expenditure is already controlled for.

Finally considering the governance variables leads to a more interesting result. None of the variables related to economic aspects of good governance appear to be relevant. However, the political and institutional aspects captured by the Freedom House index (FREE) consistently show a relatively strong relationship with student enrolment across all fixed and random effects regressions. A one-point increase on the seven-point scale

2 For a discussion of the relevance of these structural factors, in particular the student-teacher-ratio, see also Mingat and Tan (2003), Mingat and Suchaut (2000) and MINEDAF (2002).

towards oppression implies, on average, a reduction of primary enrolment rates by close to 2%.

This shows that the role of institutional factors frequently demonstrated in a more general context of development (see e.g. Rodrik, Subramaniam and Trebbi 2002; World Bank 2001) is equally important for the specific sector of education. At the same time, the relevance of economic governance seems to be limited to economic development measured by variables such as growth.

Overall, the regression results discussed so far appear to be plausible and relatively robust across differences in specifications. However, both the fixed and the random effects models as presented so far have the disadvantage of suffering from considerable autocorrelation which can be taken care of by introducing the lagged dependent variable on the right hand side of the regression equations. This step is theoretically plausible as enrolment today can be assumed to be highly relevant for enrolment tomorrow. Indeed, the Arellano-Bond GMM regressions also displayed in Table 1 consistently reveal a strongly significant impact of the lagged dependent variable. At the same time, first order autocorrelation of the residuals is now rejected by the Arellano-Bond test [A-Bo (AC1)].

Unfortunately, introducing the lagged dependent variable reduces the number of observations by about 50% and the length of the time series to just over two observations per country. Variables with a relevant impact over time therefore lose much of their explanatory power. In fact, besides the lagged dependent variable, only the student-teacher ratio and per-capita income remain significant. Moreover, overall regression statistics are by no means convincing.[3] The dynamic panel model will therefore not be discussed any further in this section, but will be taken up again in the discussion of the annual panel where slightly longer time-series will be available.

A further problem with the overall regression model could be that educational aid may not be exogenous as assumed so far. In fact, one may very well imagine that donors decide upon the allocation of aid to education on the basis of prevailing enrolment rates. If enrolment rates in a particular recipient country are already high, the need for aid in this area will appear less pressing than if they are low. If this interaction between aid and enrolment is not taken into account in the econometric analysis, it must be expected

3 In particular, the Arellano-Bond test for second order autocorrelation yields very unsatisfactory results. If the presence of second order autocorrelation cannot be rejected, coefficient estimates may be inconsistent. However, with hardly more than two observations per country, time series are obviously not long enough for any serious test of second order autocorrelation. This is why the corresponding statistics are not reported in Table 1.

that the effect of aid on enrolment will be at least partly offset by the effect of enrolment on aid. Therefore, the true impact of aid on primary enrolment rates will be underestimated.

3.2 Instrumenting educational aid

In order to solve the endogeneity problem, it is necessary to think about potential instrumental variables. A frequent choice in this context is the use of lagged variables. Indeed, at first glance, one might expect that enrolment tomorrow cannot influence aid flows today. However, this argument is not consistent with the fact that enrolment tomorrow is itself strongly related to enrolment today so that we observe considerable autocorrelation of residuals, at least in the simple fixed and random effects regressions. In the presence of autocorrelation, the lagged aid variable is not a viable instrument.

In order to find alternative instruments, development assistance channeled to other sectors such as health, water and sanitation, infrastructure, industry, energy, agriculture and government/civil service was examined with respect to the criteria set out in Angrist, Imbens and Rubin (1996). Almost all of these variables are significantly correlated with educational aid, but there appears to be a certain trade-off between the strength of the correlation and the potential endogeneity of the instrument itself. The most extreme case is aid for health which is highly correlated with aid for education both across countries and across time [partial R^2s are: 27% (within), 59% (between) and 40% (overall)[4]]. At the same time, it can be expected that outcomes in both sectors are similarly correlated. Generally unsatisfactory social sector development may enhance donor spending on health and education simultaneously. Therefore, using health as an instrumental variable may not solve the endogeneity problem.

Moreover, aid for health might raise enrolment rates independently of aid for education as healthier children may have a higher likelihood to attend school. However, this potential problem was directly checked through the data and did not find any supportive evidence. In fact, the aid for health variable does not show any correlation with the error term of the initial regression on aid for education.

An alternative instrument which can probably be considered as truly exogenous is energy aid. Energy aid comprises all assistance allocated to the production of energy,

4 The computation of partial R^2s here and elsewhere in this paper is based on the analysis suggested by Shea (1997). However, to adjust to the panel structure of the data, OLS regressions in each step were substituted by random effects regressions. Similarly, the final correlation of residuals (step 4, p. 349) was replaced by a bivariate random effects regression in order to derive partial R^2s distinguishing between the correlations within and between countries.

energy sector policy planning, institution building and distribution management. It does not include the extraction of raw materials for power generation (OECD/DAC 2004).

Figure 1: Energy aid as an instrument for educational aid

Figure 1a: Partial correlation*

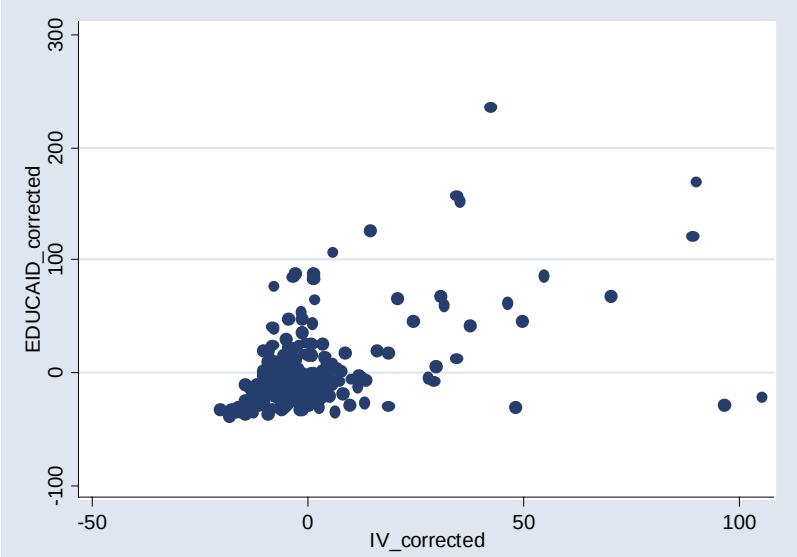
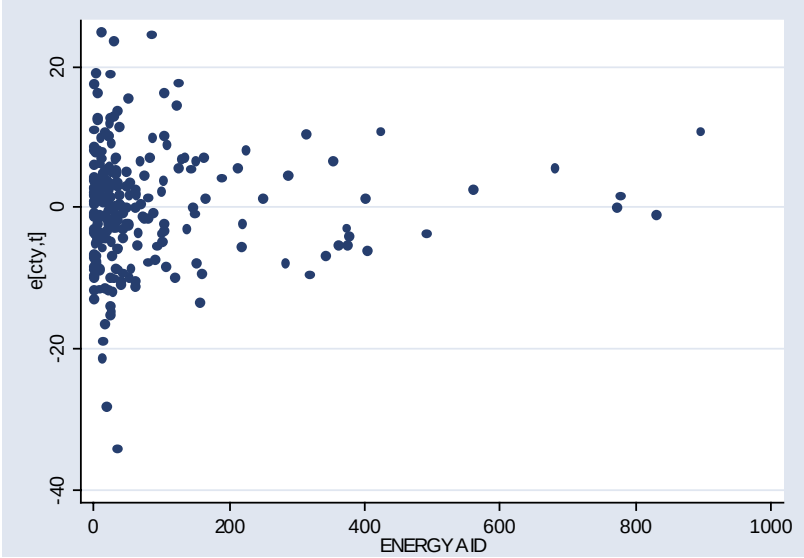


Figure 1b: Energy aid and the error term of the initial regression on educational aid



* Both EDUCAID and the instrumental variable (IV) derived in the first stage regression [using ENERGYAID, see equation (2) below] are corrected for the influence of all other explanatory variables. For details, see Shea (1997).

Unfortunately, the correlation between energy aid and educational aid is much lower than in the case of health. While the cross-country correlation is acceptable, the correlation within countries over time is almost negligible, partial R^2s are: 2% (within), 43% (between) and 23% (overall). A graphical representation of this relationship is provided in Figure 1a. Figure 1b plots the suggested instrument against the error term of the initial regression on EDUCAID and thereby gives some support to the assumption that the effect of energy aid on enrolment is truly channeled exclusively through educational aid.

Hence, despite the problem of being a relatively weak instrument, in particular when it comes to the within country relationship, ENERGYAID appears to be the best instrument available. This instrument is therefore retained in the analysis. At the same time, one should be cautious with the interpretation of the results, particularly with regard to developments over time.

Shea (1997, pp. 348f.) notes that as long as the instruments are perfectly exogenous, coefficient estimates remain consistent, but their precision is reduced. However, as within each country only few time series observations are available, finite sample properties are more relevant here. Staiger and Stock (1997) emphasize the important bias which can arise if the relevance of the instruments is weak, and show that the endogeneity bias in the simple OLS regression might in some cases be lower. Therefore, IV regressions in this paper should be taken as a complementary check for robustness of the initial fixed and random effects regression, and not necessarily as an improvement upon these.

Equations (2) and (3) present the results of the 1st and 2nd stage random effects regressions using ENERGYAID:

(2) **2SLS, 1st stage**

EDUCAID= - 7.915 + 0.082***ENERGYAID + 0.158 EXPEDUC
+ 0.294 RATIO_ST - 0.306 POPY + 0.000 GDPcap + 0.368 BUDGET
- 0.001 INFL + 0.099 OPEN + 0.674 FREE

(3) **2SLS, 2nd stage**

GPE = 96.633*** + 0.207*$EDUCAID_{IV}$ + 2.475***EXPEDUC + 0.108 RATIO_ST
- 0.533**POPY +0.005***GDPcap - 0.041 BUDGET + 0.000 INFL
+ 0.053 OPEN - 2.659***FREE

N=250, countries=76, R^2(within)=0.16, R^2(between)=0.31, Wald $\chi^2(9)$=61.3

The 1st stage equation depicts the (after all) highly significant relationship between the endogenous variable and energy aid. None of the other variables shows any significant effect. Replacing EDUCAID by the instrument created in the 1st stage and running the initial random effects model on this basis (2nd stage) produces results very similar to those of Table 1. Only the student-teacher ratio fails to be significant under this specification.

It should be noted, however, that the coefficient of EDUCAID is now considerably higher than in the initial specification. This is consistent with the above stated hypothesis that the initial fixed and random effects models may underestimate the true effect of aid for education. Nevertheless, even under the new specification, a 1 million increase in aid funds raises gross primary enrolment by only 0.2%.

On the basis of the structural panel, we may therefore conclude that the initial results are broadly confirmed, that educational aid seems to have some positive, albeit small impact on enrolment and that besides the general characteristics of the education system, the institutional and political environment of the country also plays a major role.

3.3 Initial results for the short-term annual panel

In the following the preceding analysis will be complemented by the introduction of two different aid variables available only after 1992. As mentioned earlier, aid disbursements appear to be a much more reliable source of information than aid commitments which, in some cases, may not actually be disbursed. Moreover, a major part of aid is channeled in the form of technical cooperation which seems to be the most accurate measure when it comes to the sectoral allocation of funds within individual recipient countries over time. This is why the data on technical cooperation were

suggested by the DAC secretariat for this analysis, even though technical cooperation does not fully cover all educational aid, and even though reporting for technical cooperation is not actually restricted to disbursements and may also contain commitments.

The above discussion shows that the two aid indicators introduced now also have considerable disadvantages, so that the following analysis should again be interpreted as a check for robustness, rather than as an improvement upon the analysis in the previous sections of this paper.

Using annual data, time series become long enough to produce dynamic panel regressions based on the Arellano-Bond GMM estimation with at least roughly acceptable overall regression statistics. Table 2 presents the results.

Table 2: Panel II (annual panel) – initial results

Model:	Arellano-Bond; EDUCAID endogenous, IV: ENERGYAID					
EDUCAID:	*tec. coop.*	*aid disb.*	*tec. coop.*	*aid disb.*	*coop. tec.*	*aid disb.*
EDUCAID	0.040***	-0.019				
EDUCAIDn			0.674**	0.314*		
EDUCAIDg					6.870***	3.680(*)
EXPEDUC	1.299**	0.369	1.184**	-0.034	1.058*	0.130
RATIO_ST	0.007	-0.042	0.009	-0.035	-0.027	-0.032
POPY	-0.876(*)	0.637	-0.566	0.533	-0.396	0.482
GDPcap	0.001	0.001	0.001	0.001	0.002	0.002
BUDGET	0.121	0.005	0.143(*)	-0.006	0.098	-0.022
INFL	0.003***	-0.000	0.003***	0.000	0.003***	-0.000
OPEN	-0.016	0.008	-0.009	0.013	-0.014	0.003
FREE	0.580	-0.126	0.481	-0.076	0.395	-0.020
GPE(-1)	0.314***	0.300***	0.275***	0.346***	0.256***	0.333***
N	154	122	154	122	154	122
countries	52	42	52	42	52	42
Wald stat.	$\chi^2(10)=59.5$	$\chi^2(10)=38.7$	$\chi^2(10)=55.4$	$\chi^2(10)=49.6$	$\chi^2(10)=54.3$	$\chi^2(10)=47.7$
Sargan (overidentification)	$\chi^2(49)=81.2$	$\chi^2(63)=101$	$\chi^2(49)=88.8$	$\chi^2(63)=98.1$	$\chi^2(49)=87.0$	$\chi^2(63)=109$
A-Bo (AC1)	z = -2.82	z = -0.49	z = -2.58	z = -0.88	z = -2.85	z = -0.73
A-Bo (AC2)	z = 0.63	z = 1.74	z = 0.73	z = 1.48	z = 1.38	z = 1.44

Notes: ***, **, and * denote significance at the levels of 1%, 5% and 10% respectively. (*) notifies that the coefficient just fails to be significant at the 10% level. For an overview of variable definitions and sources, see Annex.

Generally, it may be noted that considerably fewer variables are significant than before. This may be simply related to the fact that the number of observations is only about half

of those available for the fixed and random effects regressions in Panel I. While even after the introduction of the lagged dependent variable time series within each country remain longer than in those for the structural panel, the number of countries for which data on disbursements and technical cooperation are available is much lower than the number of countries for which these observations can be obtained in terms of commitments. In fact, only 52 recipient countries are covered by the regressions using technical cooperation, and only 42 by the regressions using disbursements.

An alternative explanation could be based on the fact that many of the explanatory variables are of a more structural nature and cannot be expected to change in any significant way within a single year. In fact, this was precisely the argument why the long-term panel was introduced in the first place. Annual changes in, for instance, GDP per capita, probably reflect short-term business cycle variations, rather than structural developments and can therefore be expected to be unrelated to changes in long-term investment decisions (such as, e.g. parents' decision to seek schooling for their children). Moreover, the impact of variables that do not change much over time and are relevant from a cross-country rather than from a within country perspective, should be picked up to a large extent by the impact of the lagged dependent variable.

One variable which remains significant, apparently showing some relevance even in the short run, is aid for education. This variable is highly significant in all three specifications using technical cooperation, and weakly significant in at least some of the specifications based on disbursements. In the regression on EDUCAIDg where the impact of aid can be most readily compared with the impact of national expenditure, the results of Table 1 with respect to the relative efficiency of national funds are reversed. It now appears that aid resources allocated to education are invested more efficiently than national resources. Or, turned differently, national resources seem to be invested in an even less efficient manner than development assistance.

This changed outcome may be the result of the fact that the potential endogeneity of educational aid has now been corrected for. An alternative explanation may be that relevant changes in national education expenditure are of a more structural nature than relevant changes in the allocation of aid.

Besides educational aid, national education expenditure and the lagged enrolment rate, only one more variable is strongly significant, at least in the regressions using technical cooperation. Surprisingly, this is the inflation variable, and it enters with a positive coefficient that contradicts the hypothesis on the basis of which this variable was introduced in the first place. In fact, introduced as an indicator of governance, one

should have expected that low inflation rates, i.e. good governance, would lead to higher enrolment. The opposite seems to be the case.

However, there may be some explanation to this puzzling evidence. In fact, one variable of great relevance in the context of the efficiency of education expenditures are teachers salaries. Due to limited data availability, this variable could not be included among the explanatory variables of the regression models. Teacher remuneration accounts for the bulk of current education expenditure, and its part raises up to 90% in some African countries (World Bank 2003a).

Increasing enrolment rates are very difficult to achieve under conditions of relatively high salaries (Mingat, Rakotomalala and Tan 2002). At the same time nominal teacher salaries, just as the salaries of any civil servants, are relatively sticky. From that perspective, inflation may reduce the financing needs of the education system through an effective reduction of real salaries.

However, it may be doubted whether this kind of an argument is consistent with the linear relationship assumed in the regression model. This would imply that enrolment could be continuously increased by simply raising inflation rates. Rather, one would expect a nonlinear relationship where the positive effect dampens (and eventually turns into a negative effect) as inflation rates go up.

Similarly, one might suggest that the influence of educational resources and per-capita income should equally grow at a decreasing rate. This requires additional refinements of the regression model.

3.4 Testing for non-linearities and the possible interaction of aid and governance

In fact, decreasing returns could be imagined with some plausibility for most of the explanatory variables in the regression. It might even be that some of the potentially relevant relationships have not yet been discovered because of the limitations of the linear model.

Moreover, as this section also attempts to analyze possible interactions between governance and aid, taking into account all potentially relevant non-linearities is crucial. In fact, Hansen and Tarp's (2001) critique of the Burnside and Dollar (2000) results on aid effectiveness mainly relies on this simple argument. According to Hansen and Tarp, the relevance of the interaction term between aid and governance in the Burnside-Dollar model is simply a reflection of decreasing returns to aid, or, put differently, to an omitted variable bias due to the omission of a relevant quadratic term.

In this study, in order ensure that potential non-linearities are taken into account, each structural or political variable including educational aid is inserted into the model as a quadratic function. To avoid overloading the model with too many variables, this procedure is repeated one by one for each variable separately whereby the quadratic term is retained in the overall model only if significant. In a second step, following the same procedure, each of the governance variables is inserted into the model with an interaction term with educational aid and retained in the model if significant.

Equation (4) presents the results for aid in terms of technical cooperation expressed as a percentage of GDP, the specification which facilitates the interpretation in comparison to the impact of national education expenditure.

(4) $GPE = 0.278 + 14.834^{**}EDUCAIDg_{IV} + 4.261^{**}EXPEDUC - 0.331^{**}EXPEDUC^2$
$+ 0.014\ RATIO\_ST - 0.579\ POPY + 0.002\ GDPcap - 0.117\ BUDGET$
$+ 0.009^{***}INFL - 1.23e^{-6}{}^{**}INFL^2 - 0.029\ OPEN + 0.342\ FREE$
$- 2.332^{*}EDUCAIDg \times FREE + 0.226^{***}GPE(-1)$

N=154, countries=52

Wald $\chi^2(13)=82.03$, Sargan $\chi^2(49)=89.73$, A-Bo (AC1) z=-2.93, A-Bo (AC2) z=1.54

It follows that a significant quadratic relationship could be found only with respect to the inflation rate and with respect to national expenditure for education. In both cases, the coefficients confirm the hypothesis of diminishing returns.

Moreover, interestingly, the interaction term of the Freedom House index with educational aid also shows a significant coefficient. The relationship does not simply reflect an omitted non-linear influence of the aid variable, since this possibility was tested previously and rejected. Comparing the coefficient estimate of the interaction term with the coefficient estimate of the aid variable reveals that under extremely bad political and institutional conditions (FREE>6), the effect of aid becomes negative. Evidence for the education sector thereby gives some support to the Burnside-Dollar argument that aid is effective only under conditions of good governance.

Checking for robustness under alternative specifications of the aid variable (EDUCAID and EDUCAIDn) leads to the same results. However, for the long-term structural panel, this effect could not be identified. At the same time, as opposed to the results of the structural panel, no direct effect of good governance can be observed here. One might argue that, for a certain time, aid may help governments to dissemble their bad policies. In the long run, however, their negative results will become directly observable so that there is no more interaction with the inflows of foreign assistance.

4 Conclusions

Analyzing aid effectiveness at the sectoral level provides some interesting evidence both with respect to the general debate on aid effectiveness and with respect to the interaction between aid and governance. The empirical application to the education sector shows that, in all likelihood, aid increases gross primary enrolment. This result is reasonably robust across different data and estimation methods.

At the same time, coefficient estimates for the aid variable vary greatly between the most pessimistic and the most optimistic results. According to estimations based on technical cooperation, a 1% increase in gross primary enrolment requires an increase in aid for education by 25 million US$ in absolute terms, or by 0.15% relative to the national GDP of the average recipient country. These coefficient estimates stem from different regressions. As in 2000, educational aid to the average recipient country in the sample was 13 million US$ or 0.41% of average GDP, the first estimate roughly requires a duplication of current aid efforts while the second only requires an increase by about one third.

However, a closer look at even the most optimistic coefficient estimates demonstrates that, at any realistic rate of growth of educational aid, universal primary education will not be reached by this means as long as development assistance is not spent much more efficiently than it currently is. In fact, strikingly, despite the fact that universal primary education has been made a primary international objective repeated over and over again on international conferences on poverty and education, even in 2002 the average donor's share of educational aid committed to primary education was only about 30% (OECD/DAC 2004).

Unfortunately, national education spending in many developing countries shows similar inefficiencies. Once the possible endogeneity of aid is taken into account in the regression model, government spending on primary education does appear to be even less effective than aid.

Moreover, it comes out rather clearly that the structural parameters of the education system such as the number of young people in the country, the student-teacher ratio and teacher salaries also play a crucial role when it comes to finding sustainable solutions for the financing of primary education. In particular, countries in which population growth is high will have to accept equally high student-teacher ratios and / or relatively low teacher salaries, otherwise there will be no chance they can ever achieve education for all.

Finally, the study suggests that national policies do not matter in the education sector alone. While good governance in economic terms (trade openness, budgetary austerity, price stability) does not show any significant effect on primary education enrolment, general political and institutional governance clearly does. Lack of political freedom and civil liberties is consistently negatively related to enrolment.

In addition, at least in the short run, the effects of development assistance and governance seem to be interrelated. It turns out that under very bad political and institutional conditions, aid may have a negative, rather than a positive impact on enrolment. This might be interpreted as a sign of fungibility of resources whereby more aid frees government resources for activities that are detrimental to the country's development.

Annex: List of variables

Variable name	Definition	Sources
GPE	gross primary enrolment (%)	WDI (World Bank 2003a)
EDUCAID	aid allocated to education (constant 2001 US$, millions)	commitments: IDS/CRS, table 1 disbursements: IDS/CRS, table 5 technical cooperation: IDS/DAC, table 5a (OECD/DAC 2004)
EDUCAIDn	EDUCAID (constant 2001 US$) / population	
EDUCAIDg	EDUCAID (US$) / GDP·100	
EXPEDUC	national education expenditure (% of GNP)	WDI (World Bank 2003a)
RATIO_ST	student-teacher ratio in primary education	WDI (World Bank 2003a)
POPY	population aged 0-14 (% of total population)	WDI (World Bank 2003a)
GDPcap	GDP per capita (constant 1995 US$)	WDI (World Bank 2003a)
BUDGET	budget surplus (% of GDP)	WDI (World Bank 2003a)
INFL	inflation (consumer prices, % annual)	WDI (World Bank 2003a)
OPEN	openness (export+import, % of GDP)	WDI (World Bank 2003a)
FREE	Freedom House index of political rights and civil liberties (1-7, whereby 1 shows the highest degree of freedom)	Freedom House (2004)
ENERGYAID	aid allocated to energy production and planning (constant 2001 US$, millions)	commitments: IDS/CRS, table 1 disbursements: IDS/CRS, table 5 technical cooperation: IDS/DAC, table 5a (OECD/DAC 2004)

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