Aid Effectiveness in the Education Sector
- A Dynamic Panel Analysis -

Katharina Michaelowa and Anke Weber[1]
Hamburg Institute of International Economics (HWWI)
and University of Zurich

Abstract

Applying the general question of aid effectiveness to the sector of education, this paper provides some evidence for a positive effect of development assistance on primary enrolment and completion. 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, there is some evidence that the recipient countries' general political and institutional background matters. Under conditions of bad governance, the impact of aid on enrolment can actually turn negative.

Key words: aid effectiveness, primary education, good governance
JEL-codes F350, O150, I220

[1] We would like to thank Simone Kirasic for useful research assistance, and Julia Benn (OECD/DAC) and Michael Bruneforth (UNESCO-UIS) for their support with respect to the interpretation of the DAC and UNESCO statistics. Moreover, we are grateful for helpful comments and suggestions by Jean Bourdon, Michael Funke, Ashok Parikh, Smita Sirohi, Matthias Lutz and the participants of a research seminar at IREDU (University of Burgundy, Dijon).
Contact: katja.michaelowa@uzh.ch

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% (Michaelowa and Borrmann 2006).

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, 2006) 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. Harms and Lutz (2004) as well as Doucouliagos and Paldam (2005) present a comprehensive overview of the literature available so far.

It is the objective of this paper to evaluate the apparently contradictory evidence on aid effectiveness at the example of a specific sector: education. 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 micro level project evaluation data generated by bilateral development agencies.

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" (EFA) international fora in Jomptien 1990 and Dakar 2000, as well as the "Millennium Development Goals" (MDGs) 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 in a dynamic panel analysis for about 120 low- and lower-middle income countries. While Section 2 discusses the data used for the econometric analysis, Section 3 describes the econometric approach and presents 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 draws some conclusions of this sectoral study in the context of the wider debate on aid effectiveness.

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

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

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.

As far as the measurement of progress towards universal primary education is concerned, the indicators to be used have been agreed internationally along with the definition of the MDGs' goal no. 2 on education. They include the net primary enrolment rate, persistence to grade 5 and the primary completion rate. Persistence to grade 5 always requires a simultaneous consideration of enrolment because it is defined only with respect to those students who initially enter the education system. The combination of both aspects is captured in the completion rates which relate the number of students completing primary education to the total number of children of the corresponding age group. The only disadvantage is that for completion (just as for enrolment) there is no specific final grade level identified, so that different durations of primary education may distort international comparability for those countries which significantly differ from the typical duration of five or six years. Nevertheless, the net enrolment rate (NER) and the primary completion rate (COMPLETION) appear to be the most appropriate variables in the context of our analysis.

Unfortunately, there are considerable problems of data availability. The only educational indicator for which a reasonably complete coverage exists over the years is gross primary enrolment. However, its message is difficult to interpret as more than

50% of the observations exceed 100%. The reason is that, as opposed to the net enrolment rate which only considers pupils of the appropriate age, the gross enrolment rate considers pupils of *any* age and compares them to the (much more restricted) number of children of official primary school age. Thus the gross enrolment rate is inflated by late enrolment and grade repetition which is substantial in some countries, notably in Africa and Latin America, and its increase may reflect an increase in inefficiency rather than a true increase in enrolment.

Fortunately, the simultaneous consideration of direct information on the efficiency of the education system (e.g. persistence and repetition rates) can mitigate this deficiency. Moreover, even the gender balance (in both primary and secondary education) provides complementary information. Note that whenever there is close to universal enrolment, the gender-ratio must be close to one, which is generally not the case otherwise.

For the purpose of this study, we thus combine all the information available on gross enrolment and on the additional indicators mentioned above, and use it to derive revised and more comprehensive data on NER and COMPLETION. All imputations are based on linear regressions with subsequent trimming to ensure that the imputed values are in the support of the underlying variables.

All relevant educational indicators are available from the UNESCO-UIS (2006) statistical database. For convenience, they can also be drawn together with other macroeconomic variables from the World Bank's World Development Indicators (WDI). However, the most recent WDI database (World Bank 2005) does no more include the older UNESCO statistics (up to 1997), so that it has to be used jointly with the WDI 2003 database (World Bank 2003).

In order to characterize the national education systems in recipient countries, information on current education expenditure in percent of GNI (EXPEDUC), the pupil-teacher ratio in primary education (PTR), and the share of children and youths aged 0-14 as a percentage of overall population (YOUNG-POP) 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 WDI database (World Bank 2005).

Note that in order to measure national resources allocated to education, current expenditure is preferred to the overall education budget because the latter may in some cases include the aid resources taken into account separately here.[2] This problem can be

2 In fact, UNESO-UIS questionnaires require the inclusion of aid resources into the national education budget. However, in practice, bilateral project aid cannot generally be expected to be included in these figures. In many cases, national education ministries were not even informed about the volumes concerned. Transparency improved when budget financing and the financing of sector programs were

avoided for current educational expenditure as – until recently – donors argued that regular payments were to be financed locally in order to ensure sustainability.

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 (INFLATION), 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 (World Bank 2005).

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 2005). Alternative indices such as the more recent World Bank governance indicators computed by Kaufmann, Kraay and Mastruzzi (2003, 2005) have also been considered, but have been finally rejected due to the limited length of available time series.[3]

As the overall data set contains a considerable number of missing values, imputations were carried out for all explanatory variables. With the exception of FREE, these imputations were based on linear regression using related variables, i.e. their own lags as well as other macroeconomic indicators in the case of macroeconomic variables, and different types of aid data including information on related sectors such a health in the case of EDUCAID. When information was missing for the Freedom House Index, the observation was replaced by the highest (i.e. worst) value available over time for the country concerned. For all variables, missing value indicators were computed and integrated in the econometric estimation equations in order to avoid or reduce potential bias created by these imputations.

introduced at the turn of the century. Nevertheless, according to information from UNESCO-UIS, even budget aid has not been consistently included into the national figures yet.

3 For the data, see World Bank (2006).

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 (2003) 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, over 120 low- and lower middle income countries are covered by the following econometric analysis.

Note that the data set deliberately ends in 2000 although some more recent data is available. The reason is that with the beginning of the 21st century, budget aid and sector program support have been introduced in many countries so that a distinction between aid resources and the recipient governments' own spending on education has become blurred even with respect to current education expenditure which was traditionally fully left to the responsibility of local governments.

3 Econometric analysis

As there is strong evidence of an autocorrelation of educational outcomes both in terms of enrolment and completion, the econometric analysis is carried out using the GMM dynamic panel estimators suggested by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). While Arellano and Bond (1991) use a first differenced estimator to avoid the correlation of the lagged dependent variable with the individual effect included in the error term, Arellano and Bover (1995) reinclude levels equations in combination with suitable lags of first differenced variables as instruments. Blundell and Bond (1998) demonstrate that these additional levels restrictions remain informative even if the restrictions in first differences encounter the weak instruments problem discussed by Staiger and Stock (1997). Moreover, they show that adding the levels equations considerably increases the precision of the estimator, especially when the autocorrelation of the dependent variable is relatively high.

At the same time, the overall number of instruments becomes disproportionally high in some regressions, sometimes higher than the number of countries included in the panel. Due to the additional levels restrictions, this problem arises more often with the Blundell-Bond than with the Arellano-Bond estimator. Roodman's (2005) implementation of both estimators in Stata suggests an easy way to mitigate this problem through a limitation of the lags to be considered as instruments (collapse option). In our analysis, this option is used in some regressions in order to improve overall regression statistics, in particular the test for validity of the overidentifying

restrictions (Hansen test). Note that for both Arellano-Bond and Blundell-Bond estimation, one-step and two-step options are available. Arellano and Bond's (1991) simulations suggest that the two-step option may increase the precision of coefficient estimates and considerably improve overall regression statistics in case of heteroscedasticity, but that standard errors tend to be systematically underestimated. This systematic bias is taken into account by the robust version of the estimators implemented by Roodman (2005) which include Windmeijer's (2005) finite-sample correction for the two-step covariance matrix.

An additional methodological issue is that EDUCAID cannot be realistically considered as an exogenous variable. It is highly plausible that exogenous shocks like droughts or earthquakes simultaneously influence aid inflows and development outcomes like educational enrolment and completion rates. For this reason, EDUCAID is instrumented in all regressions, generally using its own lag as an instrument.

To some extent, one might expect the same argument to be true for national resources allocated to education (EXPEDUC). As we are measuring current expenditure flows which are, by definition, more stable than capital investment, the problem may be less relevant though. In any case, in order to check the robustness of our results, we will also instrument EXPEDUC by its lag in some regression specifications.

Generally, the choice of a lagged explanatory variable as its own instrument has the advantage of a strong correlation with the initial variable. However, it is sometimes difficult to argue that it is truly uncorrelated with the error term, i.e. that it satisfies the second requirement for a valid instrumental variable (IV). In particular, a problem arises when the endogeneity of the original variable is caused by reverse causation, i.e. by an influence of the dependent variable on the regressor concerned. This may be an alternative reason for the endogeneity of EDUCAID as it is not implausible to assume that donors purposefully orient their educational aid resources towards recipient countries most in need of these resources, i.e. to countries with low net enrolment and completion rates. Obviously, if current aid is influenced by current educational outcomes, lagged aid is influenced by lagged educational outcomes. As in our case, educational outcomes are autocorrelated over time, lagged aid is indirectly also related to current educational outcomes, and hence to the error term of the current period.[4]

To give due attention to the possibility of reverse causation, we spent considerable time to think of instruments for EDUCAID that would remain valid in this case. In order to

4 Only under very specific assumptions about the relationship between the error term of the regression equation and the error term of the equation specifying the (reverse) effect of educational outcomes on aid, it is still possible to construct a situation in which the lagged EDUCAID is uncorrelated with the error term.

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 using the commitment data from the 1970s onwards and control variables as in the regressions discussed in the following section are: 27% (within), 59% (between) and 40% (overall).[5] 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. It is therefore inappropriate as an instrument for EDUCAID.

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

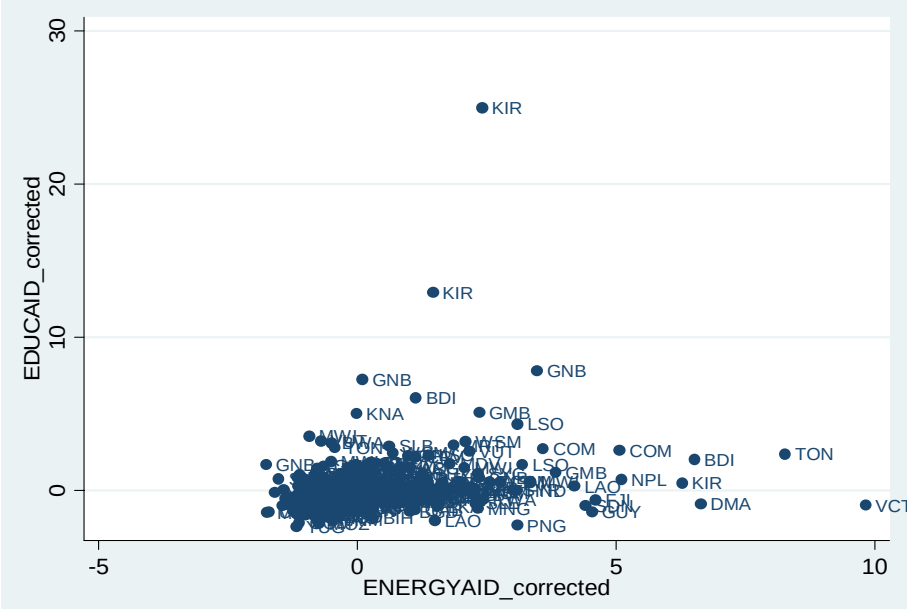
Unfortunately, the correlation between energy aid and educational aid is much lower than in the case of health. While the cross-country correlation is acceptable, the correlation within countries over time is almost negligible. Partial R^2s for the regression of EDUCAID on ENERGYAID and all other control variables as in the regression tables discussed below are: 3% (within), 31% (between) and 24% (overall).[6] Nevertheless, the relationship between EDUCAID and ENERGYAID is significant at the 1% level in this model. A graphical representation is provided in Figure 1.

---

5 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.
Note that the correlation tests were carried out before the EDUCAID variable was imputed so as to properly distinguish between the different sector variables.

6 The exact figures refer to the case in which aid is measured as a percentage of GDP, i.e. they would exactly correspond to a first step equation for the model in Table 2, equation 5 if this model had not been estimated using the more complex system GMM estimation suggested by Blundel and Bond and described above. The partial R^2s of analogous regressions for the corresponding equations in Table 1 and 3 are somewhat lower, and ENERGYAID is less highly significant.

Figure 1: Energy aid as an instrument for educational aid



* Both EDUCAID and the instrumental variable (IV) are corrected for the influence of all other explanatory variables (as of Table 2, Regression 5).

The graph shows that some positive relationship exists, but it is not very clear and blurred by several outliers. 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. The above discussion shows that ENERGYAID belongs to these relatively weak instruments, in particular when we consider the within country relationship. Nevertheless, ENERGYAID appears to be the best instrument available and will be retained in the analysis for some regressions as an alternative to the lagged EDUCAID.

The results of the different regressions will be discussed in two settings: a long term structural model (Section 3.1) and an annual model for the 1990s (Section 3.2). While the former is theoretically more appealing, the latter benefits from the availability of more reliable data.

3.1 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 1971-1975 until 1996-2000.

For the early years, information on COMPLETION is extremely scarce, so that about two thirds of the data would have to be imputed. We therefore confine the analysis of the structural panel to the determinants of NER. Results are presented in Table 1 and 2. Both tables use identical models but differ with respect to the aid variable. As the effect of a given aid volume depends upon the size of the recipient country, examining the effect of aid flows in absolute numbers does not seem adequate. We propose two different ways to adjust these numbers to country size:

(i) Education aid relative to the population of the recipient country (Table 1: *EDUCAIDn*), and

(ii) Education aid in % of recipient countries' GDP (Table 2: *EDUCAIDg*).

While the former takes into account the number of people who effectively have to share the amount of aid received, the latter reflects the relevance of aid as compared to the recipient countries' own resources.

Tables 1 and 2 present five regressions each, using always the same set of explanatory variables but different estimation techniques. Regression (1) shows the simple Arellano-Bond model, Regression (2) the Arellano-Bond model with Windmeijer's robust variance-covariance matrix, and Regression (3) the robust Blundel-Bond estimation. In all of these, EDUCAID is instrumented using its own lag (L.EDUCAID) so that we have an additional restriction added to the moment restrictions of the original GMM estimator. Regressions 4 introduces lagged national current expenditure on education as an additional IV variable for EXPEDUC and Regression 5 uses ENERGYAID instead of L.EDUCAID to instrument for aid to education.

Results are far from robust across these different regressions. EDUCAID, our main variable of interest, shows a significantly positive coefficient only in one regression (Regression (1), Table 1). Unfortunately, as discussed above, this specification is the least reliable with respect to significance levels. As soon as the structural bias of standard errors is taken into account using Windmeier's robust variance-covariance matrix, no significant effect can be distinguished any more. Moreover, EDUCAID is insignificant all through in Table 2.

Interestingly, there is no improvement with respect to the evidence for any significant impact of aid even in Regression (5) of both tables. If donors distributed aid for

education according to need, i.e. in response to low enrolment rates, we should expect the coefficients of Regression (1)-(4) to be biased downwards, but Regression (5) to show the true effect of aid. However, in Tables 1 and 2 the opposite happens: Rather than to increase and to become significant, the coefficient in fact turns negative. Thus there is no evidence that the missing link between aid resources and educational outcomes could be due to reverse causation.

With respect to national current education expenditure, we do not find any more positive result, either. This variable is significantly positive only in one regression, too (Regression 3, Table 1), and only at the 10% level. We thus do not find any evidence for a greater effectiveness of national as compared to foreign resources. Such differences in effectiveness were found by some authors on the basis of country-case studies. Mercer et al. (2002), for instance, suggest that there may be a higher effectiveness of local resources 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, especially if purchased in the donor, rather than in the recipient country. However, while this evidence certainly reflects the situation in some country-cases, the broader literature also shows the frequently inefficient use of government resources. Plotting national resources allocated to education against educational outcomes such as enrolment and even against quality related educational outcome variables in a cross-country setting typically makes it difficult to observe any clear link between the resources spent and the outcomes achieved (see e.g. MINEDAF 2002, Figure 2.3; Michaelowa 2001, p. 1702).

In this context, it should be noted, that teacher remuneration accounts for the bulk of education expenditure, and its part rises up to 90% in some African countries (World Bank 2003). At the same time, it can be expected to have a marked positive effect on enrolment only if it reflects the employment of a high number of teachers. However, much of the cross-country variation reflects differences in teacher salaries rather than differences in the number of teachers employed. This may explain why we do not find much evidence for a significant effect of national resources in our analysis either.

As far as our other control variables with respect to the national education are concerned, the pupil-teacher ratio (PTR) is positive and strongly significant in all Arellano-Bond regressions. This effect is highly plausible in a situation of under-supply in which (at a given level of resources and their distribution) enrolment can only be increased by accepting more children within each class (see Mingat and Tan 2003, Mingat and Suchaut 2000, and MINEDAF 2002 for further discussion). Our Arellano-Bond coefficient estimates imply that increasing the PTR by 10 students goes hand in hand with an increase of the net enrolment rate by 3-4 percentage points. At the same

time, we cannot observe this effect in our Blundel-Bond estimations where the coefficient turns negative although it remains insignificant except for Regression 5, Table 1, where it becomes marginally significant at the 10% level.

Surprisingly, the share of children within the total population (YOUNG-POP) does not show any significant effect although one would expect that a higher share of school aged children puts additional strain on the education system. An explanation may be that the long run relationship may be blurred through a correlation of YOUNG-POP with other factors such as the development of infrastructure which are not taken into account here. In this case, we should observe a significant relationship in Section 3.2 when we will discuss the results of the annual panel for the 1990s.

Table 1: Results for the structural panel using EDUCAIDn

Dependent variable: NER	(1) Arellano&Bond IV: L.EDUCAIDn	(2) Arellano&Bond, robust IV: L.EDUCAIDn	(3) Blundell&Bond, robust IV: L.EDUCAIDn	(4) Blundell&Bond, robust IV: L.EDUCAIDn L.EXPEDUC	(5) Blundell&Bond, robust IV: ENERGYAID
L.NER	0.74***	0.55**	0.39	0.57	0.24
	(0.005)	(0.012)	(0.165)	(0.171)	(0.359)
EDUCAIDn commitments	0.15**	0.01	0.12	0.08	-0.23
	(0.019)	(0.909)	(0.371)	(0.539)	(0.308)
EXPEDUC	0.13	-0.73	2.07*	5.30	1.04
	(0.934)	(0.629)	(0.071)	(0.688)	(0.523)
PTR	0.30**	0.44***	-0.24	-0.11	-0.27*
	(0.018)	(0.000)	(0.205)	(0.637)	(0.093)
YOUNG-POP	-0.00	0.02	0.01	0.01	0.07
	(0.979)	(0.855)	(0.896)	(0.884)	(0.489)
GDPcap	0.001	0.001	0.002**	0.002	0.003**
	(0.486)	(0.378)	(0.043)	(0.278)	(0.013)
BUDGET	-0.26**	-0.18	-0.07	-0.11	-0.01
	(0.028)	(0.132)	(0.582)	(0.554)	(0.955)
INFLATION	0.001	0.000	0.000	0.000	0.000
	(0.220)	(0.693)	(0.726)	(0.904)	(0.768)
OPEN	-2.08	-0.47	-1.23	-4.78	0.83
	(0.221)	(0.769)	(0.329)	(0.732)	(0.620)
FREE	0.06	-0.66	-0.89	-0.85*	-1.71***
	(0.936)	(0.323)	(0.107)	(0.069)	(0.003)
Wald	chi2(18)=7878.3	chi2(18)=203.4	chi2(18)=531.21	chi2(18)=1940.5	chi2(17)=247.47
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hansen	chi2(6) = 8.60	chi2(18) = 17.04	chi2(8) = 6.84	chi2(12) = 10.22	chi2(4) = 1.17
	(0.197)	(0.520)	(0.554)	(0.597)	(0.883)
AR1	z = -2.28	z = -1.88	z = -1.77	z = -1.74	z = -2.24
	(0.022)	(0.060)	(0.076)	(0.081)	(0.025)
AR2	z = 1.02	z = 1.21	z = 1.03	z = 1.05	z = 1.25
	(0.307)	(0.225)	(0.304)	(0.292)	(0.213)
N	382	382	520	520	442
Countries	122	122	129	129	124

P values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
The prefix L. denotes a lagged variable.
Constant term and missing value indicators not presented here.
For an overview of variable definitions and sources, see Annex 1.

Table 2: Results for the structural panel using EDUCAIDg

Dependent variable: NER	(1) Arellano&Bond IV: L.EDUCAIDg	(2) Arellano&Bond, robust IV: L.EDUCAIDg	(3) Blundell&Bond, robust IV: L.EDUCAIDg	(4) Blundell&Bond, robust IV: L.EDUCAIDg L.EXPEDUC	(5) Blundell&Bond, robust IV: ENERGYAID
L.NER	0.64*** (0.000)	0.64*** (0.007)	0.80** (0.031)	0.72* (0.055)	0.41 (0.396)
EDUCAIDg commitments	0.16 (0.405)	0.16 (0.738)	0.52 (0.654)	0.50 (0.605)	-2.89 (0.116)
EXPEDUC	-0.33 (0.819)	-0.33 (0.834)	0.63 (0.673)	3.55 (0.773)	-0.86 (0.643)
PTR	0.36*** (0.007)	0.36** (0.039)	-0.01 (0.945)	-0.03 (0.883)	-0.15 (0.569)
YOUNG-POP	0.04 (0.724)	0.04 (0.805)	0.04 (0.711)	0.00 (0.967)	0.01 (0.878)
GDPcap	0.002 (0.135)	0.002 (0.237)	0.001 (0.280)	0.001 (0.221)	0.002 (0.364)
BUDGET	-0.22** (0.021)	-0.22* (0.090)	-0.06 (0.677)	-0.09 (0.664)	-0.03 (0.856)
INFLATION	0.000 (0.630)	0.000 (0.771)	0.001 (0.287)	0.000 (0.811)	0.000 (0.883)
OPEN	-1.68 (0.229)	-1.68 (0.303)	-1.10 (0.540)	-3.58 (0.780)	2.05 (0.300)
FREE	-0.12 (0.831)	-0.12 (0.876)	-0.15 (0.829)	-0.62 (0.178)	-1.49 (0.158)
Wald	chi2(17)=846.38 (0.000)	chi2(17)=579.71 (0.000)	chi2(17)=398.88 0.000)	chi2(17)=1000.6 (0.000)	chi2(16)=309.68 (0.000)
Hansen	chi2(18) = 19.90 (0.338)	chi2(18) = 19.90 (0.338)	chi2(8) = 7.99 (0.434)	chi2(12) = 13.03 (0.367)	chi2(4) = 0.54 (0.969)
AR1	z = -2.08 (0.037)	z = -1.85 (0.064)	z = -1.99 (0.047)	z = -2.07 (0.038)	z = -1.77 (0.076)
AR2	z = 1.20 (0.229)	z = 1.19 (0.235)	z = 1.22 (0.222)	z = 1.13 (0.259)	z = 1.22 (0.221)
N	359	359	492	492	429
Countries	118	118	124	124	121

P values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
The prefix L. denotes a lagged variable.
Constant term and missing value indicators not presented here.
For an overview of variable definitions and sources, see Annex 1.

The control variable for the general income level shows the expected positive coefficients. The effect remains moderate, however, as educational expenditure is already controlled for, and is significant only in specifications (3) and (5) of Table 1.

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 positively related to education outcomes. Inflation (INFLATION) and openness (OPEN) are insignificant throughout and a budget surplus (BUDGET) has a negative rather than a positive effect, if at all. Possibly, this reflects that budgetary austerity might go hand in hand with cuts in national educational investment which is not taken into account elsewhere in the regression if it is not financed by aid. But the result with respect to BUDGET is not very convincing as it is clearly significant only in Regression (1) of

both tables, and this regression suffers from a downward biased standard errors as explained above.

However, as opposed to the economic variables, the political and institutional aspects captured by the Freedom House index (FREE) do show some relationship between good governance and student enrolment, at least in the (rather more reliable) robust Blundell-Bond regressions. Coefficients are significant in Regressions (4) and (5) of Table 1, and close to significant in Regression (3). According to the corresponding coefficient estimates, a one-point increase on the seven-point scale towards oppression goes hand in hand with a reduction of primary enrolment rates by 0.9-1.7 percentage points.

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) also appears to be somewhat relevant for the specific sector of education. At the same time, the relevance of economic as opposed to political governance seems to be limited to economic development measured by variables such as growth.

Overall, the regression results for the structural panel appear plausible, though not very stable when changing the estimation techniques applied. While there are certain advantages of the Blundel-Bond system GMM as compared to the Arellano-Bond estimator, and a clear underestimation problem of standard errors in the non-robust specification of the latter, any further judgment about the reliability of the different regressions is difficult to establish. Overall regression statistics are equally acceptable for all equations. At the 10% level, the null of no 2^{nd} order autocorrelation of the differenced residuals (AR2) cannot be rejected, while it is rejected for 1^{st} order autocorrelation (AR1). This reflects the structure of the differenced model in which the (differenced) residuals must be correlated of order 1 except for the case in which the errors in levels follow a random walk, while any further autocorrelation would imply that the GMM estimators are inconsistent. Moreover, based on the Hansen test, the validity of overidentifying restrictions is clearly accepted throughout. The Wald test indicates a good general fit of all regressions. Note, however, that there is a considerable variation of the number of observations available for the different regressions. By construction, Arellano-Bond estimation loses the observations for one full 5-year term as the estimation takes place in first differences. Moreover, within the Blundell-Bond regressions, the use of energy aid as an instrument for EDUCAID leads to the loss of a considerable number of observations due to missing data for the instrument, which cannot be imputed using other forms of aid given the risk of a correlation with the error term. Some of the differences in regression results may thus not be induced by variations of the estimation technique, but simply by changes in the database.

3.2 Results for the annual panel

To complement our analysis by the estimation of a short term relationship, we can now turn to an annual database for the 1990s which is more complete and reliable, both with respect to educational outcomes and with respect to aid to EDUCAID. Only information for ENERGYAID is still very limited.

For educational outcomes, we can now use either the NER or the completion rates (COMPLETION), and for EDUCAID we can use either disbursements or technical cooperation. Adding the remaining choice between EDUCAIDg and EDUCAIDn, we have eight different options for each regression. To simplify the presentation, we limit the rest of the analysis to EDUCAIDg because the corresponding point estimates are easier to interpret and to compare with the values of the coefficient for EXPEDUC which is expressed as a percentage of GNI. Moreover, Table 3 only displays the results for regressions using COMPLETION and disbursements (with regression specifications as in Tables 1 and 2) while Table 4 shows all other possible combinations of aid and educational outcome variables using a single (preferred) estimation technique.

In the setting of Table 3, EDUCAID turns out to be positive and significant throughout, except for the regression in which it is instrumented by ENERGYAID. Coefficients are always higher than those for current national education expenditure, and the latter are not significant in any of the five regressions. The highest point estimates for the coefficient of EDUCAID in those regressions in which it is significant is 2.5 (Regression (4)), which indicates that an increase in aid for education by 1% of GDP implies an increase in primary completion rates by 2.5 percentage points.

The control variables for the context of the national education system PTR and YOUNG-POP are now consistently significant as well (except for Regression 2 in the case of the PTR). The share of the population under 15 years of age shows the expected negative impact on the capacity of the education system to accommodate all children, an effect for which the evidence was lacking in the structural panel discussed earlier. As opposed to the structural panel, the effect of the PTR is now negative throughout. This may indicate that in the short run, demand-side effects dominate over supply-side restrictions. Thus the negative coefficient can be interpreted as an indication that parents do not send their children to school (or take them out again rather early) if class size is so big that they do not expect much positive result from the children's attendance.

GDP per capita does not appear to be relevant in the short run, once all the other variables are controlled for. It is significant only in Regression (1) where standard errors are known to be biased.

Table 3: Results for the annual panel using EDUCAIDg/disbursements

Dependent variable: NER	(1) Arellano&Bond IV: L.EDUCAIDg	(2) Arellano&Bond, robust IV: L.EDUCAIDg	(3) Blundell&Bond, robust IV: L.EDUCAIDg	(4) Blundell&Bond, robust IV: L.EDUCAIDg L.EXPEDUC	(5) Blundell&Bond, robust IV: ENERGYAID
L.COMPLETION	-0.07*** (0.000)	-0.07 (0.379)	0.12 (0.329)	0.16 (0.138)	0.04 (0.805)
EDUCAIDg disbursements	0.83*** (0.000)	0.83* (0.069)	2.22** (0.041)	2.53** (0.021)	31.37 (0.151)
EXPEDUC	0.29 (0.279)	0.29 (0.799)	0.68 (0.828)	2.13 (0.588)	2.04 (0.637)
PTR	-0.07*** (0.003)	-0.07 (0.561)	-0.68*** (0.000)	-0.64*** (0.000)	-0.69*** (0.003)
POP	-2.19*** (0.000)	-2.19*** (0.001)	-1.08*** (0.000)	-1.07*** (0.000)	-1.63*** (0.000)
GDPcap	-0.003*** (0.001)	-0.003 (0.309)	0.000 (0.915)	-0.000 (0.977)	0.002 (0.202)
BUDGET	0.03 (0.259)	0.03 (0.772)	-0.02 (0.884)	0.08 (0.577)	0.22 (0.435)
INFLATION	0.000 (0.639)	0.000 (0.837)	-0.000 (0.690)	-0.000 (0.670)	0.003** (0.030)
OPEN	0.32 (0.140)	0.32 (0.417)	1.55 (0.611)	-0.07 (0.985)	0.89 (0.838)
FREE	-1.05*** (0.000)	-1.05 (0.252)	-0.87 (0.208)	-0.41 (0.511)	0.81 (0.497)
Wald	chi2(19)=41455 (0.000)	chi2(19)=49.93 (0.000)	chi2(19)=253.52 (0.000)	chi2(19)=293.79 (0.000)	chi2(18)=2744 (0.000)
Hansen	chi2(88) = 87.08 (0.508)	chi2(88) = 87.08 (0.508)	chi2(18) = 28.23 (0.059)	chi2(27) = 34.77 (0.145)	chi2(9) = 11.99 (0.214)
AR1	z = -4.13 (0.000)	z = -3.20 (0.001)	z = -3.63 (0.000)	z = -3.89 (0.000)	z = -2.74 (0.006)
AR2	z = 0.09 (0.925)	z = 0.08 (0.940)	z = 1.35 (0.177)	z = 1.58 (0.114)	z = -0.30 (0.763)
N	822	822	999	999	664
Countries	124	124	128	128	112

P values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
The prefix L. denotes a lagged variable.
Constant term and missing value indicators not presented here.
For an overview of variable definitions and sources, see Annex 1.

With respect to the economic governance indicators, estimation results are similar to those of the structural panel. Again, no significant and positive relationship between good economic governance and educational outcomes can be found.

The only variable which is significant in at least one regression is INFLATION (Regression 5), but again the coefficient indicates the opposite of what would typically be expected as an effect of good governance, as inflation seems to be positively rather than negatively related to primary completion. If at all this effect can be taken seriously[7], it might have to be interpreted in relation to teacher salaries. As mentioned

7 It may also simply be a reflection of the fact that, by definition, at a significance level of 10%, the coefficient estimate must be expected to appear significantly different from 0, even if it is not, in 1 out of 10 regressions.

in the previous section, the latter make up for the bulk of current educational expenditure and increased enrolment and completion 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, have been relatively sticky, at least until the late 1990s. From that perspective, inflation may have reduced the financing needs of the education system through an effective reduction of real salaries.

In any case, this effect, if any, has nothing to do with a potential effect of good economic governance. At the same time, as opposed to Tables 1 and 2, evidence for a positive impact of good political governance is not convincing either in Table 3.

Overall regression statistics are again generally acceptable although in Regression (3), the validity of overidentifying restrictions can only be accepted if the significance level is reduced to 5%. Despite this problem, we select this regression for further analysis with varying combinations of educational outcome and aid variables. The reasons for this choice are the following:

(i) As explained above, Blundell-Bond estimation is generally preferable to the original Arellano-Bond estimation.

(ii) Among the Blundell-Bond regressions, the additional instrumentation of EXPEDUC in Regression (4) does not change much of the results, both with respect to the regression coefficients of the significant variables and with respect to overall regression statistics. While the Hansen test slightly improves, the AR2 test is rather close to rejecting the hypothesis of no 2nd order serial correlation. Using L.EXPEDUC as an IV thus does not seem to lead to an improvement of the initial specification.

(iii) The replacement of L.EDUCAID by ENERGYAID as an IV for EDUCAID in Regression (5) does lead to some improvement of the overall regression statistics. However, the number of observations decreases by 1/3 due to the missing value problem with respect to ENERGYAID already discussed above. Taking together the evidence from the structural and the annual panel presented so far, results for Regression (5) often diverge from results of the other regressions, but not in the sense expected if there were reverse causation which the IV approach would take care of. There rather seems to be some risk that the results of Regression (5) are suffer from sample selection bias induced by a non random selection of observations into the model when all the missings for ENERGYAID cannot be considered.

(iv) Finally, as compared to most of the other regressions, Regression (3) shows a relatively high and significant impact of EDUCAID. In case of doubt, we tend to select those specifications which are more favorable for a positive impact of aid. By doing so, we attempt to ensure that our final results indicate the most optimistic, rather than the most pessimistic results for the effect of aid on educational outcomes.

Table 4 therefore takes Regression (3) from Table 3 as a basis. We first keep COMPLETION as the dependent variable and replace only the disbursements by technical cooperation for EDUCAID (Regression (1)). We then show the results for disbursements, but with NER instead of COMPLETION as the dependent variable (Regression (2)). Finally, in Regression (3), technical cooperation is combined with NER as the dependent variable.

Neither the relationship between technical cooperation and primary completion rates, nor the relationship between disbursements and net enrolment rates turn out to be significant. Coefficient estimates even turn negative. However, Regression (3) which estimates the effect of technical cooperation in the education sector on primary net enrolment shows a positive and significant impact of 0.9 percentage points induced by an increase in aid by 1% of GDP. Similarly, current national expenditure is insignificant in Regressions (1) and (2), but significant with a strong positive effect in Regression (3). In fact, in this particular specification, the effect of EXPEDUC is extremely strong and about 11 times higher than the effect of technical cooperation.

All other results are similar as before. We again find a negative effect of a high pupil-teacher ratio and of a high share of children within the population. The negative effect of bad political governance which had been less obvious in Table 3 is again found here and significant at the 10% level in two out of three regressions. Among our variables for economic governance, now openness to trade shows the only significant effect (in one regression), but again, the negative coefficient estimate contradicts rather than confirms any positive effect of good economic governance.

It should be noted that overall regression statistics tend to be less convincing for this table, than in the other regression tables discussed before.

Table 4: Alternative education and aid variables

Blundell&Bond, robust IV: L.EDUCAIDg	(1) Dep.var.: COMPLETION	(2) Dep. var.: NER	(3) Dep. Var.: NER
L.COMPLETION	0.14 (0.257)		
L.NER		0.21 (0.258)	0.22 (0.360)
EDUCAIDg technical coop.	-0.54 (0.272)		0.90** (0.015)
EDUCAIDg disbursements		-1.11 (0.209)	
EXPEDUC	-0.47 (0.804)	1.26 (0.345)	10.36** (0.015)
PTR	-0.68*** (0.000)	-0.31** (0.030)	-0.25 (0.180)
POP	-1.02*** (0.000)	-0.68*** (0.002)	-0.90*** (0.006)
GDPcap	-0.000 (0.630)	0.001 (0.423)	0.000 (0.642)
BUDGET	-0.00 (0.980)	0.17 (0.185)	0.08 (0.570)
INFLATION	-0.000 (0.488)	0.000 (0.629)	-0.001 (0.665)
OPEN	2.68 (0.146)	0.65 (0.588)	-8.91** (0.032)
FREE	-1.14* (0.099)	-0.86* (0.073)	-1.07 (0.144)
Wald	chi2(19)=278.46 (0.000)	chi2(19)=178.42 (0.000)	chi2(18)=2634.56 (0.000)
Hansen	chi2(18) = 28.41 (0.056)	chi2(18) = 26.06 (0.098)	chi2(19) = 19.79 (0.407)
AR1	z = -3.58 (0.000)	z = -2.55 (0.011)	z = -1.89 (0.059)
AR2	z = 1.45 (0.148)	z = 1.50 (0.133)	z = 1.61 (0.108)
N	999	999	697
Countries	128	128	113

P values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
The prefix L. denotes a lagged variable.
Constant term and missing value indicators not presented here.
For an overview of variable definitions and sources, see Annex 1.

Comparing the results of the structural panel with the results of the annual panel for the 1990s, we do not observe major changes with respect to the effect of most of the explanatory variables. While it was expected that due to their limited change over time, especially the macroeconomic and governance variables, but also variables characterizing the education system would not reveal much impact in the annual panel, we actually observe that those which appear relevant in one case, also appear relevant in the other case.

However, we observe that overall, the annual panel appears to show a much more convincing effect of aid. In those regressions in which it is significant, it is estimated to

lie at a gain in enrolment or completion by between 0.8 and 2.5 percentage points for an increase of aid by 1% of the GDP in recipient countries. However, looking at resources currently allocated to aid for education, this effect appears only very small. On average during the 1990s and across the countries considered here, aid to education as a share of GDP was 0.3% for disbursements and 0.5% for technical cooperation.[8] Therefore, in the most optimistic case, to reach an aid induced increase in primary completion rates by 2.5 percentage points, we would need to increase aid allocated to education by 200%. Thus, neither in our structural analysis since the early 1970s, nor in our annual analysis for the 1990s, aid appears to be a strongly relevant determinant of educational outcomes. Moreover, there is no clear evidence with respect to the effectiveness of aid as compared to the effectiveness of current national education expenditure.

However, so far, we have not considered non-linearities and potential interaction effects. This may lead to a bias of our previous results and will be considered in detail in the following section.

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

Non-linearities could be imagined with some plausibility for most of the explanatory variables in the regression. The wider aid effectiveness literature shows some strong evidence for decreasing returns of aid (see e.g. Hansen and Tarp 2001), and decreasing returns seem plausible as well for GDP per capita and the different variables introduced to measure good governance. It might well be that some of the potentially relevant relationships have been underestimated or not even been discovered yet because of the limitations of the linear model.

Moreover, as Burnside and Dollar's (2000) seminal paper on aid effectiveness suggests that aid may have a relevant impact only under conditions of good governance, the interaction between aid and governance will also be examined here. Possibly, our initial results on aid effectiveness in the education sector are underestimated because this interaction is not taken into account. Moreover, even if the average effect remains small, the effect of aid could be very high in a suitable political and economic environment.

Hansen and Tarp's (2001) critique of the Burnside and Dollar (2000) results on aid effectiveness shows that the issue of interaction terms and non-linearities of individual variables should not be treated separately. According to Hansen and Tarp, the relevance

8 Calculated on the basis of the imputed dataset. Note that the higher percentage for technical cooperation may be explained either by the fact that information on this variable is more complete or by the (partial) inclusion of commitments which may not always have lead to actual disbursements (see Section 2).

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 aid to education, 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. This procedure is carried out based on the annual panel for the 1990s and for all combinations of COMPLETION and NER with disbursements and technical cooperation. The base equation to which the quadratic and interaction terms are added is again Regression (3) from Table 3, i.e. the same regression underlying Table 4.

As presented in Table 5, we find some evidence for both, decreasing returns of aid and an interaction between aid and good governance, albeit the former is statistically significant only when aid is expressed in terms of disbursements and educational outcomes in terms of NER (Regressions (2) and (7)) while the latter is significant only when aid is expressed in terms of technical cooperation (Regressions (3), (4) and (6)). While the relevance of the interaction term was tested for all governance variables (not shown), the only significant effect was found with respect to political governance expressed in terms of the Freedom House Index. FREE by itself then turns insignificant (although it remains close to significant in Regression (5)).

Note that the first four regressions of Table 5 all use the same explanatory variables and only differ with respect to the use of COMPLETION or NER for educational outcomes, and disbursements or technical cooperation for EDUCAIDg. They all include both a square term for EDUCAIDg and the interaction term between FREE and EDUCAIDg. Regressions (5) and (6) additionally introduce a square term for FREE into the two regressions using technical cooperation, in which the interaction effect with FREE was significant. This leads to some reduction of the estimated strength of the relationship, but the latter remains significant at the 10% level, at least in Regression (6). Regression (7) finally omits the interaction term from the equations based on disbursements and NER, in which only the quadratic impact of aid was significant. This change does not alter the evidence for decreasing returns of aid.

Table 5: Diminishing returns and the interaction of aid and political governance

Blundell&Bond, robust IV:L.EDUCAIDg	(1) Dep.var.: COMPLETION	(2) Dep. var.: NER	(3) Dep. Var.: COMPLETION	(4) Dep. var.: NER	(5) Dep. Var.: COMPLETION	(6) Dep. var.: NER	(7) Dep. var.: NER
L.COMPLETION	0.11 (0.378)		0.21** (0.029)		0.20** (0.041)		
L.NER		0.29* (0.098)		0.31** (0.029)		0.30** (0.044)	0.30* (0.088)
EDUCAIDg disbursements	9.31 (0.142)	8.13*** (0.005)					6.24** (0.016)
EDUCAIDg² disbursements	-0.50 (0.273)	-0.70*** (0.003)					-0.67** (0.011)
Disbursements × FREE	-2.71 (0.164)	-1.36 (0.166)					
EDUCAIDg technical coop.			4.46 (0.134)	4.34* (0.087)	2.95 (0.319)	3.62 (0.138)	
EDUCAIDg² technical coop.			-0.18 (0.236)	-0.16 (0.222)	-0.12 (0.436)	-0.13 (0.301)	
Technical coop. × FREE			-1,02* (0.075)	-0.84** (0.043)	-0.70 (0.194)	-0.69* (0.075)	
EXPEDUC	0.17 (0.962)	-0.05 (0.971)	-0.18 (0.944)	0.24 (0.886)	-0.36 (0.889)	0.28 (0.868)	0.26 (0.837)
PTR	-0.70*** (0.000)	-0.26* (0.064)	-0.64*** (0.000)	-0.20* (0.081)	-0.64*** (0.000)	-0.22* (0.074)	-0.29** (0.039)
POP	-1.07*** (0.000)	-0.60*** (0.005)	-0.91*** (0.001)	-0.68*** (0.006)	-0.91*** (0.000)	-0.64*** (0.007)	-0.58** (0.012)
GDPcap	0.000 (0.713)	0.001 (0.316)	0.000 (0.988)	0.001 (0.467)	-0.000 (0.695)	0.000 (0.661)	0.001 (0.323)
BUDGET	0.00 (0.977)	0.05 (0.678)	0.02 (0.895)	0.05 (0.725)	-0.03 (0.865)	0.02 (0.883)	0.09 (0.484)
INFLATION	-0.0001 (0.719)	0.0001 (0.405)	-0.0001 (0.521)	0.0001 (0.494)	-0.0001 (0.437)	0.0001 (0.604)	0.0001 (0.490)
OPEN	1.89 (0.596)	1.93 (0.092)*	2.07 (0.395)	1.54 (0.391)	2.25 (0.397)	1.50 (0.410)	1.68 (0.128)
FREE	-0.35 (0.626)	-0.54 (0.320)	-0.55 (0.400)	-0.51 (0.387)	-5.21 (0.107)	-3.25 (0.167)	-0.50 (0.365)
FREE²					0.54 (0.149)	0.32 (0.257)	
Wald	chi2(21)= 283.03 (0.000)	chi2(21)= 228.94 (0.000)	chi2(21)= 397.42 (0.000)	chi2(21)= 364.84 (0.000)	chi2(22)= 398.09 (0.000)	chi2(22)= 364.59 (0.000)	chi2(20)= 247.35 (0.000)
Hansen	chi2(26) = 36.12 (0.089)	chi2(36) = 41.68 (0.238)	chi2(36) = 41.42 (0.246)	chi2(36) = 45.02 (0.144)	chi2(36) = 40.46 (0.280)	chi2(36) = 45.76 (0.128)	chi2(27) = 38.39 (0.072)
AR1	z = -3.46 (0.001)	z = -2.93 (0.003)	z = -3.93 (0.000)	z = -3.19 (0.001)	z = -3.85 (0.000)	z = -3.10 (0.002)	z = -2.98 (0.003)
AR2	z = 1.14 (0.256)	z = 1.54 (0.124)	z = 1.69 (0.091)	z = 1.47 (0.142)	z = 1.65 (0.099)	z = 1.54 (0.124)	z = 1.58 (0.115)
N	999	999	999	999	999	999	999
Countries	128	128	128	128	128	128	128

P values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
The prefix L. denotes a lagged variable.
Constant term and missing value indicators not presented here.
For an overview of variable definitions and sources, see Annex 1.

Let us now more closely examine the coefficient estimates. The evidence on diminishing returns from Regression (7) suggests that the quadratic aid function has its maximum at about 5% of a recipient country's GDP. This implies that the effect of higher disbursements gradually decreases up to this point and then turns negative. 5% is more than 10-times higher than average disbursements, but still exceeds the actual amount in some individual country-cases so that its effect is rather questionable. In those countries which receive relatively little aid, however, the added value of an increase of aid resources may be marked. According to Regression (7) the effect for countries with initial aid to education of between 0.1 and 0.5% of national GDP is more than twice as high as estimated in the most optimistic results from Tables 3 and 4.

In all other regression models of Table 5, the effect of aid cannot be determined independently of the recipient country's political environment. This variable also influences the threshold after which increasing aid has a negative impact. Computing the maximum amount of aid with a positive effect from Regression (4) where both EDUCAIDg by itself and the interaction term with FREE are significant we obtain 10% of GDP for a country with an ideal situation of political rights and civil liberties (FREE=1), but only 0.4% (i.e. close to the current average) for a country with a rather difficult situation (FREE=5). For countries with an even worse situation (FREE=6 or 7) any positive amount of aid to education appears to have a negative, rather than a positive effect on educational outcomes. These results suggest that aid resources may indeed be fungible, so that under adverse external circumstances, even if they are directly allocated to a specific purpose like education, they may indirectly fuel other activities harmful to development. In the other two regressions in which the interaction term is significant, the influence of political freedom on the impact of aid is of similar (Regression (6)) or even greater magnitude (Regression (3)). In the latter, only up to a situation of moderate political freedom (FREE=4) aid to education can exert any positive effect, while the effect is unambiguously negative in all situations in which oppression is stronger (FREE≥5). Table 6 presents an overview over the simulation results based on Regression (3) with varying degrees of political freedom and initial aid.

It follows that under very positive political conditions, aid to education in the relevant range always has a positive effect while its effect is always negative under situations of extreme oppression. In between, i.e. in the ranges of FREE from 3 to 4, the effect of aid turns negative if aid is relatively high.

Table 6: Simulations of the impact of aid to education at different levels of political freedom and aid

Freedom House index (FREE)	1	2	3	4	5	6	7
	←	decreasing political freedom					→
EDUCAIDg (technical coop.)							
0.1% of GDP	3.40	2.38	1.36	0.34	-0.68	-1.70	-2.72
0.5% of GDP	3.26	2.24	1.22	0.20	-0.82	-1.84	-2.86
1% of GDP	3.08	2.06	1.04	0.02	-1.00	-2.02	-3.04
2% of GDP	2.72	1.70	0.68	-0.34	-1.36	-2.38	-3.40
5% of GDP	1.64	0.62	-0.40	-1.42	-2.44	-3.46	-4.48

Numbers indicate the partial derivative ∂COMPLETION/∂EDUCAIDg for different initial values of EDUCAIDg and FREE based on coefficient estimates from Regression (3), Table 5.

The above discussion provides a more refined picture of the impact of aid. However, overall, the effect of aid still seems to be very moderate. While the evidence on the diminishing returns of disbursements indicated that in cases of little initial aid, the impact of additional aid could be about twice as high as expected from the previous section, results for the interaction with political rights and civil liberties appear to be relatively close to the initial results, even for the best initial situations. Obviously, some of this result may be due to the low quality of the data at hand. As mentioned earlier, information on disbursements is far from complete while information on technical cooperation covers only parts of donor activity and does not clearly distinguish between disbursements and commitments. These problems may lead to downward biased coefficient estimates. However, it may also be that aid to education is not effectively oriented towards the central objective of universal primary education. This may be reflected in major parts of EDUCAID being oriented towards secondary and tertiary, rather than primary education. Specific data for development assistance allocated to primary education is available only for commitments and only after 1975 (and with many missing values).[9] As far as information is available, we find that its share is indeed rather small: On average, it is 44% of total aid to education for the late 1970s and early 1980s, and about 35% thereafter (OECD/DAC 2004). Especially after 1990, when the EFA-objectives had been internationally declared in Jomptien, one might have expected a stronger orientation towards primary education. However, it seems that the share has in fact been decreasing relative to earlier years.

9 The DAC statistics include some inconsistent data with figures for aid to primary education higher than total aid to education. To calculate the above means, these values were adjusted to the maximum possible share of 100%. Without this adjustment, the means would appear substantially higher.

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. Despite some differences in the results based on different data and estimation methods, the empirical application to the education sector provides allows us to conclude that aid to education increases primary education in developing countries (measured both in terms of enrolment and completion rates). We thus indeed observe a positive effect of aid at the sector level.

At the same time, coefficient estimates for the impact of aid are rather small. In the most optimistic case, they imply that an increase of the current aid by 200% would lead to a rise of net primary enrolment by 2.5 percentage points. Only where aid to education is relatively low at the outset, there may initially be a higher impact (about twice as high). All in all, this result demonstrates that, at any realistic rate of growth of aid to education, universal primary education will not be reached by this means. This holds at least 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 central international objective repeated over and over again on international conferences on poverty and on education, the average share of donors' aid to education effectively committed to primary education has only been about 1/3 in recent years.

Unfortunately, there is no compelling evidence that national education expenditure in developing countries shows any greater impact on education outcomes. Only in one regression specification, we obtain a rather high positive and significant coefficient implying that an increase of current education expenditure by 1% of GNI leads to a rise in net primary enrolment by 10%. Generally, coefficient estimates are much lower and insignificant. This confirms parts of the educational development literature which suggests that inefficiencies in national education expenditure are so important that results are only loosely related to financial inputs, at least in a cross-country comparison.

Moreover, it comes out rather clearly that the structural parameters of the education system such as the number of young people in the country and the pupil-teacher ratio also play a crucial role when it comes to finding sustainable solutions for the financing of primary education. In the long run, countries in which population growth is high apparently have to accept equally high pupil-teacher ratios to achieve education for all. In the short run, however, high pupil-teacher ratios may reduce the demand for education.

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 positive effect on primary education enrolment, general political and institutional governance clearly does. Lack of political freedom and civil liberties is quite 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 can have a negative, rather than a positive impact on primary enrolment and completion. This may be interpreted as an indication of fungibility of resources, whereby more aid frees government resources for activities that are detrimental to the country's overall development.

Simulations provide some evidence that the impact of aid to educations is highest when (i) aid resources remain a rather limited share of national resources (diminishing returns) and (ii) good governance in terms of political rights and civil liberties provide a positive environment for learning and its application in the society and on the labor market. Nevertheless, even under very positive circumstances, the average effect of aid remains rather small.

With this result, our evidence for the education sector comes quite close to the conclusion one might draw from the general aid effectiveness literature. While getting conceptionally closer to the micro-level than the macroeconomic studies on aid and growth, we are far from obtaining the highly optimistic results suggested by project evaluations. Given that our results on the impact of aid are as weak as at the macro level, despite the considerable reduction of complexity in the relationships to be considered, these results do not seem to be a simple reflection of omitted variable bias. It remains that our study suffers from imprecise and incomplete information on many variables, which could only be taken into account by imputations and the inclusion of missing value indicators in our regressions. This may imply that the actual effect of aid is somewhat underestimated here. However, as long as the potential bias is not really substantial, this would not alter our general conclusions.

References

Angrist, Joshua, Guido Imbens and Donald Rubin (1996): Identification of Causal Effects Using Instrumental Variables, in: Journal of the American Statistical Association, Vol. 91, No. 434, pp. 444-455

Arellano, Manuel and Stephen Bond (1991): Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, in: Review of Economic Studies, Vol. 58, pp. 277-297

Arellano, Manuel and Olympia Bover (1995): Another Look at the Instrumental Variable Estimation of Error-Components Models, in: Journal of Econometrics, Vol. 68, pp. 29-51

Blundell, Richard and Stephen Bond (1998): Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, in: Journal of Econometrics, Vol. 87, pp. 115-143

Boone, Peter (1996): Politics and the Effectiveness of Aid, in: European Economic Review, Vol. 40, No. 2, pp. 289-329

Burnside, Craig and David Dollar (2000): Aid, Policies and Growth, in: American Economic Review, Vol. 90, No. 4, pp. 847-868

Doucouliagos, Hristos and Martin Paldam (2005): The Aid Effectiveness Literature: The Sad Result of 40 Years of Research, University of Aarhus - Department of Economics Working Paper No. 15

Easterly, William (2001): The Elusive Quest for Growth, Economists' Adventures and Misadventures in the Tropics, Cambridge (MIT Press)

Easterly, William (2002): The Cartel of Good Intentions: Bureaucracy Versus Markets in Foreign Aid, Working Paper No. 4, Center for Global Development, Institute for International Economics, Washington (revised version, May)

Easterly, William (2003): Can Foreign Aid Buy Growth?, in: Journal of Economic Perspectives, Vol. 17 , No. 3, pp. 23-48

William Easterly (2006): The White Man's Burden. Why the West's effort to aid the rest have done so much ill and so little good, New York (Penguin)

Freedom House (2005): Freedom House Country Ratings, http://www.freedomhouse.org/ratings/index.htm (29/05/06)

Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2003): Governance Matters III: Governance Indicators for 1996–2002, World Bank Policy Research Working Paper No. 3106, Washington, D.C.

Kaufmann, Daniel, Art Kraay and Massimo Mastruzzi (2005): Governance Matters IV: Governance Indicators for 1996–2004, World Bank Policy Research Working Paper No. 3630, Washington, D.C.

Hansen, Henrik and Finn Tarp (2001): Aid and Growth Regressions, in: Journal of Development Economics, Vol. 64, No. 2, pp. 547-570

Harms, Philipp and Matthias Lutz (2004): The macroeconomic effects of foreign aid: A survey, University of St. Gallen - Department of Economics Discussion Paper No. 11

OECD/DAC (2001): DAC Guidelines on Poverty Reduction, Paris

OECD/DAC (2004): International Development Statistics (IDS) Databank, http://www.oecd.org/dataoecd/50/17/5037721.htm (20/01/04)

Mercer, Malcolm, Paola Gosparini, Paola Melchiori, François Orivel, Matteo Sitori and Tuija Steinback (2002): Evaluation of EC Support to the Education Sector in ACP Countries, Synthesis Report, Brussels (DRN)

Michaelowa, Katharina (2001): Primary Education Quality in Francophone Sub-Saharan Africa: Determinants of Learning Achievement and Efficiency Considerations, in: World Development, Vol 29, No. 10, pp. 1699-1716

Michaelowa, Katharina and Axel Borrmann (2006): Evaluation Bias and Incentive Structures in Bi- and Multilateral Aid Agencies, in: Review of Development Economics, Vol. 10, No. 2, pp. 313-329

MINEDAF (2002): Universal Primary Education: Goal for All, statistical document MINEDAF VIII, Dar-Es-Salaam (UNESCO)

Mingat, Alain and Bruno Suchaut (2000): Une analyse économique comparative des systèmes éducatifs africains, Paris (De Boeck)

Mingat, Alain, Ramahatra Rakotomalala and Jee-Peng Tan (2002): Achieving Education for All by 2015: Simulation Results for 33 African Countries, Washington, D.C. (World Bank)
Mingat, Alain and Jee-Peng Tan (2003): On the Mechanics of Progress in Primary Education, in: Economics of Education Review, Vol. 22, No. 5, pp. 455-467
Rodrik, Dani, Arvind Subramaniam and Francesco Trebbi (2002): Institutions Rule: The Primacy of Institutions over Integration and Geography in Economic Development, IMF Working Paper No. 02/189, Washington, D.C.
Roodman, David (2005): xtabond2: Stata Module to Extend xtabond Dynamic Panel Data Estimator, Center for Global Development, Washington, D.C., http://econpapers.repec.org/software/bocbocode/s435901.htm (10/04/06)
Shea, John (1997): Instrument Relevance in Multivariate Linear Models: A Simple Measure, in: The Review of Economics and Statistics, Vol. 79, No. 2, pp. 348-352
Staiger, Douglas and James Stock (1997): Instrumental Variables Regressions with Weak Instruments, in: Econometrica, Vol. 65, No. 3, pp. 557-586
UNESCO-UIS (2006): World Education Indicators, http://www.uis.unesco.org/en/stats/statistics/indicators/indic0.htm (23/05/06)
Windmeijer, Frank (2005): A Finite Sample Correction for the Variance of Linear Efficient Two-Step GMM Estimators, in: Journal of Econometrics, Vol. 126, pp. 25-51
World Bank (1998): Assessing Aid, Washington, D.C.
World Bank (2001): Building Institutions for Markets, World Development Report 2002, Washington, D.C.
World Bank (2003): World Development Indicators, CD-ROM, Washington, D.C.
World Bank (2005): World Development Indicators, CD-ROM, Washington, D.C.
World Bank (2006): Governance Matters IV: Governance Indicators for 1996-2004, http://www.worldbank.org/wbi/governance/pubs/govmatters4.html (20/05/06)

Annex 1: List of variables

Variable name	Definition	Sources
NER	net primary enrolment (%)	WDI (World Bank 2003, 2005)
COMPLETION	primary completion rate, total (% of relevant age group)	WDI (World Bank, 2005)
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$) / GDP·100	
EXPEDUC	national education expenditure (% of GNI)	WDI (World Bank 2003)
PTR	pupil-teacher ratio in primary education	WDI (World Bank 2003, 2005)
YOUNG-POP	population aged 0-14 (% of total population)	WDI (World Bank 2003, 2005)
GDPcap	GDP per capita (constant 2000 US$)	WDI (World Bank 2003, 2005)
BUDGET	budget surplus (% of GDP)	WDI (World Bank 2005)
INFLATION	inflation (consumer prices, % annual)	WDI (World Bank 2003, 2005)
OPEN	openness (export+import, % of GDP)	WDI (World Bank 2003, 2005)
FREE	Freedom House index of political rights and civil liberties (1-7, whereby 1 shows the highest degree of freedom)	Freedom House (2005)
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)