

AID AND PUBLIC EXPENDITURE IN AFRICA: DOES AID INCREASE THE EFFICIENCY OF PUBLIC SERVICE DELIVERY?

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Abstract

Sub-Saharan Africa in general is not on track of meeting the Millennium Development Goals (MDGs) by 2015. Thus, a doubling of aid to Africa was agreed at the G-8 summit in 2005 in order to substantially improve the delivery of government services and investments in infrastructure. This expected increase in aid to Africa will put a big challenge for public service delivery. As the efficiency of resource spending does not only depend on the capacities and characteristics of the recipient country but also on the quality of aid the main focus of this paper is on the effects of the volume and volatility of aid. In addition the institutions related to public service delivery are taken into account, including freedom of press, corruption and decentralization. An analysis of a simultaneous equation model assesses the determinants of outcomes in health, education, water and sanitation, using data for up to 113 developing countries. Overall the share of ODA that is provided for education, health and water and sanitation seems to have a positive impact on outcomes in these sectors. However, total aid seems to be negatively associated to outcomes in these sectors, whereas aid volatility is associated with better outcomes in sanitation and infant mortality, contrary to expectations. This result could imply that although aid targeted to specific sectors and targets might have positive effects, the general increase in aid might create more problems with respect to Dutch disease, less accountability of governments towards local populations and more opportunities for corruption. Overall aid cannot be the only solution for improved service delivery to meet the MDGs, due to its mixed impact.

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1. Introduction

Sub-Saharan Africa in general is not on track of meeting the Millennium Development Goals (MDGs) by 2015. Thus a doubling of aid to Africa was agreed at the G-8 summit in 2005 in order to substantially improve the delivery of government services and investments in infrastructure. Increased aid and debt relief are expected to increase government spending to improve health, education and infrastructure, which are considered classical tasks of the state.

Of the eight MDGs two are related to education, three to health and one to infrastructure.² On current trends most regions will fall short on goals for reducing child and maternity mortality, and the number of people infected with HIV/AIDS continues to grow. The goals of universal primary education and of gender equality in primary and secondary education will not be met in three of the six developing regions. In Africa the situation is even bleaker. Although primary school enrolment has increased rapidly this has not translated into higher completion rates. Likewise the reduction of child mortality and the increase of access to water and sanitation have been slow (UNECA, 2005)

Thus, to reach these MDGs improved service delivery in education and health as well as investment in infrastructure is needed. It is estimated that Sub-Saharan Africa needs to triple its health workforce, adding more than one million workers to reach the health related MDGs. To reach universal primary education the current stock of teachers has to increase by almost 20 per cent each year. On average budget allocations do not reach the benchmark of 20 per cent of the government budget earmarked for education and 15 per cent earmarked for health. However, African HIPC countries increased spending on education and health by 1.9 percentage points of GDP between 1998 and 2002 (WB/IMF, 2005 and UNECA, 2005).³

However, to reach the MDGs it is not sufficient to increase spending for public service delivery but to improve its efficiency. The question is thus how to boost service

² Goal 2: Achieve universal primary education; Goal 3: Promote gender equality and empower women (Target: eliminate gender inequality in primary and secondary education); Goal 4: Reduce child mortality; Goal 5: Improve maternal health; Goal 6: Combat HIV/AIDS, malaria, and other diseases, Goal 7, Target 2: Halve the proportion of people without sustainable access to safe drinking water and basic sanitation.

delivery and maintain a larger stock of investment in infrastructure in a sustainable way, so that it can be ultimately financed from domestic resources. Understanding the conditions and institutions under which political constraints to service delivery increase or decrease is vital to helping the poor obtain better performance from their governments.

The expected increase in aid to Africa will put a big challenge for service delivery. As the efficiency of resource spending does not only depend on the capacities and characteristics of the recipient country but also on the quality of aid in terms of predictability, consistency with recipients priorities and donor coordination, the main focus of this paper is on the effects of the volume and volatility of aid. In addition, the institutions related to public service delivery are taken into account.

After a short overview of aid flows to Africa and the current state of service delivery in the region, the theoretical effects of aid on public expenditure and the quality of service delivery in education, health and infrastructure are discussed. A simultaneous equation model for estimating the determinants of service delivery is presented and the results discussed before concluding.

2. Recent Developments in Aid and Public Service Delivery

After a decline in the 1990s, ODA to Africa has been increasing again since 2002.⁴ This trend is expected to continue after the promises made by the G-8 in Gleneagles in 2005. With respect to the sectoral distribution the largest percentage of ODA to Africa in 2001/2002 went to social infrastructure and services (36 per cent), including education and health. Another important sector is economic infrastructure and services (14 per cent) including water, transport and energy. Together with support for production (9 per cent) this is expected not only to reduce the financing gap but also contribute to future growth perspectives (OECD 2005). Increasingly, ODA is

³ These targets were agreed under the Education for All Fast Track Initiative and the Abuja Declaration, signed in 2002.

⁴ (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions and by non-DAC countries to promote economic development and welfare in recipient countries. They include matching grants for debt relief (World Bank, 2005).

given in the form of budget support instead of project and programme aid, making its use more flexible for recipients and reducing the problems of tied aid.⁵

In many African countries a large share of public investment (e.g. in infrastructure) and social expenditure (especially education and health) is financed by aid, making these crucial sectors vulnerable to aid volatility. For example in the health sector of 13 low-income African countries more than 30 per cent of spending is externally financed. In these cases aid volatility has led to stop-and start-patterns, which reduce efficiency (World Bank/IMF, 2005).

In general the volatility of programme aid is higher than that of project assistance. As the latter is designed to promote investment in physical and human capital its volatility is likely to have more severe negative effects on long-term development (Fielding and Mavrotas 2005).⁶ Aid volatility is higher for countries that depend heavily on aid (Bulir and Hamann 2003). The instability of aid disbursements may alter fiscal behaviour, possibly causing a shift from public investment to consumption and thus might have a negative impact on public service delivery (Lensink and Morrissey, 2000).

With USD26 of net ODA per capita in 2002, Africa receives more than double the amount per inhabitant than all ODA recipients on average (OECD, 2005). But whereas in African countries on average a higher share of ODA is directed towards education and health the outcomes in these sectors are worse than in other regions. By contrast for water and sanitation African countries receive a lower share of ODA, which is in line with the less favourable outcomes (Table1).

3. Theoretical effects of aid on public expenditure and the quality of service delivery
In principle, aid makes more money available for public spending in health, education and infrastructure. But it might also create significant challenges for recipient countries with respect to management of resources and dependency on volatile flows. Many studies find diminishing returns of aid on growth, which might also apply to service delivery. For the delivery of public services and investment not only the amount of money spent but also the efficiency plays a crucial role for outcomes.

⁵ Tied aid means that at least part of the amount received has to be spend by purchasing goods and services from the donor country. This reduces the efficiency of aid.

⁶ Aid volatility is measured by shocks to aid in the paper by Fielding and Mavortas (2005).

Table 1: Summary statistics on public service delivery outcomes and aid per sector, 2002

	Africa	Other developing
Mortality rate, infant (per 1,000 live births)	86.66	32.35
Mortality rate, under-5 (per 1,000)	136.29	41.34
Literacy rate, youth total (% of people ages 15-24)	77.38	93.36
Primary completion rate, total (% of relevant age group)	61.02	91.60
Improved sanitation facilities (% of population with access)	40.90	69.95
Improved water source (% of population with access)	66.26	83.83
ODA Education (% of total ODA)	9.56	8.09
ODA Health (% of total ODA)	5.24	4.46
ODA Water and Sanitation (% of total ODA)	2.91	5.11

Source: World Bank, 2005 and OECD, 2006.

Note: Averages are weighted.

In general aid does increase public expenditure but the coefficients are below one. One explanation is that aid is partly used for tax relief but there is also evidence that governments do not receive all aid flows reported by donors as some is, for example, spent on consultants from donor countries (Mackinnon, 2003).

One fundamental problem of increased public expenditure is the absorptive capacity of the recipient country. The ministries charged with managing the delivery of services might face significant organizational challenges, when they should administer much higher budgets. The increased public expenditure through aid inflows might also drive up the costs of public service delivery and construction and can increase the shortage of qualified personnel in the private sector (Mackinnon, 2003).

As higher aid is usually linked to higher volatility it is also likely to pose a significant burden on the planning capacities of countries. For example ministries must decide whether to employ more civil servants or whether to outsource service delivery not only on the basis of better service delivery but also to minimize risks from aid volatility (Heller, 2005). However, this shifts the risk to private providers and might still lead to social problems. In addition, aid is strongly pro-cyclical, which might reduce the efficiency of public expenditure further (Mackinnon, 2003).

The composition of expenditure financed by aid might change with the scale of the task. For example, two thirds of aid for education is currently provided in the form of technical assistance, although the bulk of expenditure is on local personnel. There is evidence that the number of workers in health and education services is correlated with coverage. In addition, wages especially for skilled professionals have to increase to reduce migration and brain drain. Hence, if increased aid will not also cover personnel and operational costs it is likely that the quality of service delivery will decline (World Bank/IMF, 2005).

Donor involvement is also likely to change the input mix as their decisions are based on different parameters. The cost of management time is generally higher and therefore donors prefer purchasing larger quantities of a limited number of inputs. They might also apply their business practices without adjusting it to the relative resource abundance of the recipient country (Mackinnon, 2003).

One strategy to cope with uncertainty of future aid flows is to make expenditure more flexible. For example in primary education a trend towards contract teachers, who are no longer civil servants but are employed on the basis of fixed-term contracts, is observable. These contracts are employed both by the government at different levels and by parent groups, mainly in cases where no public schools exist. In a sample of 11 francophone African countries privately employed contract primary teachers account for 29 per cent of all teachers on average, whereas publicly employed contract teachers account for 20 per cent and civil servants only for 51 per cent (Michaelowa and Wechtler 2006).

As publicly employed contract teachers earn less than half of their civil servant peers this trend has facilitated the boost of primary enrolment at relatively low costs. Although the contract teachers have a lower level of professional training and less favourable working conditions no negative effect on student performance was found, probably due to a different incentive structure as further employment prospects depend on performance and parents satisfaction (Michaelowa and Wechtler, 2006).

In general, the empirical evidence that more public expenditure might lead to better quality public services is weak. A number of studies show that the effect of public spending for education and educational attainment is low and that it is rather influenced by other variables such as per capita income, the age distribution of the

population or parental education. For the effect of public spending on health on health outcomes the picture is more mixed, with some studies finding that the effect is not significant but others do find a positive contribution (Gupta et al. 1999, World Bank/IMF, 2005). In the provision of water and sewerage services higher spending might also not lead to a proportional increase in the quality of service delivery as leakages are quite high (Briceno-Garmendia et al., 2004).

In the case of education the weak link between expenditure and results can be explained by the fact that the cost effectiveness of different measures varies widely. Whereas the provision of textbooks is relatively cheap and effective a reduction of student teacher ratios is relatively expensive and little effective below a threshold of 60 students per class. In addition, the distribution of resources plays a big role. If every second child in each class has a book, student achievements are almost as high as with individual books. Hence, an equal distribution of books to schools and classes will result in much higher achievements than a distribution of all books to a limited number of privileged schools (Michaelowa and Wechtler 2006).

In the provision of health services, an expansion of hospitals does have less impact on child mortality rates than spending on immunization programmes and malaria control. In addition the number of people involved in decision-making and service delivery and the dependency on the discretionary behaviour of individuals provides opportunities for the leakage of funds. Furthermore the difficult working conditions and uncompetitive salaries can reduce the accountability of service provision, fostering absenteeism and low quality (World Bank/IMF, 2005).

Especially becoming heavily dependent on aid can create significant problems. Lewis (2005) finds in the case of HIV/AIDS programmes aid dependency can lead to reduced incentives to mobilize domestic resources, shift of priorities towards donor interests, less concern about inefficiencies in service delivery, and a potential for increased corruption and rent seeking. In addition aid might disturb the coherence of recipient government decisions due to differing interests of donors and recipients and information asymmetries (Mackinnon, 2003).

Therefore, an increase in public expenditure is likely to increase outcomes only if institutions are in place that will ensure the efficient use of resources. Such institutions include private sector participation, decentralization of responsibilities and

labour regulations. As most of these institutions tend to be similar within a country, cross-country analysis has to be used to determine their impact.

Large variations in governments' records in delivering public services and reducing poverty often can be attributed to differences in the incentives for politicians to allocate public resources. Such misallocations can be traced to constraints on the extent to which poor people can hold governments accountable, such as lack of information about service quality, lack of credibility of political promises, and polarization of voters on social and ideological grounds. Constitutional rules, electoral regimes, and party systems interact with these constraints to determine outcomes. Greater political accountability improves public services and reduces corruption. For example, in Uganda transparency about government transfers to local spending units has reduced leakage of those funds by as much as 90 percent (World Bank, 2003).

One recent trend in public service delivery is decentralization. While decentralization may lead to greater accountability and hence to increased prospects that services would reach targeted groups, the real possibility of the local elite capturing the services suggests that decentralization is not a panacea; strengthening the institutional capability at the local level is essential if decentralization is to be effective. In addition, improving service delivery requires strengthening the relationships of accountability among policymakers, service providers, and users (World Bank, 2003).

One conclusion of the micro-level studies is that the outcomes in one sector affect also the outcomes of other sectors. For example improved access to sanitation will reduce the spread of infectious diseases. In fact, expanding water and sanitation services is perceived as one of the most cost-effective strategies for improving health outcomes. In addition, education, especially of women has a positive effect on the health of their children and measures that are meant to improve education, such as school feeding and deforming, will have an impact on malnutrition and thus health (World Bank/IMF, 2005).

3. Data and Methodology

In this paper we look at determinants of outcomes in the areas of infrastructure, health and education simultaneously as it is assumed that outcomes in one area will also affect outcomes in other areas as discussed above.

The public service delivery production functions are of the following form:

$$H_i = \alpha_0 + \alpha_1 E_i + \alpha_2 I_i + A X_i \quad (1)$$

$$E_i = \beta_0 + \beta_1 H_i + \beta_2 I_i + B Y_i \quad (2)$$

$$I_i = \gamma_0 + \Gamma Z_i \quad (3)$$

where H_i is a health outcome for a country i , which is a function of education and infrastructure outcomes E_i and I_i , and of several variables that capture public spending and aid for health, as well as a number of socio-economic variables, summarized in vector X_i . Likewise education outcome is a function of health and infrastructure outcomes as well as of public spending and aid to these areas and several socio-economic variables Y_i . Finally, infrastructure outcome is a function of aid and several socio-economic variables and Z_i . These socio-economic variables can differ between the three equations and will be elaborated below.

To be able to estimate this system of equations the reduced form of equation (1) has to be derived through replacement of E_i with equation (2). This leads to:

$$H_i = \delta_0 + \delta_1 I_i + \Delta X_i + \Theta Y_i \quad (4)$$

where health outcomes are a function of infrastructure outcomes, determinants of health outcomes and determinants of education outcomes. For the estimation of the system first equation (3) was used as infrastructure outcomes are assumed to be independent of health and education outcomes. For the estimation of equations (2)

and (4), fitted values of infrastructure are used and for equation (2) also fitted values of health are used.⁷

Through an intensification of research on the MDGs also the availability of data that better measure the outcomes of public service delivery for a relatively large number of countries has increased. For example, for education one has no longer to rely on enrolment rates, which tell little about the quality of education. A new indicator of completion of primary education gives a much better picture of the outcome of primary schooling.⁸ In addition youth literacy is used as an indicator of education outcomes. To measure health outcomes the two widely used and available indicators of infant (aged 0 to 1 year) mortality rates and child (aged 0 to 5 years) mortality rates are used. For infrastructure the two indicators used are access to improved water source and access to improved sanitation facilities as percent of the population, as these are closely related to poverty reduction and part of the MDGs.⁹

To capture public expenditure in the different sectors expenditure per student in primary education as percentage of GDP per capita and health expenditure per capita are used. Unfortunately no public expenditure data for water and sanitation were available. To capture the effect of aid, both, the shares of ODA going to health, education and water and sanitation in total ODA as well as the share of total aid in GNI were used, as aid might be fungible. In addition, the share of budget aid in total aid has increased over the past decade and might also be used for public services. Quadratic figures for the share of ODA going to the specific sector are also introduced, as there is an extended debate about declining returns to aid (McGillivray, Feeney, Hermes and Lensink, 2005). The volatility of aid (as % of GNI) was calculated as the coefficient of variation for data between 1980 and 2002.¹⁰

Several variables that are intended to measure the quality of institutions are included in the analysis:

⁷ For these regressions only ordinary least squares were used. The results of Gupta et al. (1999), who use a similar specification of the functions but without a system of equations, find very similar results using OLS and 2SLS regressions, indicating that reverse causality might not be a major problem here.

⁸ Primary completion rate is defined as the number of students successfully completing the last year of (or graduating from) primary school in a given year, divided by the number of children of official graduation age in the population (World Bank, 2005).

⁹ If not stated otherwise data are from the World Bank World Development Indicators database (World Bank, 2005).

¹⁰ ODA data are taken from OECD DAC statistics (OECD, 2006).

Federalism at the state/province level. Decentralization is one approach to better match service delivery with the preferences of people. However, especially in developing countries there are many obstacles to decentralization, because the tax base in rural areas is weak and vertical imbalances in technical and administrative capacities are large. It is expected that the decentralization variable be of different importance for different services as the level of expertise needed varies (Bardhan, 2002).¹¹

Freedom of the Press. There is some evidence that asymmetric information plays an important role in public service delivery in various respects.¹² Therefore countries with better media coverage should have more efficient public service provision (Fosu and Ryan, 2004). The variable is highly correlated with *Voice and Accountability*, measuring various aspects of the political process, civil liberties, political and human rights.¹³ It therefore captures the extent to which citizens of a country are able to participate in the selection of governments. It is assumed that greater participation will lead to a better targeting of public services and thus to better outcomes. A negative coefficient is expected for press freedom, as countries with more press freedom have a lower score.

Control over Corruption. Corruption can affect the provision of public services through three channels, namely increase of prices and decrease of government output, reduced investment in human capital and thus shortage of inputs and reduction of government revenue. Corruption reduces spending on operations and maintenance. Previous research thus found a negative relationship between corruption and the provision of health care and education (Gupta et al. 2000). The main characteristics that make the health sector vulnerable to corruption are the imbalance of information

¹¹ The variable used for decentralization is from the updated World Bank Database of Political Institutions (Beck et al. 2001). The indicator used is: Are the state/ province governments locally elected? It takes the values 0 - no decentralization, 1 - some decentralization and 2 - decentralization.

¹² The scores of Freedom of the Press produced by Freedom House are widely used by governments, international organizations, academics, and the news media in many countries. Countries are given a total score from 0 (worst) to 100 (best) on the basis of a set of 23 methodology questions divided into three subcategories. This is a modification to simplify the interpretation of results: new score = 100 – original score from Freedom House. Assigning numerical points allows for comparative analysis among the countries surveyed and facilitates an examination of trends over time (Freedom House, 2005).

¹³ These data are from the World Bank project: Governance Matters (Kaufmann et al., 2005). The indicator is based on perceptions and ranges from –2.32 to 1.72 for 2002, with higher values representing higher accountability. The correlation coefficient between press freedom and voice and accountability is –0.94.

(e.g. between professionals and patients), the uncertainty in health markets and the complexity of health systems (TI, 2006).¹⁴

The socio-economic control variables that are standard in the public service delivery literature include the following (Gupta et al., 1999; Rajkumar and Swaroop, 2002):

Fertility. If fertility is high this implies a higher share of children in the population and thus higher costs for schooling. It also increases the health care costs for pregnant women and children. Thus it is expected that the coefficient is negative for both health and education outcomes.

Adult literacy rates. Educated parents are more likely and able to send their children to school and they are better able to take care of their children, when they are sick. Therefore a positive relationship is expected for both health and education.

Urbanization. As the quality of education and health facilities is generally higher in urban areas and the costs to use them in terms of transport costs and opportunity costs such as travel time and the need for children to work is lower, it is expected that this variable is positively associated with all three outcome indicators.

Prevalence of HIV. The spread of HIV/AIDS, which is most dramatic in Africa, puts a strain on the availability of qualified personnel especially in education and health. In addition it is expected to negatively impact on infant and child health directly.¹⁵

Africa dummy. As we are specifically interested in public service delivery in Africa, where most of the MDGs are unlikely to be met an Africa dummy is included. It is expected that it will have a negative coefficient.

Interaction terms. There is some discussion that aid might only have a positive outcome, if there are good institutions in place. For example if corruption is high it is likely that only a fraction of aid to the sector will actually be spent for service delivery, whereas the remainder disappears (Rajkumar and Swaroop, 2002). Therefore the

¹⁴ The corruption indicator is also taken from the World Bank project: Governance Matters (Kaufmann et al., 2005). The indicator is based on perceptions and ranges from -1.86 to 2.45 for 2002, with higher values representing higher control and thus less corruption.

¹⁵ This is measured as a share of the population aged 15-49.

different aid variables are interacted with press freedom and control of corruption. However, in case the interaction terms were not significant in any of the specifications, they were dropped to reduce the number of independent variables, as the number of observations is quite limited.

A few variables, commonly used in similar studies - like population density - were initially included in the analysis. As they were not significant for any of the regressions they were dropped in the reported version of the results. GDP per capita could not be included as it is highly correlated with other relevant variables such as health expenditure per capita and control of corruption. The correlation coefficient between those independent variables, which are included in the regressions, is less than 0.75. Thus multicollinearity among variables could affect the standard errors of coefficients to some extent. However, there are other potential determinants of public service outcomes, which could not be included in the analysis, due to a lack of data. For example, child mortality is also influenced by other factors such as malnutrition. For the empirical analysis only developing countries were included. As a number of the variables used were only available for a limited number of years, only 2002 data were used for the analysis.

4. Results

a. Infrastructure

Table 2 reports the results of OLS regressions for access to water and sanitation. The share of ODA that is allocated for water and sanitation does not have a significant coefficient in the different specifications. However, the squared ODA share has a positive and significant association with access to sanitation (Ia) and water (IIa) in some of the specifications. By contrast total aid as a percentage of GNI always has a negative coefficient, which is significant in specification (Ia). Thus aid seems to have a mixed relationship with access to water and sanitation, indicating that its impact on the effectiveness of service delivery in these areas is limited. This might be attributed to the problems of management and increased costs associated with aid that were discussed above.

Table 2: Regression results for access to water and sanitation (% of population)

	Sanitation		Water		
	la	lb	lla	llb	
Share of ODA for water and sanitation	-0.95 [-1.15]	0.64 [0.35]	-0.56 [-1.00]	0.28 [0.20]	
Share of ODA for water and sanitation squared	0.09 [2.01]	** -0.02 [-0.13]	0.05 [1.79]	* 0.02 [0.15]	
Aid as % of GNI	-0.53 [-2.74]	*** -0.34 [-0.92]	-0.18 [-1.03]	-0.49 [-1.80]	
Coefficient of variation of aid (as % of GNI) over 1980-2002	0.16 [2.74]	*** 0.22 [3.94]	*** 0.05 [0.94]	0.08 [1.59]	+
Press Freedom	0.09 [1.24]	0.07 [0.67]	0.11 [1.99]	** 0.12 [1.61]	+
Control over Corruption index	9.55 [3.14]	*** 9.05 [2.66]	*** 2.29 [1.02]	2.22 [0.83]	
Corruption * Aid as % of GNI	-0.63 [-2.31]	** -0.49 [-1.03]	-0.13 [-0.41]	-0.53 [-1.18]	
Fertility rate	-7.68 [-4.88]	*** -8.20 [-3.68]	*** -6.12 [-5.49]	*** -7.12 [-4.69]	***
Urbanization (% of total population)	0.21 [2.15]	** 0.12 [0.93]	0.15 [2.11]	** 0.07 [0.87]	
Africa dummy	-4.61 [-1.12]	-4.67 [-0.95]	0.83 [0.26]	1.66 [0.41]	
Federalism, provincial level		-1.37 [-0.55]		-3.34 [-1.94]	*
Constant	78.20 [7.75]	*** 76.21 [4.98]	*** 96.65 [15.08]	*** 103.65 [12.78]	***
Number of observations	110	72	113	74	
Adjusted R-squared	0.71	0.69	0.59	0.61	
F-statistic	32.09***	20.52***	20.08***	9.38***	

Source: Author's calculations

Note: For all regressions white's heteroskedasticity-corrected t-statistics are shown in parenthesis. *** indicates significance at the 1 per cent level; ** significance at the 5 per cent level, * significance at the 10 per cent level and + significance at the 15 per cent level.

Surprisingly, the coefficient of aid volatility is positive and significant for access to sanitation and weakly significant for access to water (IIb). This result could be driven by the fact that infrastructure expenditure is easier to adapt to changes in aid flows than expenditure in personnel intensive sectors, where expansion of services is associated with training. However, it could also be the case that, as infrastructure projects are often big and carried out over a limited period, the implementation of these projects increases the volatility of aid disbursements.

As expected, press freedom has a positive coefficient, although it is only significant for access to water. Thus a positive association between access to information and voice and accountability and access to water and sanitation might exist. Control over corruption has a large positive coefficient as expected, which is only significant for access to sanitation. However, the interaction term between corruption and aid has a negative coefficient, which is only significant in specification Ia. That contradicts the hypothesis that higher control of corruption increases the effectiveness of aid.

The fertility rate is negatively associated with both access to sanitation and water, as expected. In addition, urbanization has a positive association with infrastructure, with a significant coefficient in two specifications. However, the coefficient for the African dummy is negative for sanitation and positive for water, but never significant. That indicates that the low performance of African countries can be explained by the other independent variables.

The level of federalism at the provincial level is only included in two specifications (Ib and IIb) as it reduces the number of observations considerably. It has a negative association with access to water and sanitation, which is only significant in the case of water. This implies that decentralization is not a panacea for pro-poor development and public service provision. If economies of scale and network externalities exist - as in the case of infrastructure - central planning might lead to better outcomes.

For the fitted values for sanitation that are used in the following regressions specification Ia was chosen as the number of observations and the adjusted R-squared were much higher.¹⁶

¹⁶ The relatively low R-squared in Table 2 are probably due to the lack of data on public spending on water and sanitation.

b. Health

The results for regressions of health outcome determinants are reported in table 3. The per capita health expenditure as well as the share of ODA for health both have insignificant coefficients in all specifications. However, the squared value of sectoral aid has a negative coefficient, which is significant for two specifications, implying that more aid for health is associated with lower infant and child mortality.

With respect to the share of ODA in GDP the picture is somewhat contradictory as the coefficient is positive in all cases and significant in three specifications, meaning aid could worsen health outcomes as in the case of infrastructure. The coefficient for the volatility of aid is significant and negative in specification IIIa, implying that higher volatility reduces child mortality. However, the coefficient is positive in two other specifications. This result is similar to that for infrastructure.

Access to sanitation also has a mixed association with health outcomes. In specification IIIa the coefficient is positive and significant, contradicting the hypothesis that access to sanitation should lower infant mortality. However, the coefficients in the other specifications are not significant and have different signs, so the association between access to sanitation and health outcomes seems to be weak.

The coefficients for press freedom are not significant in all specifications. However, the coefficient for press freedom interacted with the share of ODA for health is negative and significant in two cases. This indicates that increased press freedom and voice and accountability (which has a lower value) are associated with lower infant and child mortality as it increases aid effectiveness.

The control of corruption index does not have a significant coefficient in any specification. However, interacted with the share of ODA for health the coefficient is negative and significant in specification IVa, meaning that lower corruption might increase the efficiency of aid for reducing child mortality.

Higher fertility is positively associated with infant and child mortality, despite the higher costs. Higher adult literacy has a negative coefficient, which is only significant in specification IVa, indicating that the effect of literacy on reducing infant and child mortality is not very strong. The prevalence of HIV increases infant and child mortality as expected. The coefficients for urbanization and the Africa dummy are never significant.

Table 3: Regression results for health indicators

	Infant mortality		Under 5 mortality	
	IIIa	IIIb	IVa	IVb
Health expenditure per capita	0.01 [0.21]	0.02 [0.57]	-0.01 [-0.16]	0.01 [0.18]
Share of ODA for health	-0.02 [-0.02]	-0.77 [-0.5]	0.52 [0.46]	-0.35 [-0.25]
Share of ODA for health, squared	-0.13 ** [-2.4]	-0.07 [-1.08]	-0.22 *** [-2.89]	-0.10 [-0.97]
Aid as % of GNI	1.52 ** [2.67]	1.01 * [1.96]	2.89 *** [3.03]	1.48 [1.47]
Coefficient of variation of aid (as % of GNI) over 1980-2002	-0.25 * [-1.97]	0.04 [0.18]	-0.40 [-1.4]	0.11 [0.27]
Access to sanitation (% of population)	0.88 * [1.98]	-1.03 [-0.68]	1.19 [1.46]	-2.18 [-0.93]
Fitted values				
Press freedom	-0.15 [-0.84]	-0.01 [-0.03]	0.05 [0.13]	-0.02 [-0.04]
Press freedom* Share of ODA for Health	-0.04 ** [-2.18]	-0.03 [-1.36]	-0.08 ** [-2.56]	-0.06 [-1.69]
Control over Corruption index	-6.45 [-0.92]	3.37 [0.32]	9.25 [0.66]	36.11 [1.65]
Corruption * Share of ODA for Health	-0.80 [-0.99]	0.68 [0.68]	-1.97 * [-1.91]	0.29 [0.20]
Fertility	15.21 *** [2.76]	1.51 [0.13]	24.98 *** [2.72]	2.12 [0.12]
Literacy rate, adult	-0.36 [-1.2]	-0.16 [-0.48]	-0.74 * [-1.79]	-0.57 [-1.36]
HIV/Aids	1.07 *** [3.88]	1.25 *** [4.47]	0.49 [0.67]	0.58 [0.78]
Urbanization	-0.25 [-1.15]	-0.005 [-0.01]	-0.24 [-0.77]	0.09 [0.19]
Africa dummy	4.13 [0.58]	-6.90 [-0.70]	19.46 [1.38]	-5.07 [-0.22]
Federalism, provincial level		5.23 * [1.56]		14.15 ** [2.61]
Constant	-22.67 [-0.51]	109.58 [0.87]	-4.44 [-0.06]	237.03 [1.20]
Number of observations	54	42	54	42
Adjusted R-squared	0.88	0.89	0.91	0.93
F-statistic	31.78***	94.74***	30.69***	61.95***

Source: Author's calculations

Note: For all regressions white's heteroskedasticity-corrected t-statistics are shown in parenthesis. *** indicates significance at the 1 per cent level; ** significance at the 5 per cent level, * significance at the 10 per cent level and + significance at the 15 per cent level. Independent variables related to education were also included in the regression, due to the structure of the system of equations, but they are not reported here.

The federalism index is again only included in two specifications and has a (weakly) significant positive coefficient. More decentralization might be associated with

increased child mortality as maybe the capacity and resources at the provincial and local level to provide adequate services is insufficient.

c. Education

The results of the OLS regressions for education are reported in Table 4 (without federalism variable) and Table 5 (with federalism variable). The coefficient for public expenditure per student is always negative and significant in the specifications with youth literacy and without the federalism variable (VIa and VIb), indicating that expenditure per student does not increase education outcomes.

Table 4: Regression results for education indicators

	Primary completion rate		Youth literacy	
	Va	Vb	VIa	VIb
Expenditure per student on primary Education	-0.23 [-1.19]	-0.26 [-1.38]	-0.12 [-1.75]	-0.14 [-1.98]
Share of ODA for primary education	0.55 ** [2.05]	0.49 * [1.83]	0.14 [0.85]	0.13 [0.83]
Share of ODA for primary education Squared	-0.01 + [-1.48]	-0.01 [-1.02]	-0.003 [-0.85]	-0.003 [-0.75]
Aid as % of GNI	-0.86 *** [-2.87]	-0.71 * [-1.71]	-0.19 [-1.07]	-0.09 [-0.38]
Coefficient of variation of aid (as % of GNI) over 1980-2002	-0.08 [-1.00]	-0.12 [-1.26]	0.03 [0.90]	0.02 [0.52]
Access to sanitation (% of population)	-0.49 * [-1.70]	-0.29 [-0.74]	-0.12 [-0.70]	-0.08 [-0.44]
Infant mortality(a)/Under 5 mortality(b)	0.28 * [1.80]	0.07 [0.61]	-0.05 [-0.79]	-0.05 [-1.12]
Fitted values				
Press freedom	-0.01 [-0.05]	-0.09 [-0.79]	-0.15 *** [-2.87]	-0.14 *** [-2.99]
Press freedom* Share of ODA for primary education	-0.01 [-0.75]	-0.001 [-0.12]	-0.0006 [-0.21]	-0.0004 [-0.14]
Control over Corruption index	10.52 ** [2.18]	8.48 * [1.67]	4.07 * [1.96]	4.16 ** [2.11]
Corruption * Share of ODA for primary education	-0.09 [-0.46]	-0.16 [-0.84]	-0.09 [-1.42]	-0.11 + [-1.65]
Fertility	-13.00 *** [-3.07]	-9.50 * [-1.82]	-0.46 [-0.23]	0.23 [0.11]
Literacy rate, adult	0.46 *** [3.58]	0.48 *** [3.29]	0.82 *** [15.16]	0.79 *** [13.10]
Urbanization	0.29 * [1.84]	0.17 [1.09]	0.03 [0.53]	0.03 [0.43]
Africa dummy	-12.51 ** [-2.07]	-9.62 + [-1.48]	1.88 [0.86]	2.36 [1.04]
Constant	0.6.94 *** [3.93]	94.61 *** [3.05]	25.32 * [1.85]	25.06 * [2.01]
Number of observations	54	54	54	54
Adjusted R-squared	0.87	0.86	0.97	0.97
F-statistic	38.66***	33.69***	47.66***	45.99***

Source: Author's calculations

Note: For all regressions white's heteroskedasticity-corrected t-statistics are shown in parenthesis. *** indicates significance at the 1 per cent level; ** significance at the 5 per cent level, * significance at the 10 per cent level and + significance at the 15 % level.

In contrast, the share of ODA for primary education is positive and (weakly) significant for most specification. However, the coefficient for squared ODA to education is negative and also mostly significant. These results support the hypothesis that aid for education has a positive but declining impact. The coefficient for aid as a share of GNI is negative and significant in half of the cases and the coefficient for the volatility of aid is never significant.

Contrary to expectations access to sanitation has a negative association with education outcomes, but it is only significant in specification Va. Likewise infant mortality has a positive and significant coefficient in the regressions for primary completion rate, maybe as less children reach school age.

The coefficient for press freedom is negative and significant for all regressions of youth literacy, contrary to expectations and contrary to findings in the two other sectors. However the coefficient for control over corruption is positive and significant for all regressions in Table 4, indicating that less corruption is associated with higher education outcomes.¹⁷ The interaction terms of press freedom and control of corruption with aid for education are not significant.

Higher fertility is negatively associated with primary completion rates, as expected. The coefficient for adult literacy rate is positive and significant for all specifications. For urbanization the coefficient is only significant and positive in two cases (Va and VIIa).

The results for the Africa dummy are somewhat contradictory. For the regressions of primary completion rate the coefficient is negative and (weakly) significant in most cases. However, for the regressions of youth literacy the coefficient is positive and significant in two cases. That would indicate that although primary completion rates are lower in Africa after controlling for other factors, youth literacy is higher. For federalism the coefficient is negative and significant in the regressions of youth literacy, implying that also for education decentralization does not increase outcomes.

¹⁷ This result could be partly driven by the relative high correlation between control of corruption and press freedom of -0.62.

Table 5: Regression results for education indicators

	Primary completion rate		Youth literacy	
	VIIa	VIIb	VIIIa	VIIIb
Expenditure per student on primary Education	-0.18 [-0.66]	-0.18 [-0.61]	-0.08 [-1.14]	-0.08 [-1.12]
Share of ODA for primary education	0.53 [1.47]	0.49 [1.57]	0.21 [1.48]	0.22 [1.60]
Share of ODA for primary education squared	-0.03 [-1.73]	-0.02 [-1.48]	-0.01 [-1.66]	-0.01 [-1.89]
Aid as % of GNI	-0.75 [-2.46]	-0.75 [-1.52]	-0.08 [-0.60]	-0.10 [-0.62]
Coefficient of variation of aid (as % of GNI) over 1980-2002	-0.01 [-0.10]	-0.08 [-0.49]	-0.06 [-1.02]	-0.05 [-0.86]
Access to sanitation (% of population)	-0.42	-0.15	0.32	0.30
Fitted values	[-0.78]	[-0.21]	[1.23]	[1.13]
Infant mortality(a)/Under 5 mortality(b)	0.45 [2.67]	0.16 [0.99]	-0.04 [-0.66]	-0.004 [-0.07]
Press freedom	0.14 [0.79]	-0.01 [-0.08]	-0.16 [-2.95]	-0.15 [-3.01]
Press freedom* Share of ODA for primary education	-0.02 [-1.67]	-0.01 [-1.09]	-0.003 [-0.96]	-0.004 [-1.18]
Control over Corruption index	6.02 [0.77]	2.37 [0.26]	-2.12 [-0.67]	-1.99 [-0.60]
Corruption * Share of ODA for primary education	0.16 [0.38]	0.15 [0.37]	0.07 [0.57]	0.08 [0.66]
Fertility	-17.00 [-3.34]	-13.01 [-2.04]	2.61 [1.15]	2.12 [0.92]
Literacy rate, adult	0.36 [2.88]	0.42 [2.33]	0.78 [13.60]	0.78 [10.58]
Urbanization	0.34 [1.82]	0.18 [0.93]	-0.02 [-0.36]	-0.01 [-0.11]
Africa dummy	-11.12 [-1.62]	-8.10 [-1.07]	4.72 [2.15]	4.41 [1.90]
Federalism, provincial level	0.45 [0.21]	0.54 [0.24]	-1.59 [-2.02]	-1.62 [-2.08]
Constant	110.94 [2.50]	91.99 [1.57]	-4.78 [-0.23]	-4.36 [-0.20]
Number of observations	42	42	42	42
Adjusted R-squared	0.88	0.87	0.97	0.97
F-statistic	22.69***	13.82***	49.20***	54.70***

Source: Author's calculations

Note: For all regressions white's heteroskedasticity-corrected t-statistics are shown in parenthesis. *** indicates significance at the 1 per cent level; ** significance at the 5 per cent level, * significance at the 10 per cent level and + significance at the 15 % level.

6. Conclusions

Overall the share of ODA that is provided for education, health and water and sanitation seems to have a positive impact on outcomes in these sectors. However, total aid seems to be negatively associated to outcomes in these sectors, whereas aid volatility is associated with better outcomes in sanitation and infant mortality, contrary to expectations. This result could imply that although aid targeted to specific sectors and targets might have positive effects, the general increase in aid might create more problems with respect to Dutch disease, less accountability of governments towards local populations and more opportunities for corruption. Overall aid cannot be the only solution for improved service delivery to meet the MDGs, due to its mixed impact.

With respect to institutions the results are also mixed. Press freedom, which is highly correlated with voice and accountability, seems to have a positive association with water and health outcomes, but a negative association with youth literacy. Control of corruption is positively associated with outcomes in all sectors, but only weakly for health. Decentralization is negatively associated with access to water, reduction of child mortality and youth literacy. This might indicate that there is a considerable lack of capacity at the local level.

The expected interdependency of different public services is quite weak according to our analysis. In addition the Africa dummy is not significant in infrastructure and health regressions. In the education regressions the Africa dummy is positively associated with primary completion rates and negatively with youth literacy. That result implies that Africa is not very different from other regions after controlling for relevant determinants such as the fertility rate, HIV prevalence, urbanization and adult literacy.

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